GOVERNMENT OF WESTERN AUSTRALIA

STIRLING DAM CATCHMENT AREA
WATER SOURCE PROTECTION PLAN

Perth Metropolitan and Harvey Town Water Supply

WATER RESOURCE PROTECTION SERIES

WATER AND RIVERS COMMISSION REPORT WRP 34

2000

WATER AND RIVERS COMMISSION

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Perth Metropolitan and Harvey Town Water Supply

Prepared under the direction of
Water and Rivers Commission
Policy and Planning Division
by the Infrastructure Planning Branch
of the Water Corporation

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Foreword

Water source protection plans

Water Source Protection Plans establish the level of protection required in Public Drinking Water Source Areas (PDWSA). Catchment protection of water sources is considered a fundamental part of ensuring the provision of a safe drinking water supply.

Water Source Protection Plans identify sources of contamination that should be investigated and set out programs for management of the resource. Water Source Protection Plans are developed in consultation with affected landowners, industry groups and relevant government agencies.

Proclaiming a PDWSA under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* protects the quality of water sources for Perth Metropolitan supply in Western Australia. The Act's by-laws enable the Water and Rivers Commission to control potentially polluting activities, to regulate land use, inspect premises and to take steps to prevent or clean up pollution.

The Commission aims to work pro-actively with planning agencies to incorporate water protection in the land planning process. Decisions on land use zoning and subdivision applications have a significant impact on the protection of water sources. The Commission supports the amendment of Town Planning Schemes and Development Strategies that reflect land use compatible with Water Source Protection Plans.

This Water Source Protection Plan provides a basis for establishing compatible land uses in the Stirling Dam Catchment Area and is a mechanism for practical implementation of the Commission's protection strategies. Local government decision-makers, State planning authorities and operational staff are encouraged to recognise this document as a basis for ensuring the long-term protection of this water resource for generations to come.

Water quality protection framework

The Water and Rivers Commission is responsible for managing and protecting Western Australia's water resources. The Commission has developed policies for the protection of public drinking water source areas that include three levels of priority classification.

Priority 1 (P1) source protection areas are defined to ensure that there is no degradation of the water source. P1 areas are declared over land where the provision of the highest quality public drinking water is the prime beneficial land use. P1 areas would typically include land under Crown ownership. P1 areas are managed in accordance with the principle of risk avoidance and so land development is generally not permitted.

Priority 2 (P2) source protection areas are defined to ensure that there is no increased risk of pollution to the water source. P2 areas are declared over land where low intensity development (such as rural) already exists. Protection of public water supply sources is a high priority in these areas. P2 areas are managed in accordance with the principle of risk minimisation and so conditional development is allowed.

Priority 3 (P3) source protection areas are defined to minimise the risk of pollution to the water source. P3 areas are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments. Protection of P3 areas is achieved through management guidelines rather than restrictions on land use. If the water source does become contaminated, then water may need to be treated or an alternative water source found.

In addition to priority classifications, reservoir protection zones are defined to protect the water source from contamination in the immediate vicinity of reservoirs. Reservoir protection zones usually consist of a 2 kilometre buffer area around the top water level of a reservoir and include the reservoir itself. These zones do not extend outside the catchment area. Special conditions apply in these zones.

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Summary

Stirling Dam is located south of Perth on the Harvey River in the Darling Range. The Government allocation plan for the Harvey Basin determined the Stirling Reservoir would be a strategic source for public water supply. The Water Corporation's Stirling Harvey Redevelopment Scheme will result in the reservoir being used for Harvey's town water supply and as a strategic supply to Perth Metropolitan Area after May 2001. The scheme will provide an additional 34 giga-litres (GL) per year of potable water and will supply an estimated 350 000 people.

Stirling Reservoir is a significant source of high quality water as the catchment is predominantly undeveloped and in a relatively pristine condition.

The Stirling Dam catchment is within the gazetted Harvey Dam Catchment Area. It is recommended the Stirling Dam Catchment Area be gazetted as a separate catchment and managed for Priority 1 source protection to preserve the high quality of the water source.

The catchment is mainly State Forest and includes the Tallanalla Pine Plantation. There is a small area of freehold land close to the reservoir. A State agreement over the State Forest enables Alcoa to extract bauxite from the catchment.

This plan outlines strategies to manage risks associated with land use activities in the catchment that may have the potential to contaminate the source.

There is significant recreation activity in the catchment. The reservoir and surrounding area is a popular recreational site for marroning, fishing, camping, picnicking, bushwalking, horse riding and rally driving. Other land uses include Western Power's Muja Northern Terminal Line and Worsley Alumina's bauxite conveyor.

The plan has been produced after detailed assessment of these risks on the basis that disinfection will be the prime method of treating the source. In the case of recreation, activities that require body contact with the water or bring people in close proximity to the water are not considered acceptable in this catchment because of the potential health risk to the large population receiving water from this source. Activities that do not require contact with the water body generally pose less of a risk to water quality. Thus, they are generally considered acceptable with appropriate management conditions to ensure water quality protection objectives are met.

The development of this plan has involved extensive consultation. The Water and Rivers Commission formed a reference group to provide key stakeholders with the opportunity to raise issues for consideration. The group also suggested strategies for water quality management and commented on those suggested by the Commission. The Reference Group consisted of representatives from landowners in the Harvey Hills, the Water and Rivers Commission, the Water Corporation, Department of Conservation and Land Management, Health Department of WA, Shire of Harvey, Rally Australia, Confederation of Australian Motorsport, Motorcycling Australia WA, Department of Fisheries WA, RecfishWest and the Whitewater Canoeing Association. The members of the Reference Group are listed in Appendix 1. The Commission appreciates and acknowledges their contribution in the development of this plan.

A draft plan was released for wide public comment and submissions received were considered in the preparation of the final plan, along with further input from the Reference Group.

1. Introduction

The Stirling Dam and Reservoir is located on the Harvey River approximately 140 km south of Perth and 17km east of the town of Harvey (see Figure 1).

The catchment is predominantly in the Shire of Harvey. A section in the north of the catchment is in the Shire of Waroona and a section to the east is within the Shire of Collie.

The town of Harvey is the closest regional centre. It has a population of approximately 2650.

1.1 Existing water supply system

The Stirling Dam was constructed in 1948, has a height of 46 m and the reservoir has a capacity of 56 giga-litres (GL). The annual inflow to Stirling Reservoir is estimated to be 49 GL (Water & Rivers Commission, 1998).

Water from the Stirling Reservoir is released down the Harvey River to the Harvey Reservoir. Currently an average of 37 GL/year is released. The Water Corporation then draws water from the Harvey Reservoir to supply potable water to Harvey and irrigation supply to the South-West Irrigation Company (SWIC). SWIC distribute irrigation water to the surrounding area.

1.2 Future water supply system

Under the Stirling-Harvey Redevelopment Scheme, Stirling Reservoir will be used to supply drinking water to Harvey, Perth, Mandurah, Goldfields and agricultural area water supply schemes as part of the Integrated Water Supply System (IWSS). A pipeline will be constructed from Stirling Dam to Rockingham. This pipeline is planned for completion in 2001. The town of Harvey will be supplied by an offtake from the pipeline. Some water will still be released to the Harvey Reservoir to meet irrigation requirements.

Under the new scheme, water from the Harvey Reservoir will be used solely for irrigation. The increased storage of the new Harvey Dam will reduce the need for releases from Stirling Reservoir.

Stirling Reservoir is proposed to be supplemented with water from the Harris Reservoir via a pipeline to be completed in 2001.

Stirling Reservoir will be a source of vital importance. It will be the principal source for Harvey and relied on as a strategic source for the IWSS.

Average annual public water supply from the Stirling Reservoir will be 29 GL, supplemented by 5 GL/year from Harris Reservoir. An additional 9 GL/year will be released to Harvey Reservoir for irrigation requirements.

This Source Protection Plan is written for the Stirling Reservoir as a strategic drinking water supply source.

The objective of this plan is to propose strategies to ensure land uses and activities in the Stirling Dam catchment have negligible impact on the water quality in Stirling Reservoir.

1.3 Existing water source protection

The Stirling Dam Catchment Area is within the gazetted Harvey Dam Catchment Area which was proclaimed in 1994 under the *Country Areas Water Supply Act 1947* (see Figure 1) to protect the public water supply from the Harvey Dam.

1.4 Water resource allocation

Surface water resource use and conservation in Western Australia country areas is administered by the Commission in accordance with the *Rights in Water and Irrigation (RIWI) Act, 1914*. Under the RIWI Act, the right to use and control surface water is vested in the Crown. This Act requires licensing of surface water abstraction within proclaimed Surface Water Areas.

The Stirling Dam catchment is within the Harvey Basin Surface Water Area proclaimed under the RIWI Act. All surface water abstraction in the Harvey Basin Surface Water Area, other than that required under riparian rights, requires licensing by the Commission.

The *Proposed Harvey Basin Surface Water Allocation Plan (1998)* defined the allocation planning for the

surface water resources in this Basin on an ecologically sustainable basis. This process included allocations for environmental and important social uses as well as for consumptive uses (eg. public water supply). The Environmental Protection Authority approved this plan in 1998.

Under the Stirling-Harvey Redevelopment Scheme, water from Stirling Reservoir will be used for Harvey's town water supply and as a strategic supply to the IWSS after May 2001. The scheme will provide an additional 34 giga-litres (GL) per year of potable water and will supply an estimated 350 000 people.

1.4.1 Current allocation licence

The applicable Surface Water Licence for the Stirling Reservoir, Licence No. 0056288, applies to the Harvey Weir, Stirling Reservoir and Logue Brook Dam. The total allocation for abstraction from these sources is 64.8 GL/year. This licence is issued by the Commission for the purpose of providing water for public potable water supply and irrigation.

This Surface Water Licence will change under the Stirling-Harvey Redevelopment Scheme to reflect the change in use.

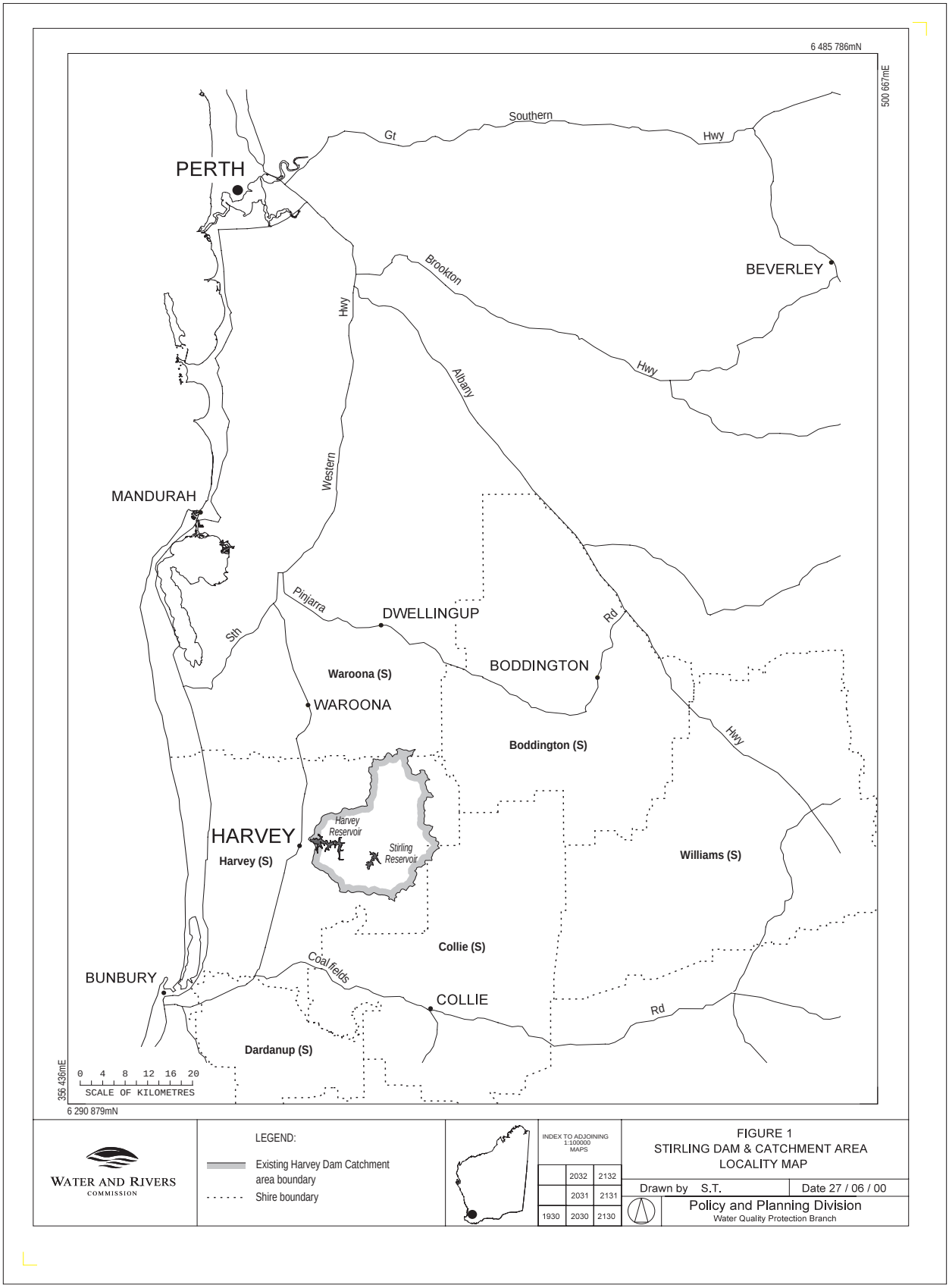

Figure 1. Stirling Dam and Catchment Area locality map

2. Physiography

The Stirling catchment is contained within the Darling Range. The Darling Range forms part of the Archaean Shield composed largely of granite which has some invaded linear belts of metamorphosed sedimentary and volcanic rocks, some isolated occurrences of which remain (Schofield, 1991). Thin sheet-like dolerite intrusions occur abundantly in the basement rock. Deep V-shaped valleys occur close to the Scarp, with shallow soils and frequent rock outcrops. On moving inland in an easterly direction, valleys are broader and more U-shaped.

Soils over the granite consist of a weathered laterite hard cap and associated clays and include shallow sand over sheet laterite, gravelly duplex soils and grey sands. Upland laterites consist of sandy loams in a gravel matrix whilst gravels tend to become finer down slope, sometimes grading into sandy yellow earths in the lowest positions.

3. Climate

The area has a Mediterranean climate, characterised by warm and dry summers with cool, wet winters. The long-term average annual rainfall for the catchment is approximately 1200 mm and most of this falls between May and September. However, average annual rainfall in the town of Harvey has not exceeded the long-term average for the last 20 years. This drop in rainfall has seen a statistically significant reduction in streamflow from 1975 to the present (WRC, 1998). The annual average evaporation is between 1200 and 1600 mm and monthly evaporation varies from 50 mm in June to 300 mm in January.

4. Hydrology

The catchment for the Stirling Dam has an area of 254 km^2. Elevation in the catchment is 80 m Australian Height Datum (AHD) at the reservoir to 320 m AHD at the head of the catchment.

Water inflow to the reservoir is mostly from surface runoff over the winter months. However, there is subsurface flow year round due to the gravelly nature of the geology in the Darling Range. The average monthly flow in winter is significantly greater than in the summer months (Public Works Department, 1984).

The long-term average volume of water entering the Stirling Reservoir is 59.4 GL/year (WRC, 1998). The current long-term average yield from Stirling Dam is 37 GL/year (WRC, 1998).

5. Water quality

Water quality in the Stirling Reservoir and tributaries into the reservoir is regularly monitored for pH, turbidity, colour, conductivity, iron, manganese and aluminium at a number of locations. Details of typical water quality at the reservoir outlet are shown in Appendix 2.

Water quality sampling results show the water in the Stirling Reservoir to be of high quality and only chlorination is required before supply as drinking water. A more comprehensive sampling program, including bacterial and chemical constituents was initiated in 1998.

6. Water treatment

Currently there is no treatment of water from Stirling Reservoir before it enters the Harvey Reservoir. The water from the Harvey Reservoir is then treated for use as a public water supply.

Under the Stirling-Harvey Redevelopment Scheme, raw water from the Stirling Reservoir will be disinfected before reaching the town of Harvey and the Perth Metropolitan supply. To achieve this, two chemical dosing plants will be constructed approximately 2 km upstream of the new Harvey Dam wall. One plant will dose chlorine and fluoride for supply to Harvey. The other plant will dose chlorine, fluoride, lime and CO_2 (the latter two for pH stabilisation) for supply to Perth.

A multiple barrier approach is used in the protection of drinking water quality. Catchment management and protection is the first important stage. Water treatment is another stage used to ensure water is safe to supply to the public. It is important to note that treatment can improve water quality but does not remove all hazards

to public health. This is why catchment protection is critical.

7. Existing and proposed land use

Land use and activities in the catchment consist of:

- freehold land used for rural pursuits
- state Forest, including the Tallanalla Pine Plantation
- recreation.

Details of current land use and activities, including recreation, are outlined in Appendix 3. Land uses and recreation activities are shown in Figures 2 and 3 respectively.

7.1 Freehold land

There is some freehold land in the catchment, close to the Reservoir, to the west of the dam wall. The area of freehold land is 35 ha, and is predominantly owned by the Water Corporation. The Water Corporation land was previously used for rural pursuits, and will be rehabilitated with native vegetation. Land that remains in private ownership has a residence (wastewater is disposed of outside the catchment), a small area of blue gum plantation, and native vegetation.

7.2 Crown land

State Forest Number 15 covers approximately 96% of the 254km^2 catchment. Within the State Forest, jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) forest dominate. Understorey species include *Banksia grandis* and *Allocasuarina fraseriana.* A small portion of the forest along the eastern boundary is designated as a dieback quarantine area.

The State Forest is vested in the Lands and Forest Commission and is managed by the Department of Conservation and Land Management (CALM).

The forest is managed for multiple uses that include timber production, water production, recreation and nature conservation, apiaries, and wildflower and seed harvesting. There is also collection of firewood for private use. Specific forest management activities include hardwood timber harvesting and prescribed burning.

The Tallanalla pine plantation is situated in the State Forest adjacent to the reservoir and covers an area of 1015 ha. The plantation was developed between 1964 and 1971 and is harvested when required. A small area of this plantation has been replanted with blue gums.

There is a Land Act Reserve, No. 25727, to the south of the Stirling Reservoir. This reserve is vested in the Minister for Water Resources for the purpose of water supply.

A Special Mining Lease covers the Crown land in the catchment. This State Agreement Tenement was granted to Alcoa of Australia in 1961. Under the State Agreement Act, Alcoa has rights to extract bauxite from areas of State Forest, with associated responsibilities to protect environmental values and rehabilitate minesites. No mining activity has occurred in the catchment to date.

The Worsley Alumina conveyor belt passes through the eastern side of the catchment in the State Forest, transporting bauxite from the minesite to the refinery.

A major Western Power transmission line, the Muja Northern Terminal Line, also passes through the catchment.

7.3 Recreation

A number of recreation activities occur in the catchment. The reservoir and the Harvey River are fished for marron using drop nets and occasionally snares. Marroning is a significant activity during the January/February season attracting large numbers of people.

Trout fishing occurs in the Harvey River upstream of the reservoir. A fish ladder is established on the Harvey River close to the Stirling Reservoir. The ladder is a popular tourist site. Boating and swimming is currently prohibited in the reservoir for safety reasons.

There is a large camping and picnicking ground at Hoffman's Mill where swimming in the Harvey River

has been permitted. It is approximately 10 km upstream of the reservoir and is a significant local site used by large numbers of people.

There are three additional designated picnic areas in the catchment, Rocky Crossing and two sites near the top of the dam wall. Rocky Crossing is on the Harvey River approximately 2 km upstream of the reservoir.

Bushwalking is a regular activity throughout the catchment, particularly along the Harvey River on the old Bibbulmun track. The new Bibbulmun track is outside of the Stirling Dam catchment.

Motor sport events are held in the catchment and these are run by Events Corp. (Rally Australia), Confederation of Australian Motorsport (CAMS) and Motorcycling Australia W.A. These events are undertaken close to the reservoir.

Organised rogaining and horse-riding groups occasionally use the catchment for events.

Recreation in the State Forest is generally managed by CALM.

Tourism associated with these activities is important to the area and forms a part of the valuable tourism industry in the south-west of the state.

Plate 1. Rocky Crossing on the Harvey River

Plate 2. Hoffmans Mill camping and picnic site

Plate 3. Undesignated camping site on the Harvey River

Plate 4. The Trout Ladder at Harvey Falls

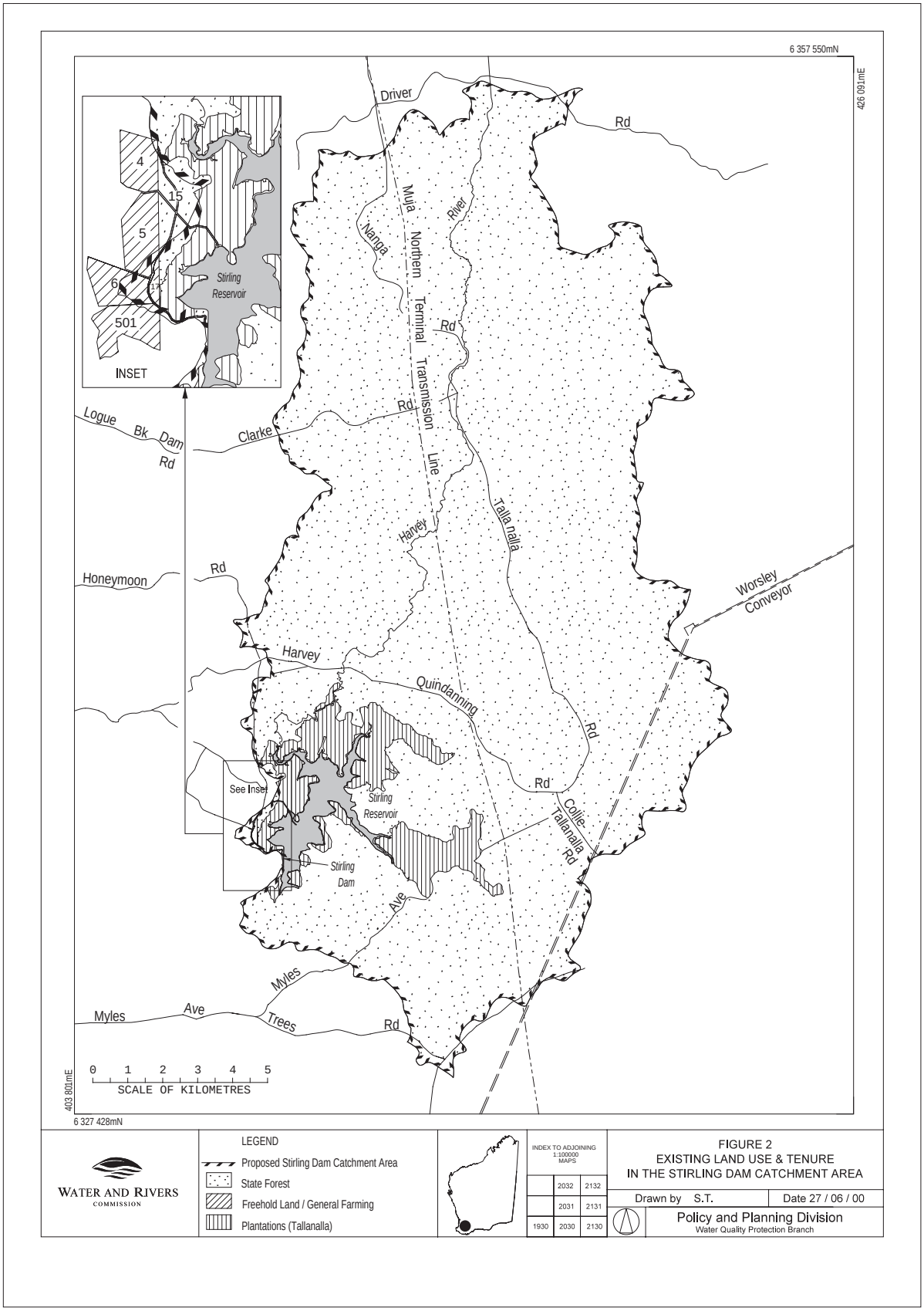

Figure 2. Existing land use and tenure in the Stirling Dam Catchment Area

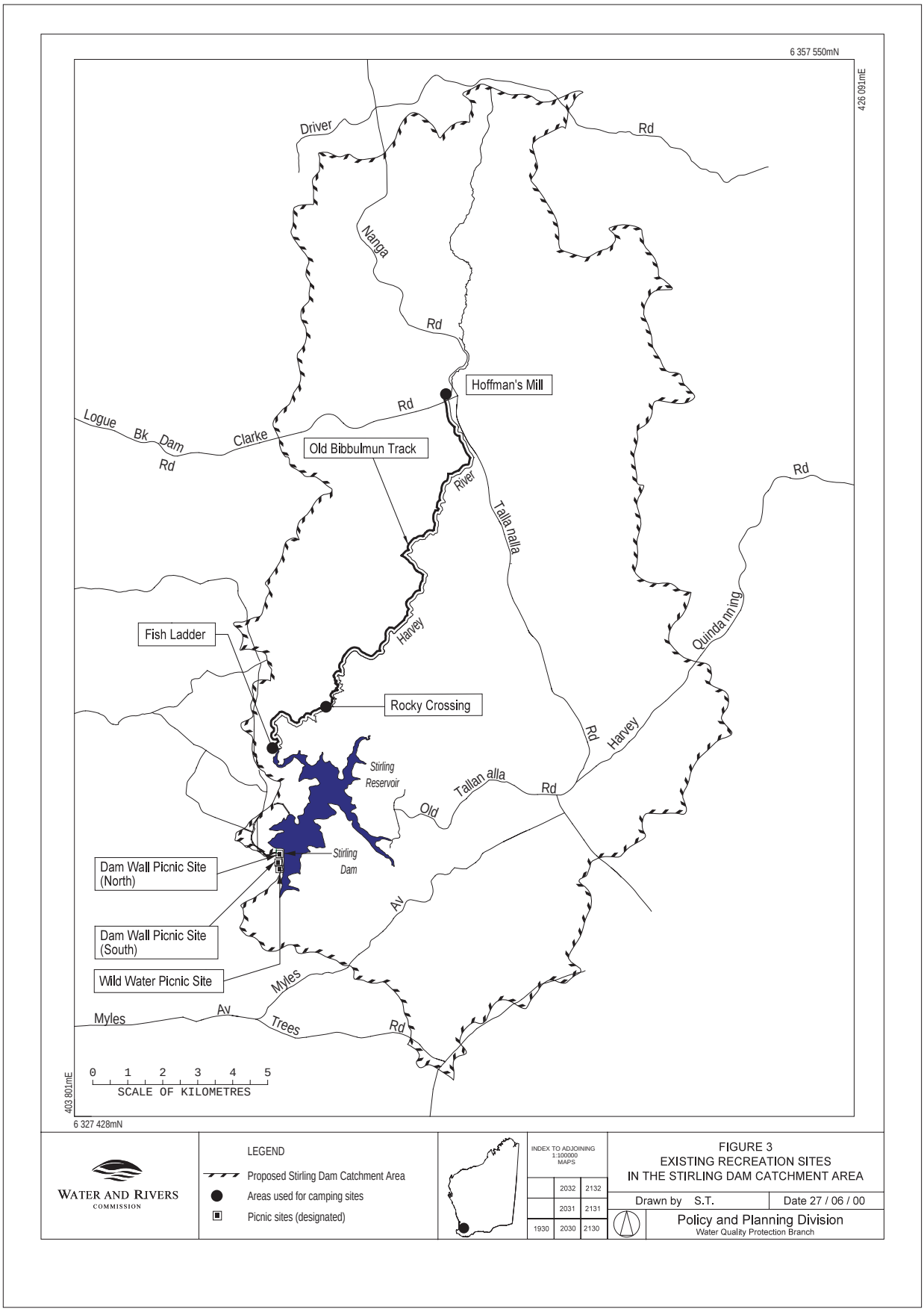

Figure 3. Recreational sites in the Stirling Dam Catchment Area

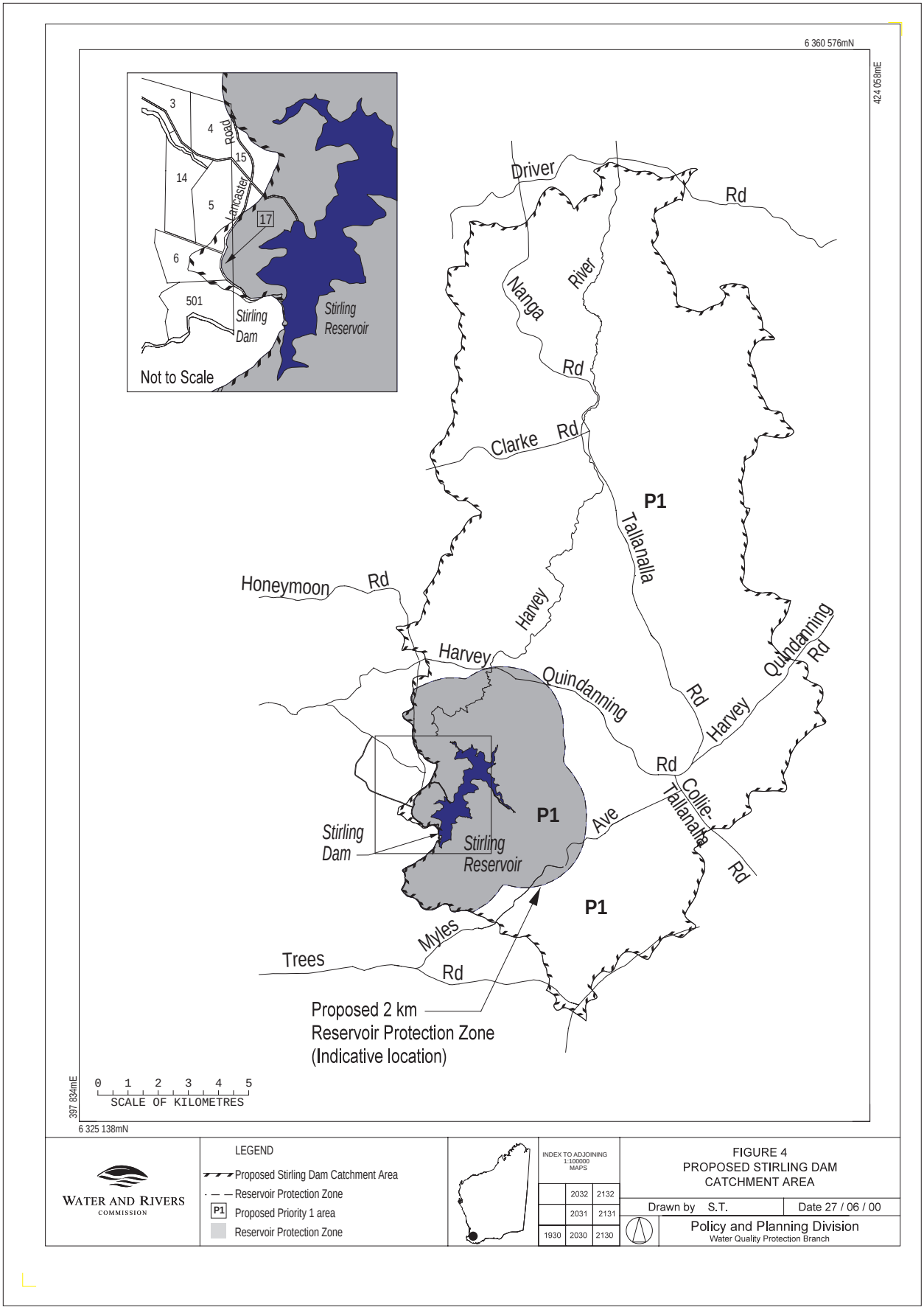

Figure 4. Proposed Stirling Dam Catchment Area

8. Proclaimed areas and priority classification

The Stirling Dam catchment was gazetted under the *Country Areas Water Supply Act 1947* as part of the Harvey Dam Catchment Area in 1994. As the Stirling Reservoir will be a strategic public water supply for the Perth Metropolitan Area, and the town of Harvey, it is proposed the catchment be gazetted separately under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909 (MWSS&D Act)*. The proposed Stirling Dam Catchment Area to be gazetted is shown in Figure 4.

It is proposed the Stirling Dam catchment be managed for Priority 1 source protection. The objective is to preserve the high quality of this water by avoiding risks of contamination. This classification is justified on the following basis:

- Stirling Reservoir will be a strategic source for the Integrated Water Supply System and Harvey water supply from 2001;
- The existing water quality is of a high standard;
- Land is mostly in crown ownership;
- Existing land uses are generally compatible with P1 or can be managed for P1 objectives with the use of best management practices;
- The only treatment of water from the reservoir is proposed to be disinfection.

The detail of general land use compatibility for the Priority 1 source protection classification is listed in Appendix 4.

8.1 Reservoir Protection Zone (RPZ)

To protect the reservoir from immediate risks to water quality, it is proposed the area close to the reservoir be managed as a Reservoir Protection Zone (RPZ).

The RPZ is defined as an area within the catchment approximately 2 km from the high water level of the reservoir (see Figure 4). On the western side of the catchment it is bounded by Lancaster Road. Under the by-laws of the MWSS&D Act this area is termed a 'prohibited zone'.

9. Management of potential water quality risks

9.1 Protection objectives

The Priority 1 classification proposed for this catchment has the fundamental water quality objective of risk avoidance. The source protection objective is to preserve the high quality of this water by avoiding risks of contamination.

Stirling Reservoir is a strategic source for potable water supplying an estimated 350, 000 people. Consequently, potential risks posed to water quality have been carefully assessed.

This plan aims to balance water quality protection and social needs and aspirations as much as possible. Where constraints limit existing activities, opportunities should be undertaken to seek locations that are more appropriate.

9.2 Predominant water quality risks in the catchment

9.2.1 Turbidity

Turbidity levels in the Reservoir are generally very low. Turbidity is the presence of suspended solids, such as soil and organic matter, in water. These particles can aid the transport of other contaminants in water.

The main sources of suspended solids are soil erosion and disturbance of the streambed.

The following practices are examples of potential contributors to turbidity:

- excessive vegetation removal
- road construction and maintenance
- harvesting of timber using heavy machinery
- off-road driving.

Management practices, such as retaining vegetation buffers to watercourses can reduce the risk of soil erosion and therefore reduce turbidity levels in the water. These practices are recommended as best management practices.

9.2.2 Pathogens

There is a substantial potential risk to water quality from possible pathogen contamination by human and domestic animal contact with water. There are many pathogens that can contaminate water supplies and a number that are commonly known to contaminate water supplies worldwide. These common pathogens include bacteria (eg. *Salmonella*, *Campylobacter*, *Escherichia coli* and *Cholera*), parasites (eg. *Cryptosporidium* and *Giardia*) and viruses. These pathogens generally occur due to faecal contamination.

The percentage of humans from around the world who are pathogen carriers ranges between 0.33% (*Shigella*) and 25% (*Cholera El Tor* in Asia), depending on the pathogen in question (Geldreich, 1996). For example, it is estimated between 1-3.9% of people are infected with *Salmonella* worldwide, 0.6-4.3% with *Crytosporidium* and 7.4% with *Giardia*. Estimates in Australia for *Giardia* are as high as 20% for children in child care (Grimmond, Radford and Brownridge, 1988).

Even if the lower limit was used, as may be expected in Australia, there is a significant potential risk of contamination by any of these pathogens if humans are present in, or near, the dam and feeder streams.

Pathogen contamination has the potential to last a significant amount of time in water. For example, *Salmonella* is viable for 2-3 months and *Giardia* for around 1 month (Geldreich, 1996). Other sources estimate viability for longer periods.

Based on the likelihood that a person near the reservoir is infected with one type of pathogen, and because of the viable life of pathogens, human contact with water and the presence of humans near the dam or feeder streams is a risk to public water supply quality and human health. While disinfection effectively kills many pathogens, it does not completely eliminate all pathogens. Preventing their presence in the water source is the most effective way of removing a public health risk.

Based on the potential risk posed by human contact with the water and the number of people that could be potentially affected, activities that require contact with the water are considered unacceptable in this catchment.

Activities that do not require or pose a risk of human contact with the water pose less of a risk. Consequently, activities with no water contact are generally permitted with management conditions, to ensure they do not compromise water quality objectives.

9.3 Best management practices

The adoption of best management practices for land use activities is encouraged to help protect water quality.

To assist the adoption of sound environmental practices, guidelines for specific industries are being progressively developed in conjunction with other agencies (eg. Agriculture Western Australia and the Department of Environmental Protection) and the relevant peak industry body. Examples include recently released Mining and Mineral Processing Guidelines, Dairy Guidelines and Draft Viticulture Guidelines. These guidelines incorporate a practical, commonsense approach to environmental management issues, and are aimed at avoiding any unreasonable burden to the industry.

The Commission will be reviewing key guidance documents related to forest management practices. These are the Code of Practice for Timber Plantations, Code of Practice for Timber Harvesting and the Manual of Management Guidelines for Timber Harvesting. This review will consider appropriate water quality protection measures and is to be undertaken in consultation with CALM.

The Commission recommends these guidance documents to landowners and managers as best practice for water quality protection.

9.4 Land use planning

Most land uses currently occurring in the Stirling Catchment Area are compatible with the Priority 1 classification. The Commission recognises landowners' legitimate rights to continue to use and develop their land in accordance with the priority classification.

Establishing appropriate protection mechanisms in statutory land use planning processes is necessary to secure the long-term protection of water sources.

It is therefore appropriate that the Stirling Dam Catchment Area and Priority 1 classification be recognised by a Special Control Area in the future Greater Bunbury Region Scheme and in the Shire of Harvey Town Planning Scheme.

The existing Shire of Harvey's General Farming zoning for the freehold land and the Landscape Protection overlay under the local Town Planning Scheme recognise the proclaimed public water source status of this catchment.

This protection plan and subsequent recognition of the catchment and priority classifications in statutory planning strategies will provide certainty for long-term management requirements for the land.

The Water and Rivers Commission's input to the development approval process is through providing advice on the compatibility of land uses with the priority classification. Advice is on a case-by-case basis.

The guidance document *Land Use Compatibility in Public Drinking Water Source Areas* (see Appendix 4) uses the term "conditional" where the land use can usually be compatible with the objectives of source protection, with the adoption of appropriate management practices. Generally, these are practical steps to protect water resources from potential contaminants and cover issues such as fuel and chemical storage, nutrient application and waste disposal.

9.5 Surveillance and By-law enforcement

The quality of water sources is protected under by-laws of the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*. By-laws under this Act are used to control potentially contaminating activities.

The Commission considers by-law enforcement, through on-ground surveillance of land use activities in water supply catchments, as a critical water quality protection mechanism.

Catchment surveillance and subsequent contact with visitors to the catchment is also important in raising the general level of awareness of the need to protect water quality.

Education (eg. signage and informative material) is a key mechanism for water quality protection for those who visit the catchment and for landowners in the catchment.

On freehold land, the Commission aims to inform landowners and managers on protection of public drinking water sources by the use of environmental management guidelines and other informative material. The Commission recommends the use of best practice for water quality protection through provision of management advice in the form of environmental guidelines and Water Quality Protection Notes.

The responsibility for catchment surveillance for water quality protection has been delegated to the Water Corporation by the Water and Rivers Commission. The powers for by-law enforcement are assigned to the Water Corporation as part of this delegation. The Water Corporation reports annually to the Commission on the surveillance program and associated issues.

9.6 Emergency response

Escape of chemicals during unforeseen incidents and use of chemicals during emergency response can cause contamination of water sources. The Shire of Harvey Local Emergency Management Advisory Committees through the Bunbury Emergency Management District should be familiar with the location and purpose of the Stirling Dam Catchment Area. A locality plan should be provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team. The Water Corporation should have an advisory role to any HAZMAT incident in the Stirling Dam Catchment Area.

Personnel who deal with WESTPLAN - HAZMAT incidents within the area should be given ready access to a locality map of the Stirling Dam Catchment Area. These personnel should receive training to ensure an

understanding of the potential impacts of spills on the surface water resource.

9.7 Land use, potential water quality risks and recommended strategies

The following table details the existing land uses in the catchment, the potential water quality risks and leads through a discussion to a recommended strategy to manage the risk.

The recommended strategies aim to secure the water quality of this strategic source for the community in the long term, yet still support the continuation of landholders' rights to use and develop their land.

The responsible agencies and appropriate timeframes for implementation of the strategies recommended in the following table are outlined in the Implementation Strategy section of this plan.

Table 1. Land Use, Potential Water Quality Risks and Recommended Strategies

The following table summarises the potential water quality risks associated with the land use activities in the catchment and recommends strategies for minimising the impact on the water quality of the Stirling Reservoir.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Freehold Land			
Activities are: blue gum plantation and residence	The potential water quality risks associated with these private land uses are pesticide and nutrient contamination (blue gum plantation), fuel storage or spills (residence and sheds) and erosion (establishment and harvesting of blue gums). While this area is small compared to the entire catchment area, it is within 1 km of the Reservoir.	Land uses pose a potential risk to water quality and are in very close proximity to the reservoir. While landowners have the right to continue their current land use, it would be ideal if this met objectives of P1 classification. The risk posed by the residence has been reduced by pumping all wastewater out of the catchment. Intensification of land use is undesirable. This position imposes significant restraints on landowners. Landowners can approach the Commission regarding land sale to the Crown if they so desire. The Commission will not compulsorily acquire the land.	*Long term crown ownership of private land.* • Landowners can stay and continue current activities, with best practices being encouraged, in compliance with P1 objectives. Voluntary Crown acquisition of land can be initiated by landowners. • Oppose intensification of land uses through planning approval process.
State Forest			
Hardwood timber harvesting	The potential risk from hardwood timber harvesting is of turbidity from erosion associated with tree felling practices and machinery using unsealed roads and tracks. There is also the risk of a fuel spill from vehicles and machinery.	These activities can be managed to minimise impact on water quality. Water quality protection is a requirement of the CALM Act, which recognises the importance of water as a resource. Research has shown that timber harvesting does not necessarily lead to increased turbidity in water-courses if proper harvesting management is in place (including vegetation buffers along water-courses and understorey vegetation left after timber harvesting) (Borg et al, 1988). Harvesting practices are in line with relevant codes of practice and management manuals.	*Acceptable activity with Best Management Practices*. • Ensure the Hardwood Harvesting Manual includes provisions for water quality protection. Details include road maintenance, buffer zones along watercourses and the reservoir, protection of soil including rehabilitation measures and protection of water. • The 1 year and 5 year timber harvesting plans for the catchment to be reviewed to ensure water quality protection objectives are met. • Routinely inspect protection measures on the ground, and monitor during operations.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Tallanalla plantation (950 ha Pines and 50 ha blue gums)	The potential risk to water quality from the plantation is from: • Establishing trees (erosion, fertiliser use, pesticides) • Maintaining and thinning the plantation (fertiliser use, pesticide use for weed control and insect control) • Harvesting (erosion and fuel spills) • Unsealed roads and tracks (turbidity). The plantation is adjacent to the reservoir in some cases. It is considered that streams draining from relatively undisturbed stands of pine trees are comparable with streams draining native forests.	Water quality protection is a requirement of the CALM Act, which recognises the importance of water as a resource. With regard to erosion, research and experience has shown that proper management, specifically retaining a buffer between the area being harvested and watercourses, can mean there is little effect on water quality from activities that may cause erosion (Borg et al, 1988). Hence, with appropriate management the activity is acceptable. It is important to note that the steepest land in the catchment is adjacent to the reservoir and 23% of pines are on land with slopes greater than 20 degrees. The steepness of the land in the plantations reinforces the need to carefully manage this land. Plantation practices are in line with relevant codes of practice.	*Acceptable activity with Best Management Practices.* • Review the Code of Practice for Timber Plantations in Western Australia. Ensure requirements for road maintenance, fuel storage and handling, fertiliser use, pesticide use and buffer zones along watercourses to a standard appropriate for protection of water quality. • All operators to adhere to the Code of Practice as a condition of their contract. • Ensure contract specifications recognise water protection objectives. • Review road network and close non-essential roads (particularly those close to reservoir). • Review logging plans and routinely inspect and monitor protection measures on the ground. • Review the Tallanalla Management Plan to ensure water source protection objectives are recognised and implemented. • Apply Health Department's requirements for pesticide use.
Roads and tracks in State Forest	Roads pose risks to water quality from turbidity due to erosion of unsealed roads and tracks. Studies have shown that unsealed forest roads are a significant potential source of sediment and management and maintenance is essential (Grayson et al., 1993).	While some roads and tracks are necessary for proper forest management, it is essential that they are well maintained. CALM has indicated that the road network could be reviewed. Management of roads and tracks is covered by the relevant codes of practice.	*Roads and tracks are acceptable but require Best Management Practice.* • Manage roads in the plantation and State Forest in accordance with the relevant Codes of Practice. • Review road network and close unnecessary roads in the plantation and State Forest, particularly those close to the reservoir. Include this in the Tallanalla Management Plan and ensure recreational needs are considered. • Review need for road at Rocky Crossing for forest management purposes. Close if deemed appropriate. • Close road over the Stirling Dam and spillway to restrict public access to the reservoir.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Fire management	Maintaining firebreaks may lead to erosion and spread of dieback. However, a serious wildfire would strip the land of vegetation, potentially resulting in significant erosion and turbid runoff into the reservoir. Also, extraction of water from the reservoir and the river for fire fighting could impact on water quality.	Controlled burning and firebreak maintenance may pose some risk to water quality, but must be balanced with the potentially greater impact of a wildfire.	*Accepted as a necessary activity in proper forest management.* • Establish specific criteria that ensure the burning program adheres to water quality objectives. For example, specific criteria would include where firebreaks can be placed, and the use and management of drainage sumps for sediment control. • Establish specific points for accessing water supplies for fire-fighting purposes.
Apiarists/ wildflower picking/ seed collection/ firewood collection/	The potential risk from these activities is from pathogen contamination and litter through the presence of people near streams and reservoir and the risk of rubbish dumping as a precursor to casual firewood collection.	The main concern from these activities is the potential for people to be in close proximity to the reservoir or feeder streams. However, the numbers of people involved are low and all these activities, except the collection of less than 1 tonne of firewood, are subject to conditional approval by CALM. The permit conditions imposed by CALM for apiary cater for water quality protection.	*Acceptable with controls such as CALM licence conditions.* • Activities to be restricted to outside proposed RPZ and away from feeder streams. • Apply conditions in CALM licences for Apiarists, Wildflower Picking and Seed collection that meet water quality protection objectives. • Promote casual firewood collection areas outside catchment area.
Shire of Harvey Roads	Harvey-Quindanning Road and Lancaster Road are managed by the Shire of Harvey. The potential risks from these roads are from a spill of a contaminating substance such as oil, diesel or chemical, and turbidity due to erosion from stormwater runoff carrying sediment.	These roads are necessary for regional transportation so the best approach would be to take measures to minimise the impact of a spill or erosion through road maintenance and management measures.	*Roads acceptable with Best Management Practice.* • Review road maintenance practices for Shire roads in catchment so risk to water quality is minimised. • Assess risk of a fuel spill by conducting a risk assessment survey of the use of the Harvey-Quindanning Road for the transport of fuel and chemicals. Place signs along Harvey-Quindanning Road with an emergency contact number in the event of a spill. • Ensure emergency response process is in place and the local emergency management advisory committee is aware of Stirling Catchment Area as a drinking water catchment so the response plan can be changed accordingly.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Defence Force activities	This activity has the potential for pathogen contamination from pit toilets, human contact with water and turbidity from vehicle use in the catchment.	Aircraft use the area for navigation training purposes. As a controlled activity the risks can be minimised by ensuring no contact with water and compliance with relevant requirements for human waste disposal. Approval for this activity is required from CALM. One key requirement of CALM approval is that vehicles keep to roads to prevent erosion.	*Acceptable activity in the catchment with conditions.* • Restrict on-ground training to outside of the RPZ. • Ensure approval for activities contains management conditions for water quality protection. For example, no contact with watercourses throughout the catchment and all waste to be contained and taken out of the catchment. • Undertake discussions with Defence Force to investigate the use of alternative areas. • Undertake surveillance to ensure compliance with approval.
Feral animal control program (Fox and Feral pig control)	Fox control: There is a baiting program throughout the south of the State, using 1080 bait. The potential risk posed by this activity is minimal as 1080 is a naturally derived poison from a native plant. The natural quantity of this poison in the catchment would far exceed the quantity used in baiting. The carcasses of poisoned animals may pose a risk of bacterial contamination. Feral pig control: Feral pigs pose potential risks to water quality through pathogens and turbidity from foraging. This activity reduces the number of feral pigs in the catchment but may pose similar risks to hunting if not carefully controlled and managed.	Fox baits are not considered to have an impact on water quality. However, if the carcasses of any dead animals are near watercourses they can result in a risk to water quality. Water Corporation has been involved with the operation of Operation Foxglove in public drinking water source areas. Feral pig control would help to reduce the risk to water quality posed by these animals and is an activity required by CALM. However, in order to minimise the risk to water quality it would need to be undertaken in a well managed and organised manner.	*Fox Baiting is an acceptable activity in the catchment with conditions.* • Control fox numbers with 1080 through CALM Operation Foxglove program . • Remove any carcasses encountered near watercourses, where practical. *Organised control of feral pigs is an acceptable activity with conditions.* • Develop guidelines for the managed control of feral pigs, which may include hunting under strict requirements. Guidelines to include water quality protection requirements. Controls could include, among other requirements, removal of carcasses from the catchment and no dogs in the catchment.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Special Mining Lease 1SA	Through the Department of Minerals and Energy, Alcoa of Australia holds a Special Mining Lease under the State Agreement Act. There are many potential water quality risks from bauxite mining activity in the catchment. Mining activity has not yet occurred in the catchment.	A multi-agency group, the Mining and Management Planning Liaison Group (MMPLG) oversees the implementation of the State Agreement Act which includes reviewing of Alcoa's 5 year mine plan and enforcing environmental (including water quality protection) conditions where appropriate.	*Acceptable if operated in compliance with conditions imposed by MMPLG.* • The conditions imposed by the MMPLG specifically pertaining to water quality protection must be adhered to.
Alumina Conveyor Belt			
Worsley Conveyor belt	There is a potential risk of turbidity and chemical contamination from maintenance procedures or in the case of a spill.	The risks posed by the conveyor belt have been addressed in the Worsley Environmental Management Plan which has been approved by the EPA. Oil storage along the conveyor belt is bunded and the conveyor belt is in the outer reaches of the catchment.	*Acceptable if operated in compliance with Management Plan.* • Worsley to continue operating in compliance with Management Plan. • This operation included in routine surveillance program.
Western Power Line			
Muja Northern Terminal Transmission Line	To maintain easement, Western Power control vegetation using machinery. This could increase risk of erosion, especially near streamlines. No pesticides are used in the maintenance of the terminal line easement.	The maintenance of the easement is necessary for operation of the terminal line. However, maintenance should be carried out to minimise erosion, especially near streamlines.	*Acceptable with Best Management Practice.* • Ensure maintenance practices minimise erosion without using other undesirable methods such as pesticides to ensure water quality objectives are met. • Include this operation in routine surveillance program.
Water Corporation Construction			
Harris-Stirling pipeline	The potential risk from construction is turbidity from erosion and spills from stored fuel and machinery.	The construction of the Harris-Stirling pipeline has been addressed in the environmental approval process for the Stirling-Harvey Redevelopment Scheme. As the pipe is to be buried and has life of greater than 100 years, it is expected that there will be no ongoing risk from pipeline management.	*Acceptable with Best Management Practices.* • Compliance with procedures outlined in Public Environmental Review (PER). • Include this activity in routine surveillance program.
Harris-Stirling pipeline outfall	The potential risk of increased turbidity from erosion caused by the pipe discharging.	The pipe discharge is a necessary part of the project. The discharge point is in a well-vegetated reach of the stream and in some areas the base is bedrock. The design of the pipe outfall will include measures for energy dissipation to reduce erosion.	*Acceptable with Best Management Practices.* • Compliance with procedures outlined in Public Environmental Review (PER). • Include this activity in routine surveillance program.
Modifications to Stirling Dam	Potential risk of increased turbidity and fuel spill from construction works which include the improvements to the spillway, the construction of a new tower, the draining of the Reservoir and the closing of the road over the dam wall.	The works at Stirling Dam are necessary for operation of the new water supply system and public safety. Risk to water quality will be minimal if construction is managed to minimise erosion and control fuel and chemical use and storage.	*Acceptable with Best Management Practices.* • Compliance with procedures outlined in Public Environmental Review (PER). • Include this activity in routine surveillance program.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Recreation			
Marroning	Risk of pathogen contamination through people being in and around the reservoir for extended periods without toilet facilities and the use of bait. There are also potential erosion problems through vehicle use.	Body contact with the water, rubbish and human waste disposal pose an unacceptable risk to water quality, particularly with the level of water treatment. The large numbers of people who are associated with this activity exacerbate these risks. Allowing a managed recreational fishery to operate in a public drinking water catchment is not considered practical. The activity could not be undertaken without contact with the water and because of forested nature of the catchment and the limited ranger resources compliance with controls would be impossible to implement. It is proposed to close the catchment to marroning. The proposed closure is consistent with other recreational management strategies for this catchment, and for other strategic drinking water supply catchments in the State. The Commission acknowledges the loss of the marroning amenity to the community.	*No marroning in the reservoir or any streams in the catchment.* • The Stirling Dam Catchment Area to be proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909.* By-laws prohibit marroning. • Advertise closure widely to ensure public awareness. • The developer of the water supply source to work with Fisheries WA and the recreational fishing community to enhance nearby alternatives. This is likely to include: - stocking program for the Harvey Reservoir; - the creation of habitat areas for juveniles during the construction of the New Harvey Dam; - a monitoring program to assess the success of the stocking program and sustainability of the fishery; - the relocation of marron from the Stirling Reservoir when the water level is lowered to facilitate remedial works at the dam; and - provision of facilities and access points to the perimeter of the New Harvey Dam for recreational marroning.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Fishing	Risk of potential pathogen contamination through people being in and around the reservoir for extended periods without toilet facilities. There is also a potential litter problem. Possible risk of erosion through vehicle use.	Fly fishing generally takes place around the Stirling Reservoir and along the reaches of the Harvey River. The activity requires some contact with the water. Having people in close proximity to the water bodies, and with the potential for body contact poses an unacceptable risk to water quality, particularly with the level of water treatment. Allowing a managed recreational fishery to operate in the catchment is not considered practical. The forested nature of the catchment and the limited ranger resources would make compliance with controls impossible to implement. It is proposed to close the catchment to fishing. The proposed closure is consistent with other recreational management strategies for this catchment, and for other strategic drinking water supply catchments in the State. The Commission acknowledges the loss of the fishing amenity to the community.	*No fishing in the reservoir or any streams in the catchment.* • The Stirling Dam Catchment Area to be proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909.* By-laws prohibit fishing. • Advertise closure widely to ensure public awareness. • The developer of the water supply source to work with Fisheries WA and the recreational fishing community to enhance nearby alternatives. This is likely to include: - Stocking program for the Harvey Reservoir; - The creation of habitat areas for juveniles during the construction of the New Harvey Dam; - A monitoring program to assess the success of the stocking program and sustainability of the fishery; - Provision of facilities and access points to the perimeter of the New Harvey Dam for recreational fishing; and - The relocation of trout from the Stirling Reservoir when the water level is lowered to facilitate remedial works at the dam.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Camping	*Hoffmans Mill* The site is located along the edge of the Harvey River approximately 10 km upstream of the Stirling Reservoir. There is a potential risk of pathogen contamination in the Harvey River through waste disposal, swimming (in the designated swimming hole and in the Harvey River), fishing, marroning and domestic animal contact with the water. There is also a potential risk of turbidity and fuel spillage through vehicle usage. This site is well managed with regular monitoring through collection of fees. There is one septic system and the reminder of the toilets have sealed tanks that are pumped out and tankered out of the catchment. *Other Camping* Camping is allowed by CALM within the catchment at some locations, often adjacent to water courses or the reservoir. The risk at these sites is greater than Hoffmans Mill with regard to pathogen contamination from waste disposal as there are no facilities. Risks from human and animal contact with water, swimming, fishing and marroning remain.	*Hoffmans Mill* Hoffmans Mill is a site of historical significance, an important camping site and generates tourism revenue for the area. The main water quality risks are from faecal contamination and litter to the Harvey River. Activities at the site can be managed so there is: • no human or animal contact with the water • no contamination from toilet facilities and no litter. It is feasible for the campsite to remain with water quality protection measures. *Other Camping* Undesignated camping poses a significant risk to water quality as: • No facilities such as toilets are provided • There is limited or no management of the sites • Camping sites in most cases are close to the river and reservoir.	*Hoffmans Mill* *Allow day access and camping at designated times. No human or animal access to the Harvey River or any watercourse.* • Allow camping from November (back to Hoffman's weekend) to April (Easter). Change to be implemented after Easter 2001. • Control access to Harvey River. No swimming permitted. • Allow managed day (picnic) access all year. • Consider alternative camping opportunities as part of Regional Recreation Planning. • Use signage and advertising to publicise need for water quality protection. • Monitor water quality risks from Hoffmans Mill. • Prohibit dogs being brought into the campsite and catchment through education/signs, promotional material, on-site management and by-laws. *Other Camping* *Uncontrolled camping with no facilities is incompatible.* • Prohibit camping at sites other than Hoffmans Mill. • Implement surveillance and by-law enforcement to discourage camping in areas other than Hoffmans Mill. • Use signage and advertising to clearly show closed camping areas.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Car rallies • Rally Australia • Stirling Stages (CAMS)	Potential risks associated with Rally Australia include: • spillage of fuel from a vehicle accident, especially near watercourses • erosion from unsealed roads and tracks used on the route • There is a risk of pathogen contamination if there are spectators in the catchment • helicopters landing in the catchment A large proportion of the Rally Australia course is near the reservoir. The risks associated with the CAMS event "Stirling Stages" are similar to the risks for Rally Australia. However, risk of turbidity in the reservoir from erosion increases due to the fact that the event is held in July, a period of high rainfall. There is a risk of pathogen contamination if there are spectators in the catchment. However, a large proportion of the Stirling Stages is held away from the reservoir and spectator numbers are minimal. Funds are provided to CALM for road maintenance after the event.	Rally Australia is an important international event that has specific requirements for not altering course routes. Both rallies are pre-existing land-uses, important to the area and well managed. The risk posed by these events can be managed if events are held in low rainfall periods, spectators are kept out of the RPZ and maintenance activities are outside of the catchment. Hence these events can remain if the risk from erosion and hydrocarbon spills are managed to ensure retention/clean-up of any spills and immediate repair of roads. Operators will be required to undertake each event in accordance with an approved environmental management plan.	*Existing rallies are acceptable with Best Management Practices.* • No additional rallies to be established in the catchment. • Each group to develop a management plan for their event. Approval for each event will be subject to the implementation and review of this plan. The plan will be explicit in addressing water quality protection measures. • No practice for events in the catchment area. • CAMS Stirling Stages officials to work towards rally being held in a drier time of the year. • No spectators in the RPZ. • Limit helicopter usage over the Stirling Reservoir.
Trail bike enduro events (Motorcycling Australia WA)	The potential risks associated with this activity are erosion, spread of weeds and dieback, pathogen, fuel and litter contamination. Erosion associated with disturbance of soil leading to turbidity, bikes crossing flowing streams exacerbate this turbidity risk. Pathogen and litter risk associated with people staying for extended periods and possibly camping. Fuel contamination from an accident or spill. There are 2-4 events per year, with one event held in August that runs close to the reservoir. Existing roads and trails are used for 95% of the course.	There are 2-4 events per year in the Stirling catchment, routes have been very close to the reservoir, cross watercourses and each event has approximately 75 competitors and an additional 75 support people involved. Portable toilet facilities are used with events currently approved through CALM. The risk posed by these events may be substantially reduced if events are held in low rainfall periods, spectators are kept out of the catchment and maintenance activities are also outside of the catchment. The Harvey area, including the Stirling catchment, is important for trail bike riding clubs. No spectators are necessary for the events. These events could remain in the catchment if the risk to water quality can be reduced.	*Existing events are acceptable with Best Management Practices.* • CALM and Commission approval for events to address risk to water quality issues. • No new events will be approved to be held in the catchment. • An environmental management plan is to be developed for each event. • Approval for each event will be subject to the implementation and review of the plan. The plan will be explicit in addressing water quality protection measures. • No practice for events in the catchment area. • No spectators or camping in the Stirling catchment. • No vehicle maintenance in the Stirling catchment.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
4 Wheel Driving Association Events	Potential risks of erosion from unsealed roads and tracks and fuel spillage. There is also a risk from waste disposal. 4 Wheel Driving Association events use designated roads and tracks and require approval from CALM.	Risks can be managed through conditional approval of events. The 4 Wheel Drive Association aims to minimise the impact of their activities to the environment and has been involved with CALM on environmental projects such as Track Care WA. Events and routes during wet months will need to be carefully considered to manage risks. Operators will be required to undertake each event in accordance with an approved environmental management plan.	*Existing events are acceptable with Best Management Practice.* • CALM and Commission approval to address water quality issues. • No events to be approved within the Reservoir Protection Zone. • An environmental management plan is to be developed for each event. • Approval for each event will be subject to the implementation and review of the plan. The plan will be explicit in addressing water quality protection measures. • Driver education through signage and training. • Control access during winter. • Approvals to include conditions on ongoing track maintenance and waste management. • Event organisers to advise participants of need to protect water quality and conditions of approval.
Bushwalking (includes orienteering, and rogaining)	There is potential risk from this activity with regard to pathogen contamination from human and animal waste if people walk in/near the reservoir or feeder streams to the reservoir. Bushwalking is an activity with low numbers using the catchment.	Any human activity in direct contact with the water body poses some risk to water quality. However, if bushwalking trails are away from watercourses and the reservoir, the risk is negligible. Bushwalking through organised groups (eg. orienteering, etc) can be managed through approval and education.	*Acceptable activity with conditions.* • Promoted walk trails to be outside the RPZ and away from streams feeding into the reservoir. Trails to cross streams where culverts and / or bridges are established. • Discourage vehicle access to the Old Bibbulmun track (along Harvey River). • Consider and promote regional bushwalking opportunities as part of a Regional Recreation Plan. • Use signage for public information on restricted areas and need to protect water quality. • Include walk trails in surveillance program. • Organised orienteering/rogaining groups to obtain approval for events. Ensure proper management of the group is a condition of approval. • Prohibit dogs being brought into the catchment through education/signs, promotional material and by-laws.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Picnicking	The potential risks from this activity are pathogen contamination, from human and animal faeces and litter (if people are near the reservoir or feeder streams to reservoir) and turbidity/spills from vehicles. This risk is increased by the fact that proximity to water is often a desirable aspect of a picnic site. Risks are minimised where managed picnic sites and facilities are provided (ie. toilets, rubbish collection) such as at Hoffman's Mill.	Any human activity in the catchment poses some risk to water quality. However, if picnicking is away from watercourses and the reservoir and facilities are provided, the risk is minimal. Hence it is an acceptable activity in the catchment with appropriate measures to reduce the risk to water quality.	*Acceptable activity in the catchment at designated sites with conditions.* • Designated picnic areas to have toilets and rubbish collection/removal facilities, an attractive outlook but no access to watercourses and outside the proposed RPZ. • Recommended picnic sites to be at Hoffman's Mill and downstream of the Stirling Dam wall. Close access to the picnic sites at Rocky Crossing and Fish Ladder. • Consider picnicking opportunities as part of regional recreational planning exercise. • Prohibit dogs being brought into the catchment through education/signs and promotional material and by-laws.
Swimming	Swimming poses a high risk of pathogen contamination through direct body contact with the water.	Swimming is not an important recreational activity in the catchment, although it occurs in the Harvey River at Hoffmans Mill. Human contact with water poses a threat to water quality and as such should be avoided. As a result swimming is not a permissible activity and is not recommended by the Health Department for public water supply sources. Swimming is not permitted under water quality protection by-laws.	*Swimming is not acceptable in the reservoir and streams in the catchment.* • Make public aware that swimming is prohibited under by-laws through signage and other advertising. • Undertake surveillance and by-law enforcement. • Close access to 'swimming hole' at Hoffmans Mill camping area.
Horse riding	The potential risks associated with this activity are erosion, pathogen and litter contamination. Erosion associated with disturbance of soil leading to turbidity, horses crossing flowing streams exacerbate this turbidity risk. Pathogen and litter risk associated with people staying and possibly camping for extended periods.	Equestrian activity rarely occurs in the catchment. Endurance events usually held over long distances in State Forest areas in the catchment. Roads and tracks are used and often riders camp overnight with horses at specific sites. Currently, approval from CALM is required for any events in State Forest areas. Camping with horses in the catchment and riding off public roads is not considered compatible with water source protection objectives.	*No horse riding off public roads in the catchment.* • Prohibit horse riding off public roads in the catchment through education/signs, promotional material, on-site management and by-laws. • Investigate potential opportunities elsewhere as part of regional recreation planning exercise.

Table 1 Contd.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Protection Strategies
Off-road driving	Potential risks associated with this activity are: • Erosion associated with disturbance of soil leading to turbidity. • Spread of weeds and dieback through vehicle use. • Pathogen contamination and litter associated with people staying for extended periods and possibly illegally camping. • Fuel contamination from an accident or spill.	Off-road driving poses a significant risk of increasing turbidity in the reservoir and the risk of human contact with waterbodies. Hence it is an undesirable activity in the catchment. Off road driving is not currently allowed.	*Off-road driving is not acceptable in the catchment.* • Recognise the activity in regional recreation plan and look at alternative sites. Encourage involvement in organised events. • Use signage to promote awareness that off-road driving is not permitted. • Undertake surveillance and by-law enforcement to control off-road driving in the catchment.
Recreational hunting	The presence of hunters in the catchment increases the potential risk of pathogen contamination from pig carcasses, humans, dog, litter and turbidity through erosion from vehicles.	Feral pigs pose a threat to water quality. However, the risk to water quality presented by uncontrolled hunting is considered unacceptable. Any hunting should be part of an organised and managed feral animal control program.	*Uncontrolled hunting is not an acceptable activity.* • Unapproved hunting is contrary to the by-laws of the MWSS&D Act. • Signs should be placed throughout the catchment indicating that hunting is illegal. • Undertake surveillance and by-law enforcement of hunting and carcass disposal in the catchment. • Control feral pig numbers through managed program.

Recommendations

1. The existing Harvey Dam Catchment Area should be de-proclaimed and the proposed Stirling Dam Catchment Area should be proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act (1909).*

2. Greater Bunbury Regional Scheme and the Harvey Town Planning Scheme should incorporate the management principles outlined in this plan and reflect the Priority 1 classification given to the Catchment Area.

3. All development and land use proposals in the Stirling Dam Catchment Area which are likely to impact on water quality should be referred to the Water and Rivers Commission for advice and recommendation.

4. Signs should be erected along the boundaries of the proposed Catchment Area to define the areas and promote public awareness of the need to protect water quality.

5. Incidents covered by WESTPLAN – HAZMAT in the Stirling Dam Catchment Area should be addressed through the following measures:
   - The Local Emergency Management Advisory Committee (through the Harvey Emergency Management District) being familiar with the location and purpose of the Stirling Dam Catchment Area.
   - The locality plan for the Stirling Dam Catchment Area being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team.
   - The Water Corporation advising the HAZMAT Emergency Advisory Team during incidents in the Stirling Dam Catchment Area.
   - Personnel dealing with WESTPLAN – HAZMAT incidents in the area given ready access to a locality map of the Catchment area and training to understand the potential impacts of spills on the surface water resource.

6. A surveillance program should be established to identify any incompatible land uses or potential contaminant threats, and enforce water quality protection by-laws within the Stirling Dam Catchment Area.

7. Review the surface water quality monitoring program to ensure key characteristic parameters are included. Routinely review water quality analysis results to detect any trends.

8. The strategies detailed in *Table 1. Land Use, Potential Water Quality Risks and Recommended Strategies* should be adopted.

9. Implementation of these recommendations should be reviewed annually after this plan is endorsed. A full review of this protection plan should be undertaken after five years.

Implementation strategy

No	Description	Implemented by	Timing
1.	Gazettal of Stirling Dam Catchment Area under the Metropolitan Water Supply, Sewerage and Drainage Act (1909).	Water and Rivers Commission.	2000
2.	Greater Bunbury Regional Scheme and Town Planning Strategies should incorporate the management principles outlined in the Water and Rivers Commission's Land Use Compatibility in Public Drinking Water Source Areas and reflect the Priority 1 classification given to the catchment area.	Shire's of Harvey, Collie and Waroona; Ministry for Planning, West Australian Planning Commission.	2000 – 01
3.	Referral of development proposals: (i) WRC to provide Shire of Harvey with guidelines for referral of development proposals. (ii) referral of development proposals.	(i) Water and Rivers Commission. (ii) Shire's of Harvey, Collie and Waroona, Ministry for Planning and Department of Environmental Protection.	(i) 2000 – 01 (ii) Ongoing
4.	Erections of signs: (i) development of guidelines for signage. (ii) determine number and location of signs required. (iii) erect and maintain signs.	(i) Water and Rivers Commission/Water Corporation (ii) Water Corporation in consultation with Water and Rivers Commission, Department of Conservation and Land Management and Shire's of Harvey, Collie and Waroona. (iii) Water Corporation	(i) 2000 – 01 (ii) on completion of signage guideline (iii) Ongoing

No	Description	Implemented by	Timing
5.	Incidents covered by WESTPLAN – HAZMAT in the Stirling Dam Catchment Area should be addressed through the following measures: (i) The Local Emergency Management Advisory Committee (through the Harvey Emergency Management District) being familiar with the location and purpose of the Stirling Dam Catchment Area. (ii) The locality plan for the Stirling Dam Catchment Area being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team. (iii) The Water Corporation advising the HAZMAT Emergency Advisory Team during incidents in the Stirling Dam Catchment Area. (iv) Personnel dealing with WESTPLAN – HAZMAT incidents in the area are given ready access to a locality map of the Stirling Dam Catchment Area and training to understand the potential impacts of spills on the surface water source.	(i) Local Emergency Management Advisory Committee (through the Harvey Emergency Management District) (ii) Water and Rivers Commission (iii) Water Corporation (iv) Local Emergency Management Advisory Committee	(i) 2000 (ii) 2000 (iii) Ongoing (iv) Ongoing
6.	Catchment Surveillance and By-law enforcement program: (i) Develop guidelines for the surveillance and by-law enforcement of Catchment Areas. (ii) Implement and undertake the surveillance program.	(i) Water and Rivers Commission in consultation with the Water Corporation (ii) Water Corporation	(i) 2000 – 01 (ii) Ongoing
7.	Water quality monitoring program: (i) Review the source water monitoring program in line with risks outlined in this plan (ii) Review water quality data regularly and advise Water and Rivers Commission of any adverse trends. (iii) If necessary, determine appropriate action.	(i) Water Corporation (ii) Water Corporation (iii) Water Corporation/ Water and Rivers Commission.	(i) Ongoing (ii) Ongoing (iii) Ongoing
8	Private land in the catchment to be managed in accordance with Priority 1 objectives.	Landowners and Water and Rivers Commission	Ongoing

No	Description	Implemented by	Timing
9.	State Forest Management Activities		
	(i) Hardwood Harvesting Manual, Code of Practice for Timber Plantations, the Tallanalla Management Plan and associated contract specifications to include provisions for water quality protection. Such provisions include, but are not limited to, road maintenance, fuel storage and handling, fertiliser use, pesticide use and buffer zones along watercourses.	(i) Water and Rivers Commission, Department of Conservation and Land Management and Water Corporation	(i) Ongoing
	(ii) The controlled burning program to include provision for water quality protection objectives. Consider provisions for accessing watercourses and the Stirling Reservoir for emergency fire-fighting purposes.	(ii) Water and Rivers Commission, Department of Conservation and Land Management and Water Corporation	(ii) 2000-01
	(iii) Review proposed 1yr and 5yr timber-harvesting plans for the catchment.	(iii) Water and Rivers Commission and Water Corporation	(iii) Ongoing
	(iv) Manage roads in accordance with relevant Codes of Practice and close and rehabilitate non-essential roads, including the road over the Stirling Dam spillway.	(iv) Department of Conservation and Land Management and Water Corporation	(iv) Ongoing
	(v) Review operating performances of water quality protection measures.	(v) Water and Rivers Commission	(v) Ongoing
10.	Ensure CALM programs for the control of feral animals address water quality protection issues.	Department of Conservation and Land Management in consultation with the Water and Rivers Commission and Water Corporation	2000-01
11.	Shire Roads		
	(i) Review road maintenance practices for water quality risks.	(i) Water and Rivers Commission and Water Corporation in consultation with Shire of Harvey.	(i) 2000-01
	(ii) Conduct a risk assessment survey on the transport of fuel and chemicals through the catchment.	(ii) Water Corporation and Water and Rivers Commission	(ii) 2000-01

No	Description	Implemented by	Timing
12.	Undertake discussions with Defence Force to investigate alternative sites for training outside drinking water catchments.	Water and Rivers Commission and Department of Conservation and Land Management	2000-01
13.	Liaise with Western Power to ensure maintenance practices do not impact on water quality.	Water and Rivers Commission/Water Corporation	2000-01
14.	Recreation (i) Enforce provisions of the Metropolitan Water Supply, Sewerage and Drainage Act By-Laws to prohibit swimming, fishing, marroning, dog access, horse riding and uncontrolled hunting in the catchment. (ii) Advertise the change to dogs, horse riding, fishing and marroning and recreational access in Stirling Catchment Area. (iii) Erect signs in the Stirling Catchment Area to promote public awareness of the need to protect water quality and define controlled activities. Signs will refer to prohibited activities and provisions for permitted activities.	(i) Water Corporation under delegation from Water and Rivers Commission (ii) Water Corporation in consultation with Water and Rivers Commission, Department of Conservation and Land Management, Fisheries Western Australia, RecFishWest (iii) Water Corporation to resource in consultation with: Water and Rivers Commission, Department of Conservation and Land Management and Fisheries Western Australia	(i) ongoing (ii) 2000-01 (iii) 2000-01
15.	Enhance recreational fishing and marroning opportunities outside the Stirling Catchment Area, including: (i) A stocking program for the Harvey Reservoir. (ii) The creation of habitat areas for juveniles during the construction of the New Harvey Dam. (iii) A monitoring program to assess the success of the stocking program and sustainability of the fishery. (iv) The relocation of marron and fish species from the Stirling Reservoir when the water level is lowered to facilitate remedial works at the dam. (v) Provision of facilities and access points to the perimeter of the new Harvey Reservoir for recreational fishing and marroning	Fisheries Western Australia and RecFishWest Water Corporation and Shire of Harvey	2000

No	Description	Implemented by	Timing
16.	Motorsport in Stirling Catchment: (i) Rally Australia, CAMS, 4 Wheel Drive Association and Motorcycle Australia WA to develop environmental management plans for their existing events. (ii) Review and approval of the management plans, their implementation and event approval. (iii) Work with CAMS Stirling Stages officials to consider move of 'Stirling Stages' rally to drier time of year. (iv) Work with Motorcycle Australia WA on assessment of water quality risks with events.	(i) Confederation of Australian Motor Sport, Rally Australia and Motorcycle Australia W.A. and 4 Wheel Drive Association. (ii) Water and Rivers Commission, Department of Conservation and Land Management and Water Corporation (iii) Water and Rivers Commission Water Corporation and Department of Conservation and Land Management, Confederation of Australian Motor Sport (iv) Motorcycle Australia WA, Water and Rivers Commission, Water Corporation and Department of Conservation and Land Management	(i) Prior to next event (ii) Ongoing (iii) 2000-01 (iv) 2000-01
17.	Ensure transitory activities (ie. organised bushwalking, 4WD groups, apiarists, wildflower collection, seed collection and military activities) are approved with water quality protection measures.	Department of Conservation and Land Management, Water and Rivers Commission, Water Corporation	Ongoing
18.	Discourage vehicle access to the Old Bibbulmun Track along the Harvey River, and any unnecessary tracks leading to it. Ensure any bushwalking trails are outside the RPZ.	Water Corporation and Department of Conservation and Land Management	2000-01
19.	Promote casual firewood collection sites outside the catchment.	Department of Conservation and Land Management in consultation with Water and Rivers Commission and Water Corporation	Ongoing from 2000
20.	Develop Regional Recreation Plan to consider and implement opportunities for recreation. Aspects covered will include campsites, bushwalking, off-road driving and picnic sites.	Department of Conservation and Land Management in consultation with Water and Rivers Commission and Water Corporation	2000-01
22.	Review of this plan and implementation strategy: (i) Review implementation strategy annually. (ii) Full review after 5 years.	(i) Water and Rivers Commission and Water Corporation (ii) Water and Rivers Commission and Water Corporation	(i) Ongoing (ii) After 2005

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Glossary

Allocation	The quantity of surface water permitted to be abstracted by a licence, usually specified in kilolitres/year (kL/a).
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Diffuse Source Pollution	Pollution originating from a widespread area eg. urban stormwater runoff, agricultural runoff.
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
Leaching / Leachate	The process by which materials such as organic matter and mineral salts are washed out of a layer of soil or dumped material by being dissolved or suspended in percolating rainwater. The material washed out is known as leachate. Leachate can pollute groundwater and waterways.
m AHD	Australian Height Datum. Height in metres above Mean Sea Level +0.026 m at Fremantle.
Nutrient Load	The amount of nutrient reaching the waterway over a given time (usually per year) from its catchment area.
Nutrients	Minerals dissolved in water, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorus (phosphate) which provide nutrition (food) for plant growth. Total nutrient levels include the inorganic forms of an element plus any bound in organic molecules.
Pesticides	Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms.
Point Source Pollution	Specific localised source of pollution eg. sewage or effluent discharge, industrial waste discharge.
Pollution	Water pollution occurs when waste products or other substances eg. effluent, litter, refuse, sewage or contaminated runoff, change the physical, chemical, biological or thermal properties of the water, adversely affecting water quality, living species and beneficial uses.
Public Water Source Area	(PWSA) As for UWPCA, but allowing the taking of groundwater for public supplies.
Runoff	Water that flows over the surface from a catchment area, including streams.

Scheme Supply	Water diverted from a source (or sources) by a water authority or private company and supplied via a distribution network to customers for urban, industrial or irrigation use.
Storage Reservoir	A major reservoir of water created in a river valley by building a dam.
Stormwater	Rainwater which has run off the ground surface, roads, paved areas etc and is usually carried away by drains.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.
Wastewater	Water that has been used for some purpose and would normally be treated and discarded. Wastewater usually contains significant quantities of pollutant.
Water Quality	The physical, chemical and biological measures of water.

Appendices

Appendix 1 The Harvey Dam Catchment Reference Group
Appendix 2 Water Quality
Appendix 3 Details of Land Use, Activities and Recreation in Stirling Catchment
Appendix 4 Land Use Compatibility in Public Drinking Water Source Areas

Appendix 1. The Harvey Dam Catchment Reference Group

The Water and Rivers Commission would like to thank the following individuals for their contributions and participation in the development of this plan as representatives on the Harvey Dam Catchment Reference Group.

Representative	Agency/Interest Group
Mr Ross Sheridan (Chair)	Water and Rivers Commission
Mr Charlie Welker (Facilitator)	Welker Environmental Consultancy
Mrs Bronwen Cooper (Logistics)	Water Corporation
Ms Ruth Harvey (Logistics)	Water Corporation
Mrs Rachael Miller	Water and Rivers Commission
Mr Ian Steele	Landowner
Mr John Sears	Landowner
Mr Chadd Hunt	Shire of Harvey
Mr Keith Barrett	Water Corporation
Mr Gary Crisp	Water Corporation Stirling Harvey Redevelopment Scheme Project Liaison
Mr Richard Murton	Water Corporation South West Region
Mr Rod Brooks	Water Corporation
Mr Ron Bennetts	Water Corporation
Dr Frank McKinnell	Department of Conservation and Land Management
Mr Chris Portlock	Department of Conservation and Land Management
Mr Nathan Harrisson	Fisheries Western Australia
Mr Richard Theobald	Health Department of Western Australia
Mr Owen Ashby	Health Department of Western Australia
Mr Frank Prokop	RecFishWest
Mr Colin Thorpe	Whitewater Canoeing Association
Mr Rob Van Leeuwen	Rally Australia
Mr Alan Cook	Confederation of Australian Motor Sport
Mr Rob McDonald	Motorcycling Australia WA

Appendix 2. Water Quality

Following is a summary of water quality monitoring by the Water Corporation in the Stirling Reservoir at the outlet to the dam. Samples summarised here were taken over 12 months from April 1998 to March 1999. This monitoring program is continuing.

Parameter	Range of Monitored Values	NH & MRC Australian Drinking Water Guidelines (1996) Guideline
Turbidity	0.4-0.9 NTU	5 NTU
pH	6.66-7.21	6.5-8.5
Colour	0.7-4 TCU	15 TCU
Iron	0.037-0.078 mg/L	0.3 mg/L
Manganese	0.002-0.018 mg/L	0.1 mg/L
Aluminum	0.008-0.037 mg/L	0.2 mg/L

[#] From NH & MRC Australian Drinking Water Guidelines (1996)

Appendix 3. Details of Land Use, Activities and Recreation in Stirling Catchment

Activity	Information on Current Situation
Private Land	
Blue gum plantation	There is part of a small blue gum plantation on Lot 5 in the Stirling Dam catchment.
Residences	There is a house on Lot 5 that is in the catchment. There is no rubbish collection service for the properties in the catchment. Hence it is possible that some properties have locations where rubbish has been dumped.
State Forest	
Hardwood Timber harvesting	Hard wood timber harvesting periodically occurs in the catchment.
Pine Plantation (Silviculture)	The 1015Ha Tallanalla plantation surrounds the Stirling Reservoir. In 1996, 1997 and 2000 some sections of the plantation were harvested. These areas have subsequently been replanted with pines or bluegums. Future harvesting details are not certain as the decision to harvest and the type of species to replant is dependent on market conditions. However, it is likely that it will occur within the next two to five years.
Roads and Tracks	There are a large number of logging tracks throughout the Tallanalla plantation and unsealed roads throughout the catchment, some very close to the reservoir.
Fire management practices	Currently CALM maintains trafficable roads as firebreaks. These firebreaks are maintained annually or as required. There is prescribed burning in the catchment.
Feral animal control program	Catchment is baited with 1080 for foxes, feral pigs and cats. Baiting operation is called Operation Foxglove and lays one bait, in the form of dry meat injected with 1080, every 20Ha. The baiting procedure excludes the reservoir but there is no buffer around the reservoir. In the PER the Water Corporation has committed to cooperation with CALM on fox and feral cat control programs. There is some feral pig shooting activity in the catchment. Some of this is under the direction of CALM and it is understood CALM are trialing a controlled and managed approach to hunting.

Activity	Information on Current Situation
Water Corporation Construction	
Construction of pipeline	Harris-Stirling pipeline will be located within the already disturbed area of Western Power's Muja Northern Terminal Line easement. This is in an area distinctly affected by dieback disease.
Pipe outfall(s)	The pipe will discharge to a stream that feeds into the Stirling reservoir. The discharge sites have intact riparian zones and in places the stream bases consist of bedrock and hence are not erodable. The bankfull capacity at Site A is $3.7m^3/s$ and Site B is $2.3m^3/s$. The average pumpback discharge is $0.7m^3/s$ and the pumpback will cease discharge if flow in the stream reaches bankfull. The risk of erosion appears minimal.
Alumina Conveyor Belt	
Conveyor belt	The Worsley conveyor belt passes through the south-eastern corner of the catchment, transporting bauxite from the mine to the refinery. The conveyor is a metal structure and covered to prevent dust pollution. It is constructed in a 30 m wide corridor with a private maintenance road, which is bituminised. There are drainage ditches down each side of the easement with sumps in low-lying places to contain runoff. Oil stored along the length of the belt is fully bunded. Worsley's environmental plan requires any incident of environmental significance to be reported to the DEP.
Western Power Line	
Muja Northern Terminal Line	Western Power maintains the easement of the Muja Terminal Line, which passes through the catchment. There is currently a 40 m easement, which will be widened by a further 20 m this summer. They periodically crush the regrowth in the area with a tractor and debris is left where it lies. Pesticides are not used as they are not cost effective. This process is carried out in summer due to dieback considerations and repeated when needed.
Recreation	
Marroning	The marroning season on Stirling Dam is open 9 January to 28 February. There is a daily bag limit of 10 marron per fisher and the use of diving gear or boats to catch marron is illegal. On Stirling the use of scoop and drop netting methods are allowed. Fisheries W.A. and RecFishWest claim that 2000 people are at Stirling Reservoir on the opening night of the season. There is a significant problem of poaching outside the season. CALM have increased surveillance due to problems associated with fire and rubbish (people would often camp).
Fishing	Reservoir is stocked annually with Rainbow trout and Redfin Perch; the fishery is not self-sustaining. Fishing extends around the reservoir, and the Harvey River to Hoffmans Mill. Stirling Reservoir is open for trout fishing all year, although the reservoir is used less than its tributaries. The tributaries are closed to trout fishing from 1 May to 30 August each year. Relatively low numbers of people undertake this activity.

Activity	Information on Current Situation
Camping	There are three camping locations in the catchment and these are shown on Figure 3 in the plan: *Hoffmans Mill* CALM owned but maintained by contractor. The site is both for camping and day-use and is very popular with approximately 600 to 700 people camping at this site in Easter 1999. Over 6000 people used the site between December 1998 and May 1999. The site is adjacent to the Harvey River and is equipped with toilets (one block have septic tanks and the other toilets have sealed tanks which are pumped out), BBQ's and picnic areas. There is a swimming hole at the site, bridges over the river and a walking trail near the river. Rubbish is collected in a large steel bin that is emptied weekly. Water used at the site is pumped from the river to a tank and there are signs to boil the water before drinking. There are some small improvements to Hoffmans Mill planned. *Along the Harvey River between Hoffmans Mill and the Harvey-Quindanning Road* There are many campsites scattered along the river in this area where camping is allowed by CALM. There are no facilities at any of these sites but they are heavily used. There are many sites, including around the reservoir, where camping occurs but it is discouraged by CALM through signs and surveillance.
Motor Sports	Rally Australia uses roads through the catchment each November for the Australian stage of the World Rally Championships : • Event held in November so there is minimal chance of excessive rainfall and hence turbidity problems. • Spectator area is on Stirling Dam Rd, and is outside of the catchment. • No servicing of cars in the catchment. • Cars are present in the catchment for only a few hours for this annual event. • Emergency response plan and team in place • Cars are under constant watch from the air and ground based officials. The Western Australian Car Club holds a rally, known as the "Stirling Stages" around Stirling and Harvey Dams, at the end of July. Rally Australia and CAMS are preparing an environmental management plan for their events. Motorcycle Australia W.A. also extensively use the catchment, with 2-4 events held per year.
Bushwalking	There are no designated bushwalking trails through the catchment. However, there is an old bridge downstream of the dam wall and people walk a short circuit from the spillway, along the Harvey River and back to the spillway. The Bibbulmun Track no longer runs through the catchment; however, track signs remain in the catchment. The Old Bibbulmun track, which may still be used by some people, runs along the Harvey River.

Activity	Information on Current Situation
Picnicking	There are four main picnic/recreation sites either in the catchment or adjacent to the dam wall; their locations are shown on Figure 3 in the plan: *Wild Water Picnic Site* - Below dam wall Facilities are fire rings, picnic tables, sun shelter, and self-composting toilet. Activities encouraged by CALM are picnicking and bushwalking. This area attracts many canoers and spectators for special events. *Picnic Sites near top of dam wall on both north and south sides* - In catchment Facilities are fireplaces, picnic tables and a car park. Activities include picnicking and sight seeing. The site on the North side of the dam is close to the reservoir but is separated by a fence and a sheer drop of about 10m; however, the reservoir is accessible by road. The reservoir is accessible from the picnic site on the south side of the dam. *Fish Ladder* - In catchment The only facility is a car park. Activities are sightseeing and observing fish climb the trout ladder. Estimates vary from about 40 persons/year to around 20 people per day during marron season. Illegal camping has also been observed around this site. *Rocky Crossing* - In catchment Facilities are fire rings, picnic tables, gravel car park and a pit toilet approximately 50m from the river. The picnic site itself is separated from the Harvey River by a 20m vegetated buffer. Activities include picnicking and swimming in a number of water holes along the Harvey River, which are close to the site and readily accessible. There is easy vehicle access and the road crosses through Harvey River. Estimated number of people is 20-30 per season. In all cases domestic pets are allowed but must be restrained at all times.
Swimming	There has been no swimming observed in the Stirling Reservoir. However, there is some swimming in the Harvey River, upstream of the reservoir. These sites are at Rocky Crossing and Hoffmans Mill.
Four Wheel Driving	Some 4WD groups use the area with CALM approval. Other 4WD use not prolific due to increased CALM supervision of catchment. The catchment appears in the 4WD book endorsed by CALM - *4WD Days out of Perth* under the "Harvey Hills" chapter. In general the Shire of Harvey discourages the activity throughout the shire and inquiries are referred to CALM for approval.

Appendix 4. Land Use Compatibility in Public Drinking Water Source Areas

LAND USE COMPATIBILITY IN PUBLIC DRINKING WATER SOURCE AREAS

Purpose

These notes provide the Commission's views on practices and activities related to the quality of the State's water resources. They are recommendations only, and may be varied at the discretion of the Commission.

The notes provide a basis for developing formal guidelines in consultation with key stakeholders.

Scope

These notes apply to land use within Public Drinking Water Source Areas (PDWSAs).

PDWSAs include Underground Water Pollution Control Areas, Water Reserves and public water supply Catchment Areas declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, and the *Country Areas Water Supply Act 1947*.

The notes are not intended to override the statutory role and policy of other State or local government authorities. Project proponents will need to fulfil their legal responsibilities including those covering land use planning, environmental, health and building permit matters.

PDWSA Protection Framework

The Water and Rivers Commission is responsible for managing and protecting Western Australia's water resources. The Commission has policies for the protection of public drinking water source areas that include three levels of priority classification of lands within PDWSAs.

Priority 1 (P1) source protection areas are defined to ensure that there is **no degradation** of the water source. P1 areas are declared over land where the provision of the highest quality public drinking water is the prime beneficial land use. P1 areas would typically include land under Crown ownership. P1 areas are managed in accordance with the principle of **risk avoidance** and so land development is generally not permitted.

Priority 2 (P2) source protection areas are defined to ensure that there is **no increased risk of pollution** to the water source. P2 areas are declared over land where low intensity development (such as rural) already exists. Protection of public water supply sources is a high priority in these areas. P2 areas are managed in accordance with the principle of **risk minimisation** and so conditional development is allowed.

Priority 3 (P3) source protection areas are defined to **manage the risk of pollution** to the water source. P3 areas are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments.

Protection of P3 areas is achieved through **management guidelines** for land use activities. If the water source does become contaminated, then water may need to be treated or an alternative water source found.

In addition to priority classifications, **well-head protection zones** and **reservoir protection zones** are defined to protect the water source from contamination in the immediate vicinity of production wells and reservoirs. Well-head protection zones are usually circular, with a radius of 500 metres in P1 areas and 300 metres in P2 and P3 areas. Reservoir protection zones usually consist of a 2 kilometre buffer area around the top water level of a reservoir and include the reservoir itself. These zones do not extend outside water reserves. Special conditions apply within these zones.

Tables showing land use compatibility with the Commission's PDWSA protection strategy

These tables should be used as a guideline only. More detailed information on the Commission's requirements in the form of activity guidelines or notes is available for some land uses. These can be found on the 'Protecting Water' web page on the Commission's Internet site (www.wrc.wa.gov.au). Alternatively information relating to land use and development within PDWSAs including those not listed in the tables, can be obtained from the Commission's Water Quality Protection Branch.

The Commission recognises that many activities were established before the introduction of these tables. The Commission will negotiate with the operators of such activities to develop appropriate management practices to minimise the impact on water resources.

These tables do not replace the need for activity assessment by the Commission. Please consult the Commission for advice on any land use proposals in Public Drinking Water Source Areas that may impact on water resources.

Definitions used in the following tables

Compatible	The land use is compatible with the management objectives of the priority classification.
Conditional	The land use can be compatible with the management objectives of the priority classification, with appropriate site management practices. All conditional developments / activities should be referred to the Commission for assessment on a case specific basis.
Incompatible	The land use is incompatible with the management objectives of the priority classification. Any such development proposals received may be referred for formal Environmental Impact Assessment under Environmental Protection Act,
Extensive	Where limited additional inputs are required to support the desired land use. eg supplementary animal feed only during seasonal dry periods.
Intensive	Where regular additional inputs are required to support the desired land use. eg irrigation, fertilisers and non forage animal feed dominates.

More information

We welcome your comment on these notes. They will be updated from time to time as comments are received or activity standards change. The Commission is progressively developing Water Quality Protection

Notes and Guidelines covering land uses described in the following tables. Advice on available guidance documents may be obtained by contacting the Commission.

If you wish to comment on the notes or require more information, please contact the Commission's Water Quality Protection Branch at the Hyatt Centre in East Perth.
Phone: (08) 9278 0300 (business hours) or Fax:(08) 9278 0585.
E-mail: use the {feedback} section at our Internet address (http://www.wrc.wa.gov.au) citing the topic and version.

Tables showing land -use compatibility with PDWSA protection objectives

AGRICULTURE - ANIMALS

Land use	Priority 1	Priority 2	Priority 3
Animal saleyards and stockyards[14]	Incompatible	Incompatible[7]	Conditional[7]
Apiaries on Crown land	Conditional	Conditional	Conditional
Aquaculture eg. crustaceans, fish, algae	Incompatible	Conditional	Conditional
Dairy sheds	Incompatible	Incompatible[11,15]	Conditional[15]
Feedlots	Incompatible	Incompatible	Conditional
Livestock grazing - pastoral leases	Conditional	Compatible	Compatible
Livestock grazing - broad acre (extensive)	Incompatible	Conditional[11]	Compatible
Livestock grazing (intensive)	Incompatible	Incompatible	Conditional[11]
Piggeries	Incompatible	Incompatible	Incompatible
Poultry farming (housed)	Incompatible	Conditional	Conditional
Stables	Incompatible	Conditional	Compatible

AGRICULTURE - PLANTS

Land use / practices	Priority 1	Priority 2	Priority 3
Broad land cropping i.e. non-irrigated	Incompatible	Conditional[1]	Compatible
Floriculture (extensive)	Incompatible	Conditional	Compatible
Floriculture (intensive)	Incompatible	Incompatible	Conditional
Horticulture- hydroponics	Incompatible	Conditional	Conditional
Horticulture - market gardens	Incompatible	Incompatible	Conditional
Orchards	Incompatible	Conditional	Compatible
Nurseries (potted plants)	Incompatible	Conditional	Compatible
Silviculture (tree farming)	Conditional	Conditional	Compatible
Soil amendment (clean sand, loam, clay, peat)	Incompatible	Conditional	Compatible
Soil amendment (industry byproducts & biosolids),	Incompatible	Incompatible	Conditional
Turf farms	Incompatible	Incompatible	Conditional
Viticulture (wine & table grapes)	Incompatible	Conditional	Compatible

DEVELOPMENT - COMMERCIAL

Land use	Priority 1	Priority 2	Priority 3
Aircraft servicing	Incompatible	Incompatible	Conditional[6]
Airports or landing grounds	Incompatible	Incompatible	Conditional[6]
Amusement centres	Incompatible	Incompatible	Compatible[6]
Automotive businesses	Incompatible	Incompatible	Conditional[6]
Boat servicing	Incompatible	Incompatible	Conditional[6]
Catteries	Incompatible	Compatible	Compatible
Caravan and trailer hire	Incompatible	Incompatible	Conditional[6]
Chemical manufacture / formulation	Incompatible	Incompatible	Conditional[6]
Consulting rooms	Incompatible	Incompatible[7]	Compatible[6]
Concrete batching and cement products	Incompatible	Incompatible	Conditional
Cottage Industries	Conditional	Conditional	Compatible

Land use	Priority 1	Priority 2	Priority 3
Dog kennels	Incompatible	Conditional	Conditional
Drive in / take-away food shops	Incompatible	Incompatible	Compatible[6]
Drive -in theatres	Incompatible	Incompatible	Compatible[6]
Dry cleaning premises	Incompatible	Incompatible	Conditional[6]
Dye works	Incompatible	Incompatible	Conditional[6]
Farm supply centres	Incompatible	Incompatible[7]	Conditional
Fertiliser manufacture / bulk storage depots	Incompatible	Incompatible	Conditional
Fuel depots	Incompatible	Incompatible	Conditional
Garden centres	Incompatible	Incompatible	Compatible
Laboratories (analytical , photographic)	Incompatible	Incompatible	Conditional[6]
Markets	Incompatible	Incompatible	Compatible[6]
Mechanical servicing	Incompatible	Incompatible	Conditional[6]
Metal production / finishing	Incompatible	Incompatible	Incompatible
Milk transfer depots	Incompatible	Incompatible	Conditional
Pesticide operator depots	Incompatible	Incompatible	Incompatible
Restaurants and taverns	Incompatible	Incompatible	Compatible[6]
Service stations	Incompatible	Incompatible	Conditional[6]
Shops and shopping centres	Incompatible	Incompatible[7]	Compatible[6]
Transport & municipal works depots	Incompatible	Incompatible	Conditional
Vehicle parking (commercial)	Incompatible	Incompatible	Compatible
Vehicle wrecking and machinery	Incompatible	Incompatible	Conditional
Veterinary clinics / hospitals	Incompatible	Incompatible[7]	Conditional[6]
Warehouses	Incompatible	Incompatible[7]	Conditional[6]

DEVELOPMENT - INDUSTRIAL

Land use	Priority 1	Priority 2	Priority 3
Heavy Industry	Incompatible	Incompatible	Incompatible
Light or general Industry	Incompatible	Incompatible	Conditional[6]
Power Stations / Gasworks	Incompatible	Incompatible	Incompatible
Petroleum refineries	Incompatible	Incompatible	Incompatible

DEVELOPMENT - URBAN

Land use	Priority 1	Priority 2	Priority 3
Aged and dependent persons group dwellings	Incompatible	Incompatible	Compatible[6]
Cemeteries	Incompatible	Incompatible	Conditional
Civic buildings	Incompatible	Conditional[7]	Compatible[6]
Clubs -sporting or recreation	Incompatible	Conditional	Compatible[6]
Community halls	Incompatible	Conditional[7]	Compatible
Family day care centres	Incompatible	Incompatible[7]	Compatible[6]
Funeral parlours	Incompatible	Incompatible	Compatible[6]
Health centres	Incompatible	Incompatible	Compatible[6]
Hospitals	Incompatible	Incompatible	Conditional[6]
Medical, veterinary, dental centres	Incompatible	Incompatible	Compatible[6]
Toilet blocks and change rooms	Incompatible[7]	Conditional	Compatible

EDUCATION / RESEARCH

Land use	Priority 1	Priority 2	Priority 3
Community education centres	Conditional[7]	Conditional[7]	Compatible[6]
Primary / Secondary Schools	Incompatible	Incompatible	Compatible[6]
Scientific Research	Conditional	Conditional	Compatible
Tertiary Education Facilities	Incompatible	Incompatible	Conditional[6]

EXPLORATION, MINING AND MINERAL PROCESSING

Land use	Priority 1	Priority 2	Priority 3
Extractive industries (sand, clay, peat and rock)	Conditional[2]	Conditional[2]	Conditional[2]
Mineral and energy source exploration	Conditional[4]	Conditional[4]	Conditional[4]
Mining	Conditional[4]	Conditional[4]	Conditional[4]
Mineral processing	Incompatible	Incompatible	Conditional[4]
Oil or gas extraction / decontamination for transport	Conditional[4]	Conditional[4]	Conditional[4]
Tailings dams	Incompatible	Incompatible	Conditional[4]

PROCESSING OF ANIMALS / ANIMAL PRODUCTS

Land use	Priority 1	Priority 2	Priority 3
Animal product rendering works	Incompatible	Incompatible	Incompatible
Abattoirs	Incompatible	Incompatible	Incompatible
Dairy product factories	Incompatible	Incompatible	Conditional[6]
Food Processing	Incompatible	Incompatible	Conditional[6]
Manure stockpiling /processing facilities	Incompatible	Incompatible[7]	Conditional
Tanneries	Incompatible	Incompatible	Incompatible
Wool-scourers	Incompatible	Incompatible	Incompatible

PROCESSING OF PLANTS / PLANT PRODUCTS

Land use	Priority 1	Priority 2	Priority 3
Breweries	Incompatible	Incompatible	Conditional[6]
Composting / soil blending (commercial)	Incompatible	Incompatible	Conditional
Forestry product processing- pulp & paper, timber preservation, or wood fibre works	Incompatible	Incompatible	Conditional
Vegetable / food processing	Incompatible	Incompatible	Conditional[6]
Wineries	Incompatible	Conditional[15, 18]	Conditional [15]

SUBDIVISION

Land use	Priority 1	Priority 2	Priority 3
Rural subdivision to a minimum lot size of 4 ha	Incompatible	Compatible	Compatible
Rural subdivision to a lot size less than 4 ha	Incompatible	Incompatible	Incompatible
Special rural subdivision to a minimum lot size of 2 ha	Incompatible	Conditional[8,9]	Conditional[8]
Special rural subdivision to a lot size between 1 and 2 ha	Incompatible	Incompatible	Conditional[8,9]
Special rural subdivision to a lot size less than 1 ha	Incompatible	Incompatible	Incompatible[9]
Urban subdivision	Incompatible	Incompatible	Compatible[6]
Industrial subdivision	Incompatible	Incompatible	Conditional[6]

Note: Subdivision of lots to any size within Priority 1 areas is incompatible

SPORT AND RECREATION

Land use	Priority 1	Priority 2	Priority 3
Equestrian centres	Incompatible	Incompatible	Compatible
Golf courses	Incompatible	Incompatible	Conditional[1]
Motor sports ie permanent racing facilities	Incompatible	Incompatible	Conditional
Public swimming pools	Incompatible	Incompatible	Conditional
Recreational parks -irrigated	Incompatible	Incompatible	Conditional[1]
Rifle ranges	Incompatible	Conditional	Compatible

STORAGE/ PROCESSING OF TOXIC AND HAZARDOUS SUBSTANCES (THS)

Land use	Priority 1	Priority 2	Priority 3
Above ground storage of THS	Conditional	Conditional	Conditional
Underground storage tanks for THS	Incompatible	Incompatible	Conditional

TOURISM ACCOMMODATION.

Land use	Priority 1	Priority 2	Priority 3
Bed and breakfast accommodation	Incompatible	Conditional[16]	Compatible
Caravan parks	Incompatible	Incompatible	Conditional[6]
Farm stay accommodation	Incompatible	Conditional[16]	Compatible
Motels, hotels, lodging houses, hostels, resorts	Incompatible	Incompatible	Compatible[6]

WASTE TREATMENT AND MANAGEMENT

Land use	Priority 1	Priority 2	Priority 3
Injection of liquid wastes into ground water	Incompatible	Incompatible	Incompatible
Landfills -Class I, II or III	Incompatible	Incompatible	Conditional
Landfills -Class IV and V	Incompatible	Incompatible	Incompatible
Recycling depots	Incompatible	Incompatible	Conditional
Refuse transfer stations	Incompatible	Incompatible	Conditional
Sewers (gravity)	Incompatible	Incompatible	Compatible
Sewers (pressure mains)	Incompatible	Conditional	Compatible
Sewage pump stations	Incompatible	Conditional	Conditional
Used tyre storage / disposal facilities	Incompatible	Incompatible	Incompatible
Wastewater treatment plants	Incompatible	Incompatible	Conditional
Wastewater application to land	Incompatible	Incompatible[17]	Conditional

OTHER DEVELOPMENTS

Land use	Priority 1	Priority 2	Priority 3
Caretaker's housing	Incompatible[7]	Conditional	Compatible
Communications receivers / transmitters	Conditional	Conditional	Conditional
Construction projects (not shown elsewhere)	Conditional	Conditional	Conditional
Drinking water treatment plants	Conditional	Conditional	Conditional
Forestry	Conditional[1]	Compatible	Compatible
Major transport routes	Incompatible	Conditional[10]	Compatible
Construction /Mining camps,	Conditional	Conditional	Conditional
Prisons	Incompatible	Incompatible	Conditional[6]
National and Regional Parks[13]	Compatible	Compatible	Compatible
Nature reserves	Compatible	Compatible	Compatible

Table reference notes:

1. Conditions may limit fertiliser and pesticide application.

2. Conditions cover the storage of fuels and chemicals, the depth of excavation in relation to the water table with specified guidelines for rehabilitation.

3. Conditions cover the storage and use of fuel and other chemicals.

4. Conditions placed via the Department of Minerals and Energy lease and / or Environment Minister's /Department of Environmental Protection approval.

5. Special rural development must have appropriate provisions under the Town Planning Scheme, to prevent introduction of land uses and practices that pose an unacceptable risk to water resources.

6. Must be connected to deep sewerage, except where exemptions apply under the current Government Sewerage Policy.

7. May be accepted if this facility is necessary to support acceptable land use in the area and is consistent with State and local government planning strategies.

8. Lots should only be created where land capability allows effective on-site soakage disposal of treated wastewater. Conditions apply to siting of wastewater disposal systems in areas with poor land drainage and / or a shallow depth to groundwater, animals are held or fertiliser is applied. Alternative wastewater treatment systems, where approved by the Health Department, may be accepted with maintenance requirements.

9. An average rather than minimum lot size may be acceptable if the proponent can demonstrate that the water quality objectives of the source protection area are met, and caveats are placed on titles of specified blocks stating that further subdivision cannot occur.

10. Conditions cover road design, construction and the types of goods that may be carried.

11. May be permitted if animal stocking levels (number of animals per hectare) are consistent with source protection objectives.

12. May be permitted if the type, volume and storage mechanisms for chemicals are compatible with water quality protection objectives.

13. Visitor and management infrastructure and facilities must be appropriately sited and maintained.

14. This does not include on-farm / pastoral lease stock-yards used for animal husbandry

15. Waste management practices must be compatible with source protection objectives.

16. Conditions apply on density of accommodation in Priority 2 areas

17. May be permitted if the quantity and quality are compatible with water quality protection objectives.

18. Size of annual grape crush does not exceed 500 tonnes and grapes sourced from operator's vineyards within the P2 area.

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