HARRIS RIVER DAM PROJECT
WATER AUTHORITY OF WESTERN AUSTRALIA

Report and Recommendations of the Environmental Protection Authority

Environmental Protection Authority
Perth Western Australia
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1. INTRODUCTION

Potable water is supplied from the Wellington Reservoir 19 kms south west of Collie to consumers on the Great Southern Towns Water Supply (GSTWS), Collie District, and the Swan Coastal Plain. This water supply is expected to increase in salinity to levels which exceed the National Health and Medical Research Council's long term objectives for water quality in the near future. Salinity increase in the Wellington Reservoir has been a direct result of the clearing of native vegetation within the catchment area.

In view of the increasing salinity, the Water Authority of WA began to investigate the various options available in order to meet the following objectives:

- determine the optimum quality of water which should be supplied to domestic services;
- supply water of this quality in a cost effective manner as soon as possible;
- ensure adequate water is available to meet the projected demand for domestic services supplied by the GSTWS beyond the year 2000; and
- facilitate the management of freshwater inflows into Wellington Reservior so that the average quality of irrigation water can be maintained.

Over 200 options were examined with reference to a prime study period of 15 years to the year 2000. The principal alternatives were:

- de-salinisation of Wellington Reservoir water;
- diversion of saline flows away from Wellington Reservoir;
- development of the Collie Basin groundwater;
- raising the existing Stirling Dam;
- building a new dam on the Brunswick River; and
- building a new dam on the Harris River.

The Water Authority decided that a dam on the Harris River would best meet the selection criteria. The construction of this dam would require Commonwealth funding under the Federal Water Resources Assistance Programme.

In October 1985 the Environmental Protection Authority (EPA) was advised of the proposal and requested that an Environmental Review and Management Programme (ERMP) be prepared. The ERMP was released in December 1985 for a public comment period of three months. However, following a request from the Minister for Water Resources, the EPA deferred the public review period in February 1986, pending a review of the location and capacity of the proposed dam. A Consultative Group to the Minister for Water Resources was formed to advise on the matter. Subsequently the public review of the ERMP was reactivated in October 1986, for a period of six weeks with no change to the proposal. The submission period closed on 22 November 1986.

2. DESCRIPTION OF PROPOSAL

2.1 ALTERNATIVES CONSIDERED

Eight alternatives to a new source on the Harris River were considered by the Water Authority. Issues relating to these have been described in the ERMP. Briefly they are as follows:

- PARTIAL REFORESTATION OF THE WELLINGTON CATCHMENT AND RESERVOIR

  A partial reforestation of the Wellington Catchment programme was commenced in 1979 involving the replanting of 8 000 ha and is ongoing. However, slow planting and growth rates of trees means that significant improvement in catchment salinity is not expected for 10-15 years.

- FULL REFORESTATION OF THE WELLINGTON CATCHMENT

  This would involve the planting of more than 50 000 ha of farmland and would result in the reduction of agricultural output in the area. Further, this option would not achieve the required salinity reductions quickly enough to meet the supply objectives for the GSTWS.

- DESALINISATION OF WELLINGTON RESERVOIR WATER

  This option is considered to be too expensive.

- DIVERSION OF SALINE FLOWS AWAY FROM WELLINGTON RESERVOIR

  This would involve pumping saline water via pipes to the sea, which would be too expensive, or pumping into the Blackwood River, which is considered environmentally unacceptable.

- DEVELOPMENT OF COLLIE BASIN GROUNDWATER

  Investigations indicate limited supplies of low salinity groundwater are available, most of which is already allocated to Muja Power Station.

- RAISING THE EXISTING STIRLING DAM

  This option would not fulfil the long term water requirements.

- BUILDING A NEW DAM ON THE BRUNSWICK RIVER

  The option is considered to be slightly more expensive than the Harris option, but will be considered for future water requirements.

- BUILDING A DAM ON THE HARRIS RIVER

  A survey of the eight alternative water supply options has identified a dam on the Harris River to be the most effective option which would provide adequate high quality water to the GSTWS in the short term, and have the least environmental impact. Other advantages of a dam on the Harris River identified in the ERMP include:

  (i) Availability of fresh water for diluting saline water in the Wellington Reservoir, for irrigation purposes. This would be dependant on the GSTWS draw and the size of dam storage. On average,

salinities would improve by approximately 40 mg/L per annum, but would reduce as GSTWS demand increases. Table 3 in the ERMP illustrates the effect of the construction of a dam at site 5 on irrigation supplies under various conditions of catchment reforestation and demands on the GSTWS.

(ii) Availability of the Wellington Reservoir for recreation. A dam on the Harris would provide some scope for recreation both on the reservoir and developments along the foreshore. The Water Authority proposes to prepare a management plan for recreation on the Wellington in conjunction with surrounding land owners, State and Local Government Authorities and other interested parties.

(iii) Decreased cost of pumping sewage from the Wellington catchment.

(iv) Free current town planning restrictions within the Wellington catchment.

2.2 THE PROPOSAL

2.2.1 ALTERNATIVE SITES CONSIDERED

Two potential dam sites were considered on the Harris River, referred to in the ERMP as Dam site 1 and Dam site 5 (Figure 1).

Dam site 1 has a catchment area of 383 sq kms and a Mean Annual Flow (MAF) of 46 x 10^6m^3. Dam site 5 has a catchment area of 321 sq kms and MAF of 36 x 10^6m^3.

A range of storage sizes and yields for each site have been considered. Within identified environmental constraints, the maximum size of a dam at Site 1 would have a storage of 134 x 10^6m^3, a Full Supply Level (FSL) of 221.5 m, and an annual yield of 32.8 x 10^6m^3. At site 5, the largest dam under similar contraints would have a storage of 77 x 10^6m^3, a FSL of 223.5 m and an annual yield of 19.8 x 10^6m^3. A dam at site 1 with an equivalent annual yield would require a storage size of 46 x 10^6m^3 and a FSL of 212.5 m.

The construction of a dam at site 1 with a FSL of 212.5 m would involve the flooding of 300 ha of State forest. A dam at site 5 with a FSL of 223.5 m would involve flooding 800 ha of State forest.

Initial investigations have suggested that better geotechnical conditions for dam foundations exist at site 5.

Storage at either dam site would significantly improve the average quality of the GSTWS water and would also reduce the salinity of irrigation water available to farmers. For either site additional works would be required to meet increases in demand from the GSTWS beyond the year 2000, especially if further deterioration in irrigation water quality is to be avoided. In the case of dam site 1 this could involve raising the embankment and spillway crests. In the case of dam site 5, additional source developments would be required.

The ERMP states that there is little difference in the capital costs of development between the two sites for dams of equal yield. However for larger yielding schemes, the capital costs of dam site 5 increase at a

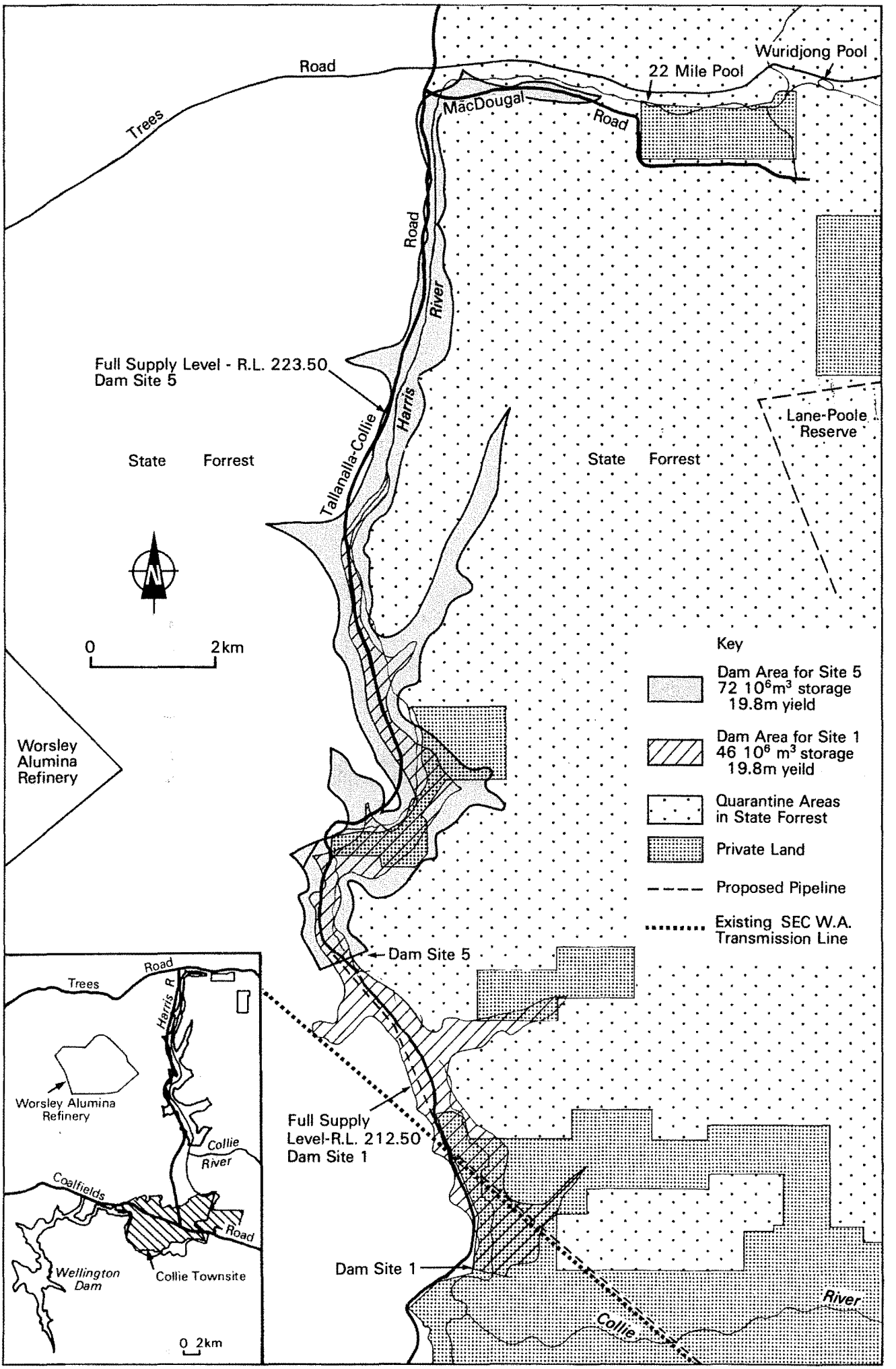

Figure 1. Map indicating location and area of proposed Harris River Dam Sites 1 and 5.

faster rate than at dam site 1. It is suggested that the environmental impact of both Harris Sites can be considered to be acceptable provided full storage levels do not flood Twenty-Two Mile Pool (ERMP, p22)

2.2.2 PREFERRED SITE

Following a review of the two potential sites the Water Authority has selected Dam site 5 with a FSL of 223.5 m and a yield of 19.8 x $10^6 m^3$ as the preferred site. The dam would involve the construction of the following components:

- main dam embankment;
- spillway;
- intake tower;
- outlet culvert;
- pump station and raising main;
- public viewing areas, recreation facilities and amenities.

The embankment would be of homogeneous earth fill obtained from local sources, protected with a rip rap layer of rockfill material. Foundation stripping would remove organic material, and deep excavation of the river bed would be necessary to remove alluvium.

The spillway would be an open lined concrete chute founded on rock excavation, and have the capacity to pass all floods up to the Probable Maximum Flood (PMF) level. A terminal structure and Stirling basin would be located where the spillway flows re-enter the river.

The intake tower would consist of a reinforced concrete stem and a sheet steel clad hoist house, with access from the embankment via a bridge. The tower would have multiple intake posts to enable water to be drawn over a range of water levels. A concrete outlet culvert, housing two 900 mm nominal diameter pipelines would extend from the intake tower to a pump station located immediately downstream of the embankment. Construction will be carried out early in the development programme so that the culvert could divert river flows.

A rising main would be constructed from the pump station to link with the GSTWS pipeline from Wellington Dam approximately 3 km east of Collie Pumping Station. The power supply to the pump station is expected to be via a power line from the existing SECWA grid, and is proposed to be located adjacent to the main access road, Tallanalla Road.

Other permanent facilities would include sealed access roads linking all the major facilities, public vantage points (and associated parking facilities) and a public recreation area downstream of the embankment. Site access would be gained via the relocated Tallanalla - Collie Road, which will facilitate heavy vehicle access to the site.

Earthfill material would be obtained from borrow pits within the reservoir area. Fine filter materials would be from a new sand pit located near

Griffin. Coarse filter material, aggregate from concrete shelters and rip rap material would be obtained from established local quarries.

3. ENVIRONMENTAL IMPACTS

3.1 CONSERVATION PERSPECTIVE

In assessing the potential environmental impacts of this proposal, the Environmental Protection Authority took into account that a major thrust of its System 6 report was the recognition that components of the Darling System have significant regional conservation and landscape values. These values were acknowledged by the adoption of a comprehensive system of regional parks which included both environmentally important linear landscape features and other areas of high conservation value.

Within the Darling System, the regional park concept was applied through recommendations to rivers including the Moore, Avon, Brockman, Murray, Harvey, Serpentine, Collie, Preston and Blackwood. Through this process river valleys with particularly high conservation value have been identified for protection, and a mechanism to achieve this was also outlined (System 6 Recommendation 16). Substantial progress has been made towards implementing these recommendations. In particular the creation of the Lane Poole Reserve has ensured the preservation of the most important conservation elements of the Murray River valley.

3.2 ALTERNATIVES

The ERMP has identified the need for an alternative water supply to be constructed for the GSTWS. The primary reason for this is the increasing salinity of water within the Wellington Reservoir as a direct result of catchment clearing. Water quality in the Wellington Reservoir is deteriorating at a rate of 30 mg/L per annum. This problem is further exacerbated by evaporative concentration.

The Authority recognises the substantial economic and engineering evaluation that has been undertaken of potential alternative water supply sources to the GSTWS and accepts the basis upon which the selection of the Harris River was made.

3.3 SPECIFIC IMPACTS

3.3.1 DAM CONSTRUCTION

Construction of a dam on the Harris River would have the following impacts:

- obtaining construction materials;
- construction of related facilites;
- dieback control;
- surface soil disturbance and erosion;

. dust and noise;

. loss of archaeological sites.

The Water Authority proposes to obtain the majority of materials for the earth embankment from borrow pits within the reservoir area below full supply level. The proposed fine filter material quarry near Griffin will require approvals from the Collie Shire. The Environmental Protection Authority would expect that the quarry will be operated in a manner consistent with current extractive industry standards including rehabilitation requirements.

Some construction related activities and facilities will be located outside the reservoir area. These should be restricted in area and any disturbance of soil or vegetation should be minimised. The ERMP proposes that temporary buildings, construction refuse and hardstand material would be removed at the completion of the construction programme. Also all oils and fuel will be stored according to the requirements of appropriate regulations. All wastes would be collected in a sump and transported to an approved waste disposal site.

State forest at both dam sites are affected by jarrah dieback. Clearing equipment would be confined to the reservoir basin, the immediate area of the dam wall, and associated works (ERMP, p57). Full liaison would be maintained with the Department of Conservation and Land Management (CALM)in accordance with forest hygiene requirements.

Topsoil from within the reservoir areas would be stockpiled for use in rehabilitation of disturbed areas above full supply level, including cut and fill faces and construction pads not required for further construction activities. Revegetation in the vicinity of the dam would conform to a landscape plan prepared in consultation with CALM officers, and regular inspections made of rehabilitated areas to identify areas requiring further treatment.

The generation of sediment transport and turbidity immediately downstream of the dam site during construction would be unavoidable. The ERMP indicates that most earthworks would be carried out during the summer period when run off is low, minimising the effects of erosion and sediment transport. The early construction of a dam outlet culvert would bypass river flows around the construction site. Clearing operations would be kept to a minimum, and revegetation of cleared areas commenced as soon as possible (ERMP, p58).

Noisy equipment would only operate during daylight hours and residents will be informed prior to blasting. Work areas would be sheeted with gravel and watering carried out to minimise dust where necessary from a water tank fitted with sprays.

Fifty three archaeological sites and sixty one isolated artifact finds would be inundated, destroyed or lose their integrity. Twelve archaeological sites would be similarly affected in the event of a dam at Site 1. The Water Authority recognises its obligations under the Aboriginal Heritage Act (1972-80) and sites will be testpitted and recorded as required.

3.3.2 RESERVOIR ENVIRONMENT

Clearing of the existing riverine vegetation and creation of a new deep water area will cause significant environmental change. Specific impacts on the reservoir environment include:

- close proximity to reserves and significant Aboriginal site;
- clearing of State forest;
- management of Forest Disease Risk area;
- inundation of farmland;
- construction operations, including the realignment of the existing Tallanalla - Collie Road (Site 5) and use of existing roads;
- impact on beekeeping;
- loss of rare plant species;
- modification of aquatic environment;
- loss of habitat; and
- creation of new habitat.

The full supply level of the proposed dam at Site 5 has been stated in the ERMP as being 223.5 m AHD. This level lies within 0.5 km of the Twenty-Two Mile Pool, an environmentally significant area which provides an important summer refuge area for many species of terrestrial and aquatic fauna. It is also located in close proximity to the Lane Poole Reserve. The ERMP states that a buffer area of swamp vegetation will be retained by limiting clearing in the shallow upper part of the reservoir to the 223 m contour (ERMP, p61). Wuridjong Pool, a site of significance to living Aboriginal people is also close to the full supply level. It is recognised by the Water Authority in the ERMP that, in view of the environmental value of this area, there will be no future option to increase the full storage level of a reservoir above the 223.5 m AHD. This commitment is strongly supported by the EPA.

Approximately 800 ha of State forest would be located within full supply level 223.5 m AHD for Site 5, and 310 ha within full supply level 212.5 m AHD for Site 1. Both areas are affected by jarrah dieback. All vegetation within the full supply level would be removed before flooding the reservoir. A forest buffer of up to 1 308 ha would also be required around the dam at Site 1 and 2 086 ha for Site 5. Within this buffer, access to timber resources could be restricted due to potential turbidity problems. The Department of Conservation and Land Management has requested that it be contacted at least 12 months prior to clearing to arrange for the logging of suitable timber from within the reservoir basin. The ERMP states that remaining vegetation would be heaped up in the cleared reservoir basins and burnt on site.

The majority of the proposed reservoir is located within a disease risk area of State forest. The ERMP indicates that stringent conditions would be enforced to minimise the spread of dieback in disease risk areas, and the

Water Authority would establish guidelines for dieback control in consultation with CALM.

The ERMP states that 313 ha of farmland would be inundated by a dam constructed at Site 5, and 770 ha by a dam at Site 1. The Water Authority has already purchased the farmland at Site 5 over the past several years.

The construction of the dam at either site would necessitate the re-routing of the Tallanalla - Collie Road. Upgrading would include sealing the road and constructing table dams and control of water drainage off the road (ERMP, p60). At Site 5, this road construction may involve the destruction of 30-40 ha of forest for road and gravel pits, and could place between 900 and 1400 ha of State forest at risk of dieback spread. As this is a major through-road it may be difficult to achieve a high degree of hygiene and CALM advise that the spread of dieback should be considered likely. The EPA points out to the Water Authority that CALM's requirements regarding forest hygiene apply. The Water Authority and CALM should liaise regarding future requirements for that portion of the road rendered redundant. Measures should also be considered to control and minimise erosion during the realignment of the road.

The Water Authority intends to liaise with CALM and affected apiarists on the need to rationalise and relocate apiary sites.

A stand of the gazetted rare plant species Grevillea drummondi would be inundated by the construction of a reservoir at either site. While it is not possible to avoid flooding these plants, efforts could be made to include the species in landscaping associated with the dam. Floristic investigations elsewhere in the northern jarrah forest have indicated that the variety Grevillea drummondi may be more abundant than previously thought. However, at this time it is still gazetted as a rare and endangered plant under the Wildlife Conservation Act. The EPA draws the Water Authority's attention to the requirement to seek the Minister for Conservation and Land Management's approval to disturb gazetted rare plants. A significant area of the riverine environment will also be either inundated or modified during dam construction. It would be useful to know what portion of specific habitat types in the surrounding area would be affected by the dam construction.

3.3.3 DOWNSTREAM ENVIRONMENT

It is expected that the construction of the proposed dam may have an impact on downstream aquatic flora and fauna. Critical factors affecting aquatic organisms include changes in downstream water volume, water temperature, water quality, food supply, and migration patterns. It is acknowledged in the ERMP that significant alteration of any of these factors will result in a change in the population dynamics of the aquatic ecosystem (ERMP, p66). As a consequence the Water Authority has conducted site investigations to provide baseline information for species distribution. The ERMP states that additional surveys will be undertaken after construction and reservoir flooding to provide information on changes in species diversity and abundance (ERMP, p66).

Other impacts on the downstream environment include:

. proposed water pipeline route;

. spillway releases;

- powerline relocation (site 1);

- riparian releases.

The alignment of the water pipeline from Harris Dam to link up with the GSTWS pipeline (from Wellington Dam) would involve crossing the Harris and Collie Rivers and would be within the existing SECWA alignment. The ERMP indicates that the pipeline would be buried and the backfilled trench topped with stockpiled topsoil and allowed to revegetate. The pipe would probably cross the Collie River on a pipebridge, and the Harris River crossing may be buried. Details of pipeline alignment and proposed construction method should be provided to EPA prior to construction.

Construction of the proposed dam would obviously reduce flood flows downstream and approximately 65% by volume of Harris River would be stored in the reservoir. Flows downstream would be from the topping of the spillway or from programmed releases. The spillway will be designed to incorporate a stilling basin structure which will minimise scour where spillway flows enter the river. Management guidelines to be adopted for the operation of a dam are provided in the ERMP.

3.3.4 RECREATION

The proposed Harris Dam will create an additional tourist attraction in the region. The Water Authority proposes to restrict public access to the reservoir consistent with guidelines for the protection of water quality on Class 1 catchments for public potable supplies (WA Water Resources Council, 1985). The re-routed Tallanalla-Collie Road will remain open for public access.

As a new attraction the proposed dam will necessarily increase the need for management control and enforcement by various Government agencies, such as CALM, Dept of Fisheries and the Water Authority.

A management plan for the Harris site is to be developed in consultation with CALM and other relevant agencies and local interest groups.

3.4 ENVIRONMENTAL IMPACT

The environmental impacts of a dam located at Harris dam site 1, with a FSL of 212.5 m AHD yield of 19.8 x $10^6 m^3$ and reservoir storage capacity of 46 x $10^6 m^3$ would include:

- the resumption of 590 ha and inundation of 862 ha of privately owned farmland;

- the clearance of 300 ha of State forest, representing a total cost of $600 000 in loss of timber resources (based on CALM figures at rate of $2000/ha);

- the establishment of a 500 m buffer zone around the reservoir to reduce potential turbidity problems. This will involve 1300 ha, within which access to timber resources will be restricted;

- the relocation of a portion of the existing SECWA 330 KV transmission line; and

. the relocation of a portion of the Tallanalla-Collie Road.

The environmental impacts of a dam located at Harris dam site 5, with a FSL of 223.5 m AHD yield of 19.8 x 10^6m^3, a reservoir storage capacity of 72 x 10^6m^3 would include:

. the inundation of 313 ha of farmland;

. the clearance of 800 ha of State forest, representing a total cost of $1 600 000 in loss of timber resources;

. the establishment of a 2100 ha buffer zone around the reservoir to reduce potential turbidity problems. Access to timber in this area will also be restricted;

. a full supply level in close proximity to environmentally sensitive areas including Twenty-Two Mile Pool and Lane Poole Reserve, and a significant Aboriginal site; and

. the relocation of a portion of the Tallanalla-Collie Road.

Capital costs for dam construction at either site are approximately the same.

The Authority has noted that the majority of submissions favoured a dam on site 1 rather than site 5, for a range of environmental and other reasons. Assessment of the proposals on the Harris River has indicated that a smaller environmental impact would be incurred by development of site 1. However, the EPA considers that a dam on either sites would be environmentally acceptable.

3.5 WELLINGTON RESERVOIR

The construction of a dam on the Harris River and its usage for the GSTWS has the potential to enable the Wellington Reservoir to be released for recreational activity which would have local and regional implications for tourism, as well as other forms of development.

In conjunction with affected landholders, State and Local Government agencies and other interested parties, the Water Authority proposes to prepare a management plan defining opportunities for recreation on and around the foreshores of the Reservoir. The plan would indicate the location and density of recreation facilities and activities, taking into account; environmental issues, engineering services and access, landscape quality, conflicts in recreation use, public attitudes and finance management and maintenance. Some progress on a study of the opportunities presented has already been made. It should be recognised that the catchment has areas of significant environmental value and sensitivity (eg System 6). Development should recognise and protect these areas.

The Wellington Dam represents a significant community asset, with some existing uses threatened by water salinity. One control method already in operation has been the aquisition of strategically located private property in the Collie River Catchment and its reforestation. A programme is currently in place to plant 2 000 ha with trees until 1992. This programme should be continued beyond that date and consideration should be given to increasing the planting rate.

3.6 SITE INVESTIGATION IMPACT

The EPA recognises that some engineering and geological investigations are required to determine the suitability of a potential dam site. Wherever possible, minimal disturbance to vegetation and soil should occur during these investigations. The EPA is of the view that investigations which are likely to cause substantial impact should only occur after necessary approvals have been given.

In regard to the Harris River dam proposal, the Water Authority carried out substantial drilling during early 1986 to review spillway and embankment conditions. As a consequence, considerable disturbance of the valley floor and eastern abutment has taken place.

3.7 FUTURE REGIONAL IMPLICATIONS

One distinguishing characteristic between the two potential dam sites on the Harris River is that within known environmental constraints, site 5 provides a significantly lower yield than site 1. While the proposed yield of site 5, 19.8 x $10^6 m^3$ is more than double the existing GSTWS requirement, this level will certainly be insufficient early next century. To provide additional supplies for the GSTWS, the Water Authority will be required to develop a new site if site 5 is selected now. If site 1 were chosen now, a dam at this location could be expanded to fulfil future requirements at a later date.

Each new source has particular environmental impacts and in a regional sense these may be considered to be cumulative. The expansion of the capacity of an existing source will, in general, have a substantially smaller environmental impact. Deferment of the development of any new source is environmentally advantageous.

4. PUBLIC SUBMISSIONS

The Authority received a total of 22 submissions on the ERMP; 8 from government departments and 14 from members of the public and other agencies. A list of those who made submissions is provided in the Appendix.

All public submissions were received in letter form. Issues raised include:

- ALTERNATIVE WATER SUPPLIES ARE INADEQUATELY CONSIDERED

  Several submissions expressed concern that the Water Authority prematurely determined the dam site and dam size, and presented only selective information in the ERMP that would support the decision.

- SOCIAL COSTS

  The fact that private land within the proposed dam site 5 storage area has already been purchased by the Water Authority should not exclude the fact that this is an additional social cost and should therefore be included in the Environmental Assessment Ratings Analysis (Table 5 of the ERMP). Further, conclusions are drawn to the relationship between the dam proposal and unemployment situation in the Collie area (Section 11), however no details are given regarding the existing situation.

. WATER QUALITY

Concern was expressed that reduced water flows in the Harris River downstream of the proposed dam during summer and autumn periods would have a detrimental effect on livestock and farm productivity.

. WATER COLOUR

Water colour in the proposed dam would frequently be more excessive than total dissolved salts (TDS) in the Wellington. One government department submission argued that both are aesthetic criteria, in which case saline water of the Wellington is to be exchanged for coloured Harris water.

. WATER FOR IRRIGATION

Concern was expressed that the ERMP failed to recognise the seriousness of the irrigation water quality problem and that in the provisions of fresh water for the GSTWS, requirements of irrigation farmers would be overlooked and their supply adversely affected. Dam yield figures quoted in the ERMP were considered to be misleading. The dam would barely cope with forecast GSTWS demands, reducing the likelihood that water would be available to scour or 'shandy' existing saline water from the Wellington.

Some farmers believe dam site 1 should be the preferred option as it would provide a larger yield for a similar cost, could be enlarged at a future date when demand increases, and would ensure that fresh water would always be available for irrigation purposes. In addition the ERMP does not sufficiently address or give sufficient consideration to the effect of irrigation saline water on plant growth and productivity.

. WATER YIELD

As mentioned above, yield figures quoted for the proposed dam site are thought to be misleading as data is based on the last 77 years of rainfall, of which the last 37 have experienced drought. The ERMP states that dam site 5 has a maximum storage of 71 x $10^6 m^3$ and has a safe yield of 20 x $10^6 m^3$. However yield can be as low as 16 x $10^6 m^3$ if statistics are based on the last 37 years which have been drought affected. If the drought continues, storage would not be adequate to cater for population growth alone to the year 2000, especially if water consumption increases in the Collie area, as it invariably will as a result of factors including; increased tourism and recreation activity around the Wellington Dam, relaxed town planning restrictions within the Wellington catchment, increased power plant requirements, and industrial and mining developments, which are not included in the cost-benefit analysis. Drought sequences are thought to be less likely to occur at dam site 1 and would be of shorter duration.

. EROSION CONTROL

There is a need to control erosion, in particular in relation to the realignment of the Tallanalla-Collie Road.

. POLLUTION

Concern was expressed that contamination of the Harris Dam may result from the Worsley Refinery and proposed new power station near Collie.

. TIMBER PRODUCTION

The ERMP does not consider rational future timber production requirements. A submission identified that dam site 5 occupies 2.5 times the surface area of Stirling Dam, and yet only adds an additional 25% capacity.

. FOREST HYGIENE

The ERMP should address in more detail measures to ensure that the construction phase does not result in reduced forest hygiene. The dam basin will be exposed over a period of two summer periods (18 months) during which time 800 ha of forest will be removed, in the case of dam site 5, much of which is affected by dieback.

. CLEARANCE OF NATIVE FOREST

The clearance of native forest was not considered to be acceptable by some people as it would further exacerbate salinity problems. If it was seen to be absolutely necessary to inundate an area through the construction of a dam, dam site 1 should be the preferred option as it would inundate already cleared farmland. The unit cost of water from dam site 1 would be considerably less in terms of environmental destruction.

. LOSS OF RARE PLANT SPECIES

While it is accepted that there are existing commercial stands of Grevillea Drummondi, the clearance of natural stands would significantly reduce the available gene pool. This is contrary to the 'Rare Flora Act' (Wildlife Conservation Act).

. WELLINGTON DAM CATCHMENT REFORESTATION

Concern was expressed regarding the success of the reforestation programme. It is thought to be too slow, and grazing has been occurring which limits any regeneration of the forest understorey. Grazing of livestock in remaining bushland should be discouraged, other species of trees, including naturally occuring jarrah, wandoo, marri and flooded gum should be included in the reforestation programme, tree cover should be established in areas of water intake along high ground, and clearance of vegetation through the construction of firebreaks, fencelines and road widening should be reduced.

. IMPACT ON EXISTING ROADS

Damage to roads, in particular Mornington Road and Myles Avenue through vehicles involved in dam construction have not been addressed in the ERMP. The Water Authority should ensure that damage to roads associated with transport and commuter vehicles employed in the dam construction should be rectified, and roads should be regularly maintained throughout the construction phase.

. AQUATIC FAUNA

Discussion of biological components of the aquatic ecosystem is based on models from the USA and Europe. These comments are thought to be too general and there is insufficient data on species habitat. It would be

useful to know what proportion of the habitat types in the surrounding area would be destroyed by dam construction.

. ABORIGINAL SITES

The Environmental Assessment Ratings Table (Table 5) in the ERMP does not include the impact of dam construction on Aboriginal sites. Further, in Section 12.8 the ERMP states that any new sites discovered during the course of construction work would be reported to the Registrar of Aboriginal Sites. This is inadequate as sites are unlikely to be found by untrained people. The Water Authority should provide further professional inspections as work progresses.

. TOURISM AND RECREATION

The ERMP fails to address the likely impact of tourism on State forests, local road works and the proposed dam.

5. CONCLUSIONS

The Authority has considered the information in the ERMP and that provided in the submissions. It believes that the environmental impacts associated with a dam at site 1 are less than those for site 5. The EPA is however, of the view that the development of a dam at either site could be environmentally acceptable.

In reaching the above conclusions, the EPA was conscious that through its System 6 recommendations, conservation values of river valleys were identified. In particular, the Government has made significant progress towards implementation of the recommendation for example the establishment of Lane Poole Reserve, and the EPA has concluded that construction of a dam at either site would not jeopardise these recommendations. In addition the EPA strongly endorses the commitment made by the WA Water Authority to ensure that a dam on the Harris River would not inundate Twenty-Two Mile Pool or any other environmentally significant area.

In evaluating the alternative sites on the Harris River, the EPA has considered the implications of future water supply requirements. Lower environmental impacts are associated with increased development on an existing facility and with this in mind the EPA expresses a preference for Dam site 1. It is appreciated that environmental factors are only one of several issues which need to be considered before a final commitment to either site is made. While the EPA's preference for Dam site 1 should be included within the decision making process, it should not necessarily determine it.

6. RECOMMENDATIONS

RECOMMENDATION 1

The Environmental Protection Authority has concluded that a dam on the Harris River at either Site 1 or Site 5 would be environmentally acceptable subject to the comments within this Assessment Report and commitments made by the WA Water Authority in the ERMP. These are listed in Appendix 1.

RECOMMENDATION 2

The Environmental Protection Authority recommends that details of the water pipeline alignment, construction and proposed rehabilitation methods be referred to the Authority prior to construction.

APPENDIX 1

MANAGEMENT COMMITMENTS

The following management commitments were presented in the ERMP:

CLEARING OF FOREST AND REHABILITATION

Trees and large scrub up to the full supply level will be removed before flooding the reservoir.

CALM will be contacted as early as possible to arrange for logging of suitable timber in the reservoir basin. Timber to the east of the dam could be logged at the same time. The remaining vegetation will be heaped up within the cleared reservoir basin and the immediate area of the dam wall and associated works. Full liaison will be maintained with CALM, in accordance with forest hygiene requirements.

Topsoil from the reservoir area will be stockpiled for use in rehabilitation of disturbed areas. Disturbed areas above full supply level which do not support improvements will be rehabilitated. Such areas will include cut and fill faces and construction pads which are not required for further construction activities and the Griffin sand pit. Topsoil that has been stockpiled during construction will be used to cover the disturbed areas. They will then be deep ripped to promote water infiltration, control erosion and encourage root penetration. Revegetation in the vicinity of the dam wall will conform to a landscaping plan prepared in consultation with CALM officers. Elsewhere, CALM prescriptions for rehabilitation in the jarrah forest will be adhered to.

Regular inspections of rehabilitated areas will be undertaken to identify areas requiring further treatment and maintenance. These inspections will be undertaken annually, prior to each winter season. The prescribed treatments will include:

. control of noxious weeds;

. repairs where signs of soil erosion are evident;

. replanting as required.

Such treatments will be regarded as routine maintenance. It is anticipated that once satisfactory rehabilitation is achieved, it will be self-sustaining.

SURFACE DISTURBANCE AND EROSION CONTROL

The extent of these effects will be minimised by:

. most of the earthworks will be carried out during the summer period when runoff is normally low which will minimise the opportunities for erosion and limit the extent of sediment transport downstream;

. early construction of the dam outlet culvert will bypass river flows around the construction site.

Elsewhere environmental impacts from surface disturbance will be minimised by:

- restricting clearing operations to the minimum required for construction and safe access;

- utilising the area upstream from the dam wall and below full supply level for borrow material and construction facilities;

- in consultation with the relevant authorities, upgrading and using existing roads for access during logging, clearing and construction;

- revegetate disturbed areas outside the storage area as soon as possible after construction is completed.

DUST AND NOISE

Noisy, heavy equipment will only operate during daylight hours to minimise any inconvenience to residents. Residents will be fully informed of any blasting operations and all people will be excluded from the danger area during shot firing. The sealing of the Tallanalla Road from Collie will minimise noise and dust due to heavy vehicle traffic.

Working areas will be sheeted with gravel or when necessary, watering will be carried out using a water tanker fitted with sprays. Watering will be minimised consistent with dieback control requirements where relevant. Employees exposed to unacceptable noise or dust levels will be issued with suitable protective equipment.

CONSTRUCTION OPERATIONS

Adverse impact upon the site environment will be minimised by:

- using cleared areas below full supply level, wherever feasible, for construction facilities and parking areas for workers' cars;

- removal of temporary buildings, construction refuse and hardstand material at the completion of the construction programme;

- supplying appropriate facilities for workers, with regular removal of refuse to appropriate disposal facilities.

Upgrading of Tallanalla - Collie Road will include:

- sealing the road and constructing table drains;

- drainage off the road will be controlled wherever practicable.

Care will be exercised in storage and handling of petroleum based products, as there is the potential for contamination of surface soils and water from oil or fuel spills. All oils and fuel will be stored according to the requirements of the appropriate regulations. All wastes will be collected in a sump and trucked to an approved waste disposal site.

MANAGEMENT OF FOREST DISEASE RISK AREA

As Dam site 5 and the majority of the reservoir are located within the disease risk area stringent conditions will be enforced by the Water Authority on its staff and contractors to minimise the spread of dieback in the disease risk area. The Water Authority will establish guidelines for dieback control in consultation with CALM.

AQUATIC ECOSYSTEMS

To protect Twenty-Two Mile Pool, the full supply level of Harris Dam has been fixed at 223.5 m. The low gradients in this area will mean that the reservoir surface will remain at least half a kilometre from the pool. To further ensure the integrity of the pool ecosystem, it is proposed to retain a buffer area of swamp vegetation below it. This will be achieved by limiting clearing in the shallow upper part of the reservoir to the 223 m contour. As this part of the reservoir will dry out annually, the existing vegetation is expected to survive since it is adapted to seasonal inundation.

Vegetation upstream of Twenty-Two Mile Pool will be protected by selection of the 223.5 m contour as full supply level.

FAUNA

The full supply level has been set at 223.5 m to avoid the swamps above Twenty-Two Mile Pool, on which sensitive species such as the Quokka (Setonix brachyurus) depend.

Inundation of dense stream zone vegetation will reduce the habitat available to the Red-eared Firetail finch. As this species has now been shown to be more widespread than previously thought (Nichols, 1982), and there is a large area of similar habitat upstream, this loss is unlikely to significantly affect the overall status of the species.

FOREST MANAGEMENT USE

CALM will be consulted regarding utilisation of timber remaining in the reservoir area, before the reservoir fills. Access to the east of the dam will be retained via Norm Road. The Water Authority will liaise with CALM to ascertain if direct access to the Collie-Tallanalla Road is required in the long term for fire control and reserve management.

BEEKEEPING

The Water Authority will liaise with CALM and affected apiarists on the need to rationalise and relocate apiary sites, in keeping with the need to minimise conflict with other land uses while maintaining honey production.

MINING

In the longer term as Bauxite Mining approaches the reservoir, the Water Authority will liaise with the relevant parties as it now does regarding sites elsewhere in the Darling Range. It is possible that constraints will be placed on future mining operations in order to maintain water quality.

TRANSPORTATION

The following guidelines for relocation of Tallanalla Road will be used in the final design:

- all affected authorities including CALM, Collie and Harvey Shires, SECWA, Worsley Alumina Company and property owners will be consulted regarding relocation;

- relocation west of the current alignment will take into account the need to minimise the potential for the spread of dieback as well as maintain water quality.

Access for forestry management activities east of the dam will be provided in consultation with officers from CALM. The opportunity for further control of access may well be consistent with the conservation and disease management needs of this area. Liaison will be maintained with the Shires regarding the need for increased road maintenance due to construction traffic. It is anticipated that the unsealed portion of the Collie-Tallanalla Road will be sealed.

DOWNSTREAM ECOSYSTEMS

The site investigations have provided baseline information for species distribution and abundance. Additional surveys after construction and reservoir flooding would provide information on changes in species diversity and abundance.

It may be possible, with more precise ecological information, to use the aquatic ecosystem to gauge the physical and chemical condition of the stream. Some organisms, such as the nymph, Tasmanocoensis tillyardi, may become useful biological indicators. However, the lack of information concerning aquatic biology in the southwest of Western Australia precludes this possibility for management purposes at this time.

Accordingly, the following management guidelines will be adopted for a dam located at Dam site 5.

- release of warmer epilimnion water during the dry season and colder hypolimnion water during winter to minimise adverse thermal effects on aquatic organisms;

- surveys to assess changes in species distribution and abundance - the results of which will be notified to appropriate government departments.

PROPOSED SPILLWAY

The spillway will be designed to incorporate a stilling basin structure which will minimise scour where spillway flow enters the river.

IMPACT OF THE PIPELINE ON EXISTING ENVIRONMENT

The proposed pipeline will follow the transmission line corridor and the Collie-Tallanalla Road throughout its length. Current indications are that the pipeline will be buried and the backfilled trench allowed to revegetate by separate return of stockpiled topsoil over backfilled spoil. The most

likely form of river crossing will be pipebridges, although the Harris River crossing may be buried.

IMPACT OF RESERVOIR ON WATER SUPPLY

The Harris Dam will be operated and managed to achieve:

- immediate improvement in the quality of water supplied to the GSTWS by the supply of low salinity Harris River water;

- a small improvement on average in quality of Wellington Dam water, reducing the salinity of irrigation water supplied to users in the Collie Irrigation District.

NATURE OF PROPOSED RESERVOIR

To minimise the exposure of bare reservoir bed in the gently sloping upper reaches, it is proposed that the bed remain uncleared beyond the 223 m contour in the area of swamp immediately downstream of Twenty-Two Mile Pool. Vegetation in this area would be expected to tolerate seasonal inundation, as it does now.

RESERVOIR HABITATS AND ECOSYSTEMS

The reservoir and its shores will be inspected to detect the introduction of any aquatic weeds and appropriate remedial measures will be implemented.

SHORELINE HABITATS AND ECOSYSTEMS

Retention of existing vegetation down to the 223 m contour, immediately below Twenty-Two Mile Pool, will limit the extent of bare reservoir bed exposed and limit opportunities for the establishment of exotic species. Controls on public access to the reservoir margin will further limit the disturbance to the exposed bed.

IMPACT ON AESTHETICS

It is proposed to capitalise on the aesthetic opportunities provided by a new dam by:

- landscaping the area adjacent to the dam wall;

- providing vistas across the reservoir at selected sites.

IMPACT ON RECREATION

The Water Authority also proposes to:

- examine the suitability of the area downstream of the dam for recreation, particularly picnicking and bushwalking;

- in conjunction with other relevant authorities, give due consideration during the design stage to the tourism potential of the rerouted section of Collie-Tallanalla Road;

- restrict public access, consistent with guidelines for the protection of water quality on Class 1 catchments for public potable supplies (WA Water

Resources Council, 1985). The rerouted Tallanalla-Collie Road will remain open to public access.

WELLINGTON RESERVOIR

In conjunction with affected landholders, State and Local Government agencies and other interested parties, the Water Authority will prepare a management plan defining opportunities for recreation, on the waterbody and on the shorelines around Wellington Reservoir. This plan would indicate the locations and densities of recreational facilities and activities taking into account:

(a) engineering services and access;

(b) environmental issues -

- water quality
- erosion
- flora and fauna

(c) landscape quality;

(d) conflicts in recreation use;

(e) finance, management and maintenance;

(f) public attitudes to development of the area.

ARCHAEOLOGICAL SITES

- The Water Authority acknowledges its obligations to site protection as outlined in the Western Australia Aboriginal Heritage Act, 1972-80, and will comply with any directions given by the Minister.
- Sites S1848, S1869 and S1878 will be test pitted.
- Sites S1865 and S1871 will be recorded in detail and the archaeological material collected.
- Any new sites discovered during the course of the work will be reported to the Registrar.

APPENDIX 2

LIST OF ORGANISATIONS AND INDIVIDUALS WHO MADE WRITTEN SUBMISSIONS

R and V Hawks
COLLIE WA 6225

Mr H S Whittington
BROOKTON WA 6306

Mr L G Adamson
QUAIRADING WA 6383

Mr R H Pearce
KALAMUNDA WA 6076

Mr E A Riley
COLLIE WA 6225

Mr E Trautman
GERALDTON WA 6530

Mr M Hipkins
EAST PERTH WA 6000

General Secretary
The Tree Society
CLAREMONT WA 6010

The Shire Clerk
Shire of Harvey
HARVEY WA 6220

The Shire Clerk
Shire of Collie
COLLIE WA 6225

A A Standring
COWARAMUP WA 6284

The Executive Officer
Land Management Society
WEST PERTH WA 6005

Primary Industry Assoc
(Irrigation Committee)
BUREKUP WA 6227

Mr D Partridge
c/o WA Water Resources Council

Department of Mines

Fisheries Department

Department of Resources Development

Government Chemical Laboratories

Agriculture Department

Department of Conservation and Land Management

Western Australian Museum

Department of Arts, Heritage and Environment