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DWELLINGERUP CATCHMENT AREA WATER SOURCE PROTECTION PLAN

Dwellingup town water supply

WATER AND RIVERS COMMISSION REPORT
WRP 40
2001
WATER RESOURCE PROTECTION SERIES

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Cover photograph: Dwellingup Dam [Taken by Gary Crisp, Water Corporation]

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Dwellingup 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

WATER AND RIVERS COMMISSION
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Foreword

Water source protection plans

Water Source Protection Plans establish the level of protection required in Catchment Areas. 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. The plans are developed in consultation with affected landowners, industry groups and relevant government agencies.

Proclaiming Catchment Areas under the *Country Areas Water Supply Act 1947* protects the quality of water sources in country 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 Water and Rivers 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 proposed Dwellingerup 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 of lands in Public Drinking Water Source Areas (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, 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 some 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 coexist 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 (RPZs) are defined to protect the water source from contamination in the immediate vicinity of the waterbody. These zones do not extend outside the catchment area and special conditions apply in these zones.

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Summary

The Dwellingup Dam is on North Dwellingerup Brook about 2 km southwest of the town of Dwellingup. Currently water from the North Dwellingerup Brook catchment is used to supply potable water to the town of Dwellingup.

West Dwellingerup Brook is the preferred source development option for providing increased water supply to Dwellingup. The catchment is called the West Dwellingerup Brook catchment.

The scope of this plan is to protect the water quality of both the North and West Dwellingerup Brook catchments.

The existing Dwellingerup Catchment Area was proclaimed in 1971. It is recommended that the catchment boundary be amended to reflect both the inclusion of the West Dwellingerup Brook catchment and an accurate representation of the physical boundary of the North Dwellingerup Brook catchment.

The objective of water source protection in both these catchments is to preserve water quality at its current level, and where practical achieve an improvement. Generally, the catchments should be managed to ensure there is no increased risk to water quality. It is recommended privately-owned land be managed for Priority 2 source protection, and that Crown land in both catchments be managed for Priority 1 source protection.

In the North Dwellingerup Brook catchment a large proportion of land is privately-owned farming land. Land uses include orchards, cattle grazing, hobby farming and short-stay accommodation. Stormwater from the town of Dwellingup drains into the North Dwellingerup Brook catchment due to drainage works that have been undertaken in the area. It is recommended that, for source protection, drainage from the town is re-diverted outside of the catchment. The remainder of the North Dwellingerup Brook catchment is State Forest managed by the Department of Conservation and Land Management (CALM). Recreation activities in the State Forest include cycling and bushwalking.

This plan has been developed in consultation with relevant State agencies (including Ministry for Planning, CALM and the Shire of Murray), landowners within the catchment, residents of Dwellingup and other interested parties, such as Alcoa World Alumina Australia.

The draft plan was released in August 2000 and all submissions have been considered in the preparation of this plan.

1. Introduction

The town of Dwellingup is located approximately 97 km southeast of Perth and has a population of around seven hundred. Orchards, timber mills, mining operations, State Forest operations and tourism form the basis of the local economy. The locality of Dwellingup is shown in Figure 1.

The North and West Dwellingerup Brook catchments are both in the Shire of Murray.

This Water Source Protection Plan addresses the protection of current and potential future water supply sources to the town of Dwellingup.

1.1 Existing water supply system

The source for the Dwellingup Town Water Supply (TWS) is a 2300 m^3 excavated soak (dam) on the North Dwellingerup Brook. The dam was constructed in 1973. This is currently the only water source for the town of Dwellingup. Water is pumped from the dam to the treatment plant to service tanks and from there to an elevated tank that maintains water pressures in the town. Water is chlorinated just before entering the elevated tank.

The existing source provides a safe and reliable supply for Dwellingup and is likely to be sufficient for demand for the immediate future.

The TWS scheme is shown in Figure 2a.

1.2 Existing water source protection

The Dwellingerup Catchment Area was proclaimed in 1971 under the *Country Areas Water Supply (CAWS) Act (1947)* to ensure protection of the water source from potential contamination. The boundary predominantly follows cadastral boundaries (see Figure 1).

1.3 Future water supply system

The preferred future development option is a small pipehead dam on West Dwellingerup Brook approximately 1.4 km southwest of the existing dam (Crisp, 1995). This pipehead dam would supplement the existing source. The proposed dam has not been designed and therefore its capacity and surface area are unknown. The catchment for this pipehead dam is the West Dwellingerup Brook catchment.

Following the public comment period for this plan, the Water Corporation revised the 1995 water source plans for Dwellingup. The water supply needs for the immediate future can be met by the existing North Dwellingerup source.

The option to supply from South Dandalup Dam is significantly more expensive than alternatives, and there are other more cost-effective options for an adequate supply to Dwellingup. West Dwellingerup Brook is the preferred long-term source development option for providing additional water supply to Dwellingup when required.

1.4 Water resource allocation

Surface water resource utilisation and conservation in Western Australia country areas is administered by the Water and Rivers 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 with the Crown. This Act requires licensing of surface water abstraction within proclaimed Surface Water Areas.

1.4.1 Surface water area

The Dwellingerup Catchment Area is part of the Murray Surface Water Area proclaimed under the *Rights in Water and Irrigation Act (1914).* All surface water abstraction within the Murray Surface Water Area requires licensing by the Water and Rivers Commission.

1.4.2 Current allocation licence

The current allocation licence (Surface Water Licence No. 0056286) allows the Water Corporation to divert up to 167 000 kL per annum from the North Dwellingerup Brook. The estimated divertible yield from North Dwellingerup Brook is more than 200 000 kL a year.

The Water Corporation has withdrawn its licence application to divert water from West Dwellingerup Brook following a review of the 1995 water source planning.

The Commission's allocation licensing process involves consultation with downstream users. Under the Act, licence applications must be published in the Government Gazette and advertised in at least one issue of a newspaper circulating in the area. Notices may also be directed to downstream users who are specifically affected.

This process will be initiated when another licence application is received from the Water Corporation.

2. Physiography

The North and West Dwellingerup Brook catchments contain lateritic soils over Archaean granite and metamorphic rock. Both catchments are within the western portion of the Yilgarn Craton.

The valleys in both catchments are characterised by the Yarragil landform, consisting of gravelly sands on gentle slopes and swampy valley floors with bright yellow earths. There is a low-medium risk of erosion associated with this landform.

The Murray landform occurs in the northeast of the North Dwellingerup Brook catchment and comprises deeply incised valleys with red-yellow earths on slopes. The erosion risk is high with this landform.

The remainder of both catchments is of the Dwellingup landform, which is characterised by gently undulating laterised upland, gravelly sands and boulders. There is a low erosion risk associated with this landform.

3. Climate

Both catchments are subject to a Mediterranean type climate with high winter rainfall. The long term average annual rainfall for both catchments is 1277 mm with the annual pan evaporation being 1650 mm. However, there has been a significant decline in rainfall over the last 20 years.

4. Hydrology

4.1 North Dwellingerup Brook catchment

The physical catchment for the North Dwellingerup Brook has an approximate area of 250 ha. The physical catchment boundary is shown in Figure 1.

The Dwellingup Dam collects runoff from the catchment in winter and seepage from an upstream perennial spring during the remainder of the year. Flow to the dam occurs all-year-round and is considered reliable. Peak flow occurs in winter.

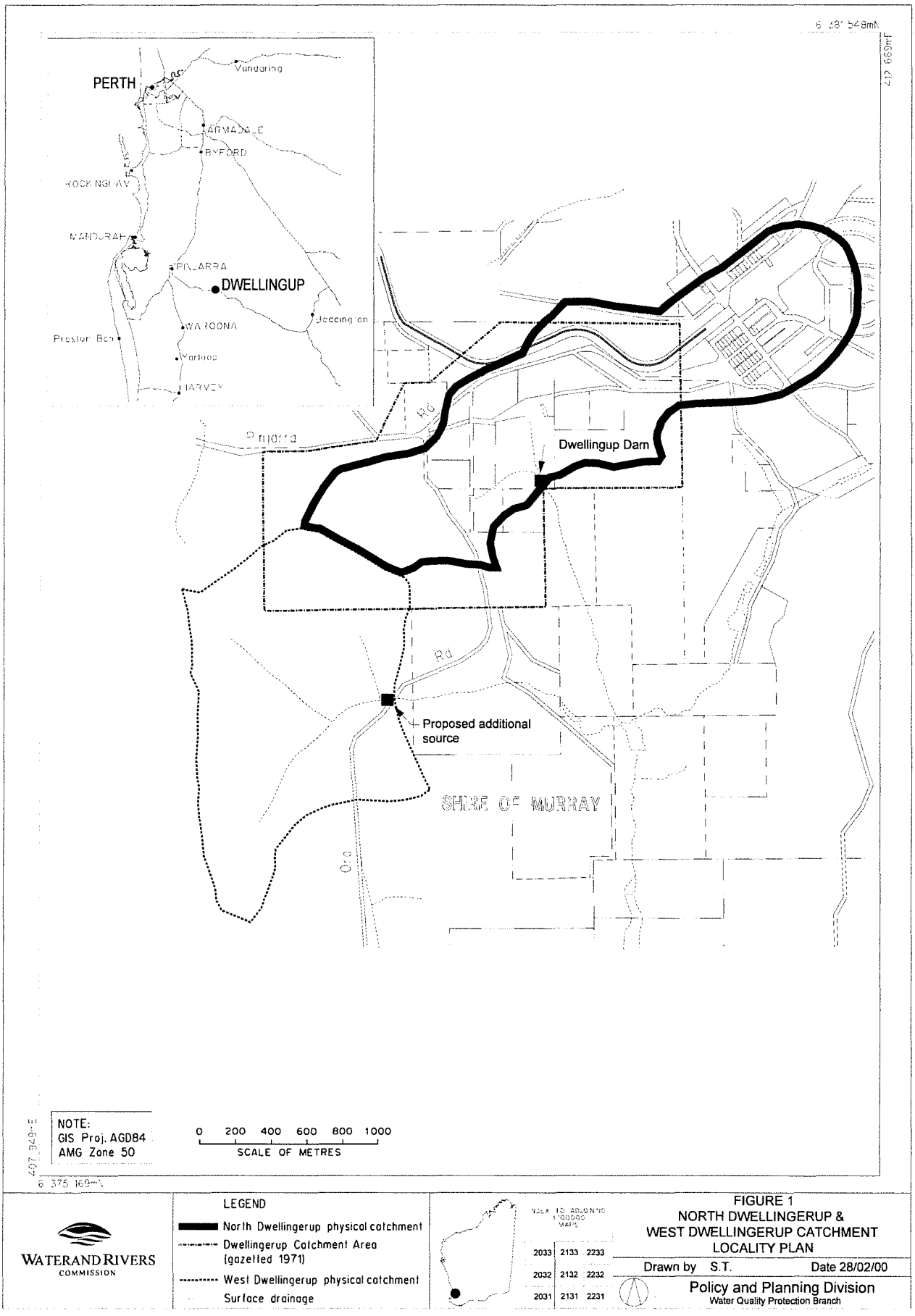
The mean annual flow in North Dwellingerup Brook is approximately 579 000 m^3 (Public Works Department, 1984). This volume is from the natural catchment and does not include stormwater runoff from the town that is diverted into the catchment.

4.2 West Dwellingerup Brook catchment

The physical catchment for the proposed pipehead on West Dwellingerup Brook has an approximate area of 190 ha. All the catchment is forested land. The catchment boundary is shown in Figure 1.

Results from monitoring undertaken by Alcoa World Alumina Australia, shows that West Dwellingerup Brook also flows all year (McIntosh *et. al.*, 1988). The peak flow occurs during winter.

The annual flow in West Dwellingerup Brook was measured at 592 000 m^3 in 1996 and 475 000 m^3 in 1997 with the latter being a year of below average rainfall.


PERTH
Vundering
ARMADALE
BYFORD
ROCKINGHAM
MANDURAH
SERPENTINE
DWELLINGUP
WARONA
Jarrahdale
Preston Beach
Yarloop
HARVEY
Dwellingup Dam
Proposed additional source
SHIRE OF MURRAY
Rd
NOTE:
GIS Proj. AGD84
AMG Zone 50
0 200 400 600 800 1000
SCALE OF METRES
WATERAND RIVERS COMMISSION
LEGEND
North Dwellingerup physical catchment
Dwellingerup Catchment Area (gazetted 1971)
West Dwellingerup physical catchment
Surface drainage
2033 2133 2233
2032 2132 2232
2031 2131 2231
FIGURE 1
NORTH DWELLINGERUP &
WEST DWELLINGERUP CATCHMENT
LOCALITY PLAN
Drawn by S.T.
Date 28/02/00
Policy and Planning Division
Water Quality Protection Branch

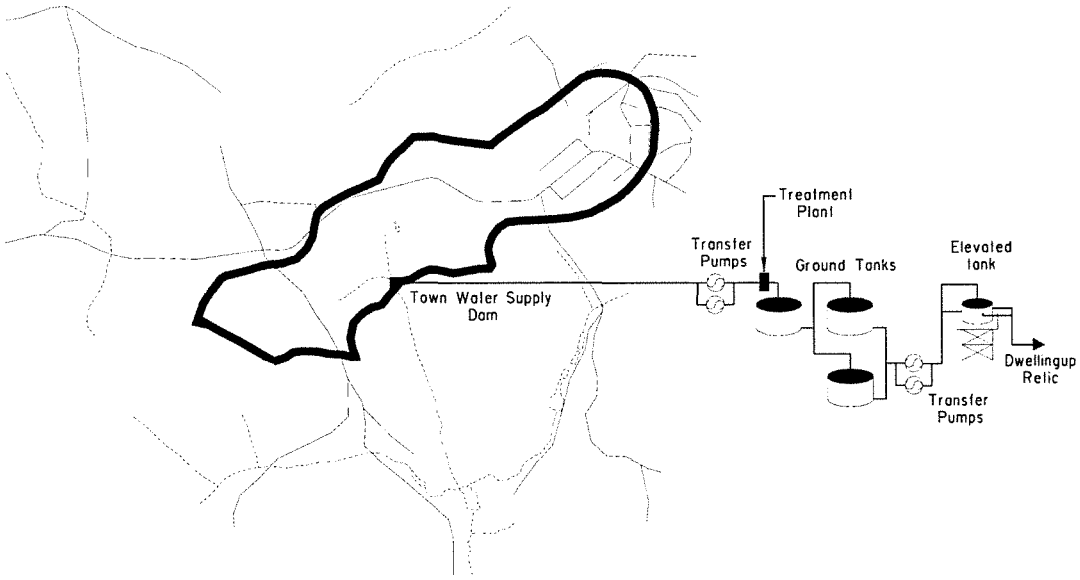


FIGURE 2a
CURRENT WATER SUPPLY SYSTEM

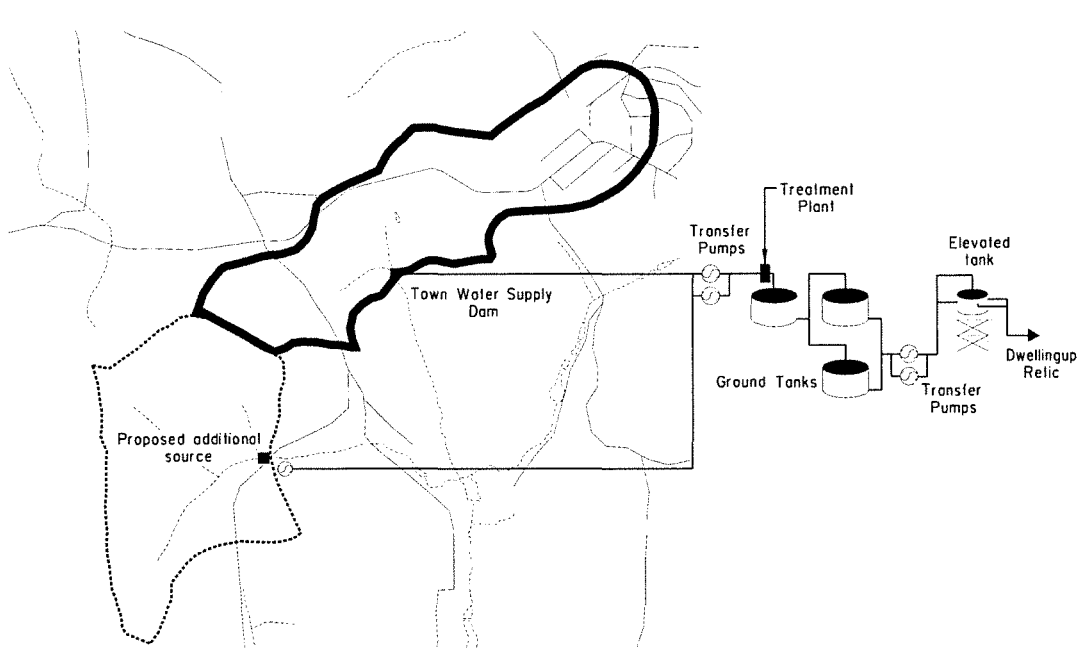


FIGURE 2b
FUTURE WATER SUPPLY SYSTEM

NOTE:
GIS Proj. AGD84
AMG Zone 50

0 400 800 1200 1600 2000
SCALE OF METRES

WATERANDRIVERS COMMISSION

LEGEND
- North Dwellingerup physical catchment
- West Dwellingerup physical catchment
- Surface Drainage

INDEX TO ADJOINING 1:50000 MAPS

2033	2133	2233
2032	2132	2232
2031	2131	2231

FIGURE 2
CURRENT AND FUTURE
WATER SUPPLY SYSTEM SCHEMATIC

Drawn by S.T. | Date 28/02/00

Policy and Planning Division
Water Quality Protection Branch

4.3 Water quality

The Water Corporation has an ongoing annual water quality monitoring program. Comprehensive water quality tests are taken regularly at the source and in the reticulation system for operational and compliance purposes. Water quality results must comply with guidelines set by the National Health and Medical Research Council (NHMRC). In addition to the regular monitoring program, organochlorine pesticides are tested monthly at the Dwellingerup Soak and a private orchard dam in the catchment. The results are forwarded to the Shire of Murray. If health related water quality monitoring results exceed guideline values, the Health Department is notified.

See Appendix 1 and Appendix 2 for indicative water quality monitoring results.

4.3.1 North Dwellingerup Brook catchment

Water quality from the Dwellingup Dam generally conforms to the raw drinking water quality guidelines.

Samples taken from the Dwellingup Dam indicate that pH, turbidity, colour, iron and aluminium concentrations are occasionally outside the guidelines. The turbidity is likely to be due to erosion from the cleared areas and access tracks in the catchment. The colour, iron and aluminium concentration is likely to be due to the eroded soil being lateritic, which is naturally high in these elements. Nitrate, sodium, hardness as $CaCO_3$ and sulphate are at low concentrations.

For the range of results from indicative monitoring refer to Appendix 1.

Samples are taken monthly from the Dwellingup Dam and a private dam in the catchment to be analysed for various organochlorine pesticides. Occasionally some organochlorine pesticides have been detected at very low levels. The levels are well below health values set by the Australian Drinking Water Quality Guidelines (NHMRC, 1996).

Indicative pesticide monitoring results are shown in **Appendix 2**.

4.3.2 West Dwellingerup Brook catchment

Samples taken monthly in West Dwellingerup Brook in the first half of 1998 indicate that pH is low and turbidity, colour, iron concentration and aluminium concentration are at lower levels than in the Dwellingup Dam. This is likely due to greater forested area in the West Dwellingerup Brook catchment. These samples also indicate that the water is low in sulphate, sodium and hardness as $CaCO_3$. Nitrate levels are well below the levels allowed for drinking water supply.

For indicative monitoring refer to Appendix 1.

4.3.3 Dwellingup Dam

Towards the end of summer, the Dwellingup Dam is susceptible to significant concentrations of suspended solids and aquatic vegetation growth. Cleaning of the dam can not be undertaken in summer as disturbance increases the suspended solids concentration. Currently the water is treated by chlorination only. However, the Water Corporation is currently installing a water treatment plant.

4.4 Water treatment

A new treatment plant, consisting of a clarifying and filtration unit, has recently been installed and is anticipated to be operational by early 2001. With the addition of alum, polyelectrolyte and soda ash, the treatment process will remove iron and turbidity from the raw water. Treatment will also improve the effectiveness of chlorination.

5. Existing and proposed land use

5.1 North Dwellingerup Brook catchment

Land use and activities in the catchment consist of:

- State Forest;
- private rural land; and

- the town of Dwellingup.

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

The catchment is also subject to a mining exploration licence application number 70/2274.

5.1.1 State Forest

State Forest numbers 14 and 23, managed by the Department of Conservation and Land Management (CALM), constitute approximately one third of the catchment. The forest consists of an open forest of *Eucalyptus marginata* subspecies *marginata-Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors. The area is periodically subject to hardwood timber harvesting.

Bush walking, dog walking and bike riding are popular activities. There are some unsealed vehicle tracks through the forest.

5.1.2 Water Corporation land

The block of land surrounding the water supply dam, Lot 101, is owned by the Water Corporation and is covered in grasses with blackberry bushes along the streamline. This property is not well secured and cattle stray onto the area.

5.1.3 Private Rural Land

Private rural-zoned land constitutes a significant portion of the catchment. Land uses on these properties include orchards, cattle grazing and hobby farming. Two properties have short-stay accommodation, one with a raspberry plantation. All residences in the catchment have septic systems.

The private rural lots in the catchment are all part of an "Intensive Agriculture" precinct (Precinct IA5) in the Dwellingup Structure Plan. The Shire of Murray has indicated that it is unlikely that activities other than orchards, viticulture or floriculture would be permitted.

5.1.4 Town of Dwellingup

The town of Dwellingup is outside the gazetted Catchment Area however, a change to stormwater drainage means a large proportion of the town drains into the catchment. Land uses in the town include residential housing, shops, industrial sites, a service station, a police station, a church, a mill, a railway line and a hotel.

There are two significant roads within the catchment, Williams Road and Oro Road.

The catchment boundary and land use details are shown in **Figure 3**.

5.2 West Dwellingerup Brook catchment

The catchment is managed by CALM and consists entirely of State Forest Number 23. Oro Road runs through the southeast of the catchment. This road passes over the Brook downstream of the proposed offtake point.

There are access tracks in the forest and bush walking and cycling are popular pastimes. Some of the forest in this catchment is effected by dieback.

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

Part of the catchment is also subject to a mining exploration licence application, number 70/2274.

Land use details are shown in Figure 3.

6. Proposed proclaimed area and priority classification

The existing Dwellingerup Catchment Area, proclaimed in 1971, is based on cadastre boundaries and does not follow the physical catchment area.

It is proposed that the gazetted Catchment Area be modified to:

- include the West Dwellingerup Brook catchment (in accordance with the physical boundary); and
- accurately represent the physical boundary of the North Dwellingerup Brook catchment (this excludes the town of Dwellingup).

The proposed Dwellingerup Catchment Area is shown in **Figure 4**. The proposed boundary excludes the Dwellingup townsite as it is recommended the stormwater drainage be diverted away from the Catchment Area (See **Table 1**).

The aim of source protection for the proposed Catchment Area is to avoid the risk of surface water contamination on Crown land and have no increased risk of surface water contamination from private land.

The "Land Use Compatibility in Public Drinking Water Source Areas" water quality protection note in **Appendix 4** outlines the compatibility of land uses with source protection classifications.

It is recommended that all Crown Land in both catchments, and Lot 101 in the North Dwellingerup Brook catchment, be classified for Priority 1 source protection. This classification is justified as:

- water from these sources is strategic to the Dwellingup town water supply;
- retention time in the Dwellingup Dam and proposed dam is short, so there is little time for water quality improvement during storage; and
- existing land-uses are generally compatible with P1, or can be managed for P1 objectives with the use of best management practices.

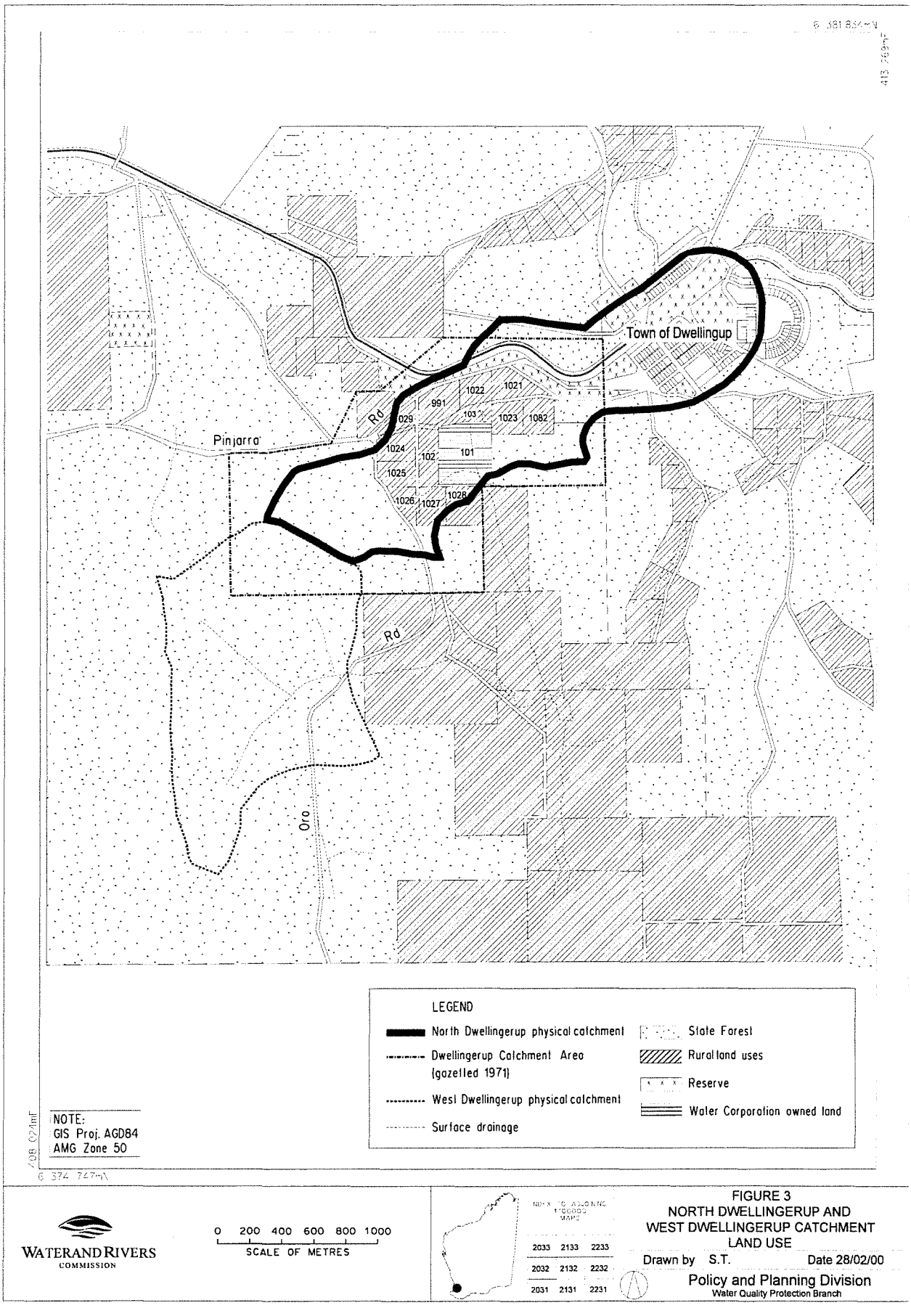
It is proposed that all private land in the North Dwellingerup Brook catchment be classified for Priority 2 source protection. This classification is appropriate as:

- water from this source is strategic to the Dwellingup town water supply;
- a clarifier and sand filters are to be installed to ensure that water quality will consistently meet public water supply standards;
- land is freehold so a higher source protection classification would be unfair and not practical; and
- existing and potential land uses consistent with Local Government plans for the area can be managed for P2 objectives with implementation of Best Management Practices.

The P2 classification of private land and active management measures will minimise the risks to water quality in the catchment.

6.1 Reservoir Protection Zone

To protect the Dwellingup Dam from immediate risks to water quality including human contact, it is proposed that Lot 101 surrounding the Dam be managed as a reservoir protection zone (RPZ).

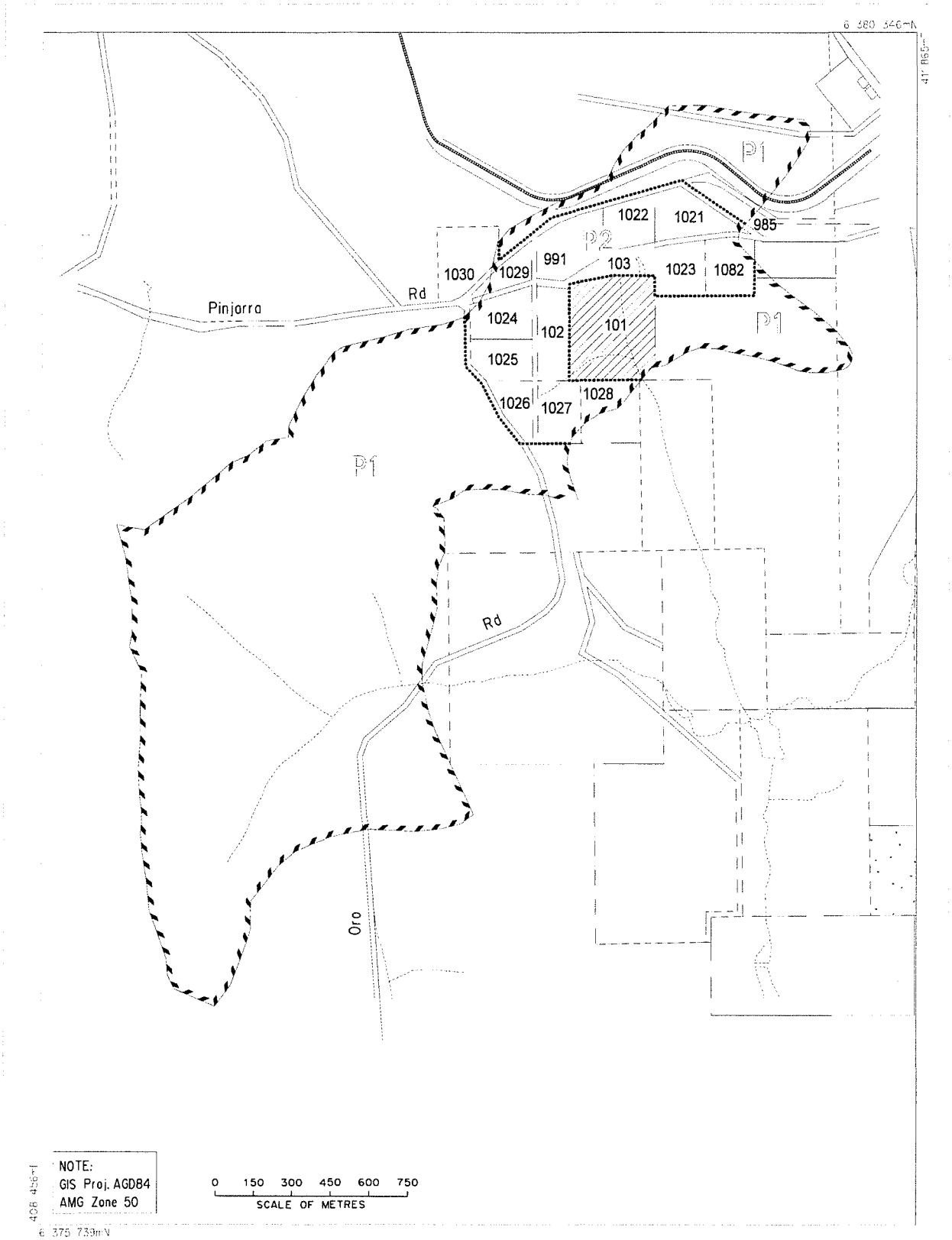


WATERANDRIVERS COMMISSION

FIGURE 3
NORTH DWELLINGERUP AND WEST DWELLINGERUP CATCHMENT LAND USE

Drawn by S.T. Date 28/02/00

Policy and Planning Division
Water Quality Protection Branch



WATERAND RIVERS COMMISSION

FIGURE 4
PROPOSED
DWELLINGERUP CATCHMENT AREA

Drawn by S.T. | Date 28/02/00

Policy and Planning Division
Water Quality Protection Branch

7. Management of water quality risks

7.1 Protection objectives

Priority 1 areas are managed in accordance with the principle of risk avoidance and Priority 2 areas are managed in accordance with the principle of risk minimisation.

The Dwellingerup Brook water sources are strategic to the water supply for the Town of Dwellingup. Consequently risks to water quality in the catchments have been carefully assessed.

Both the North Dwellingerup Brook and the West Dwellingerup Brook catchments should be managed to maintain the high quality of water from the forest areas and minimise risks to water quality from private land.

The objective of this plan is to protect these drinking water sources in the interest of providing safe drinking water to Dwellingup, however the right of existing approved land uses to continue in the catchment area is recognised.

7.2 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 Water and Rivers 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.

7.3 Land use planning

Land uses currently occurring in the Dwellingerup Catchment Area are generally compatible with the Priority classifications. The Commission recognises landowners' and managers' 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 Dwellingerup Catchment Area and Priority classifications be recognised by a Special Control Area in the Peel Region Scheme and in the Shire of Murray Town Planning Scheme.

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 best 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.

7.4 Surveillance and by-law enforcement

The quality of country water sources is protected under by-laws of the *Country Areas Water Act (1947)*. 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 land owners and 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 educational 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 should be delegated to the Water Corporation by the Water and Rivers Commission. The powers for by-law enforcement would be assigned to the Water Corporation as part of this delegation. The Water Corporation would report annually to the Commission on the surveillance program and associated issues.

7.5 Emergency response

Escape of chemicals during unforeseen incidents and use of chemicals during emergency response can cause contamination of water sources. The Local Emergency Management Advisory Committees through the Bunbury Emergency Management District should be familiar with the location and purpose of the Dwellingerup 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 Dwellingerup Catchment Area.

Personnel who deal with WESTPLAN - HAZMAT incidents within the area should be given ready access to a locality map of the Dwellingerup Brook Catchment Area. These personnel should receive training to ensure an understanding of the potential impacts of spills on the surface water resource.

7.6 Land use, potential water quality risks and recommended strategies

The following table details the existing land uses in the proposed Catchment Area, the potential water quality risks and recommends a strategy to manage these risks.

The recommended strategy aims to secure the water quality of this strategic source for the community in the long term while minimising the constraints on development opportunities by recognising landholders' rights to continue using their land for lawful purposes.

Table 1. Land use, potential water quality risks and recommended strategies

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Strategy
Private Rural Land			
Private land in the North Dwellingerup Brook catchment has the following uses: orchards (apples, stone fruit), cattle grazing, short stay accommodation and hobby farm activities (horses, raspberry plantation). There are also private farm dams in the catchment. There is no private land in the West Dwellingerup Brook catchment.	The potential water quality risks associated with these private land uses include: • pathogen contamination including *Giardia* and *Cryptosporidium* (septic systems, grazing animals, domestic pets); • pesticide and chemical contamination (orchards, pasture, raspberry plantation); • nutrient contamination (grazing animals, fertiliser application on orchards, pasture and raspberry plantation); • fuel contamination (from use of farm machinery and storage); and • turbidity (stock access to streams, grazing, horticulture practices) Farm dams may have an accumulation of nutrients and pesticides and if a dam was to burst, it could potentially compromise drinking water quality.	The water quality from the catchment is generally compliant with Australian Drinking Water Quality Guidelines with the occasional exception of some physical parameters. Monitoring for organochlorine pesticides indicates that these have occasionally been detected but well below the drinking water health guidelines. The details of pesticides used in the catchment are shown in Appendix 3. Details indicate that there is a low risk of these pesticides reaching the current TWS dam. Pesticides are sampled monthly from the TWS dam and the private orchard dam. Runoff from orchard areas to the TWS dam should be minimised. WRC recognise that use of private land in the North Dwellingerup catchment for agriculture is both an existing land use and essential for the livelihood of residents. Private land is currently zoned as "Intensive Agriculture" under the Dwellingup Structure Plan. The Shire of Murray has indicated that it is unlikely that activities other than orchards, viticulture or floriculture would be permitted. These land uses can be compatible with P2 objectives. The aim is to have no further deterioration in water quality from the catchment.	*Private land to be classified for P2 source protection. Existing land uses to continue. Use of Best Management Practices will be encouraged.* • Ensure Dwellingup Structure Plan recognises the proposed Catchment Area and reflects P2 protection objectives. • Development proposals to be assessed to ensure that water quality protection objectives are met. Guidance should be given on all development proposals within proposed Catchment Area. • Develop Best Management Practice (BMP) guidelines for agricultural activities in drinking water catchments with industry and other community agencies. Landowners would be encouraged to adopt the guidelines. The guidelines will be specific in requirements to provide a useful tool. Ensure pesticide practices are consistent with policy on pesticide use (WRC, 1999b). • In the interim, before BMP guidelines are released, Water and Rivers Commission to offer advice to landowners on their activities. • Divert runoff from the orchards to the North Dwellingerup Brook downstream of the TWS dam[1]. • Review monitoring program so that pesticides currently being used in the catchment are monitored in the TWS at appropriate intervals. • Siting and density of new septic systems to meet health and water quality protection objectives. • Ensure solid septic waste is removed from the catchment. • Ensure landowners are aware of water quality protection issues through education (eg appropriate rubbish disposal practices, pesticide use and dam maintenance). • Ensure proper management of all fuel storage in the catchment. Assess risk from fuel storage and initiate action where appropriate. • Encourage initiatives for revegetation of key streamlines in the catchment where it is not currently well vegetated.

[1] *A diversion structure at the head of the dam will allow water to be diverted. This diversion would only divert runoff in either a major storm event that is likely to cause turbidity problems in the dam, or in the event of catchment contamination. As a result significant quantities of water will not be diverted away from Dwellingup Dam and volume available for town water supply will not be affected.*

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Strategy
Town of Dwellingup			
A part of the town of Dwellingup stormwater drains into the catchment. Land uses in this portion include: a mill, housing, offices, shops, caravan park, church, service station, industry, hotel, restaurant, workshop and school.	Potential risks to water quality include: • pathogen contamination including *Giardia* and *Cryptosporidium* (from numerous septic systems); • hydrocarbon and chemical contamination (from service station, roads, industry and the mill); • nutrient contamination (from septic systems and gardens); and • pesticides and chemicals from use in urban areas.	A large portion of the town's stormwater drainage runs into the North Dwellingerup Brook catchment due to alteration of natural contours and the installation of a culvert. The mean annual flow in North Dwellingerup Brook is 579 ML, without the runoff from the town. This is substantially greater than the 167 ML currently allocated to the Water Corporation for public water supply. Diverting runoff from the town out of the catchment will not effect the Corporation's ability to supply water. It is considered the runoff from the town to the catchment poses an unnecessary risk that can readily be removed. The proposed Catchment Area does not include the town.	*Alter drainage* • Alter drainage to divert the town of Dwellingup stormwater outside the North Dwellingerup Brook catchment.
State Forest			
Bauxite Mining	Through the Department of Minerals and Energy, Alcoa World Alumina Australia holds a Special Mining Lease under the State Agreement Act. There are many potential water quality risks from bauxite mining in the catchment. Mining activity has not occurred in the catchment to date.	A multi-agency group, the Mining and Management Planning Liaison Group (MMPLG) oversees the implementation of the State Agreement Act, which includes review of management plans and enforcing environmental (including water quality protection) conditions where appropriate.	*Acceptable if operated in compliance with conditions imposed by MMPLG* • MMPLG conditions should address water quality protection measures.
Hardwood timber harvesting	The risk from hardwood harvesting is of turbidity from erosion associated with tree felling practices and machinery using unsealed tracks. There is also the risk of a fuel spill from vehicles and machinery. Pesticides are not used in the State Forest in this catchment. Harvesting activities can be managed to minimise impact on water quality.	Timber harvesting of State Forest could potentially pose a risk to water quality in terms of increased turbidity. However, research has shown that if proper management is in place (including vegetation buffers along water courses and understorey vegetation left after timber harvesting) timber harvesting does not necessarily lead to increased turbidity in water courses (Borg *et al*, 1988). Therefore timber harvesting with appropriate management should be a permissible activity.	*Acceptable activity with Best Management Practices.* • Ensure the Hardwood Harvesting Manual includes provisions for water quality protection. Details include road maintenance, buffer zones along water courses, protection of soil including rehabilitation measures and protection of water. • The 1-year and 5 year logging plans for the catchment should be reviewed to ensure water quality protection objectives are included. • Inspect on-the-ground water quality protection measures.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Strategy
Fire management	Maintaining firebreaks may lead to erosion, spread of dieback, and possibly pesticide contamination, depending on the method used. However, a serious wildfire would strip the land of vegetation, potentially resulting in significant erosion and turbid runoff into the dam.	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 and farm 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. • Establish specific points for accessing watercourses for fire-fighting purposes.
Roads and tracks – State Forest	The likely risk to water quality is turbidity from erosion of unsealed roads and tracks.	Some roads and tracks are necessary for forest management and with proper maintenance there should be minimal erosion and hence impact on water quality.	*Best Management Practices are required for all roads in the catchment.* • Manage roads in accordance with CALM Codes of Practice.
Feral animal control program	Fox Baiting: The catchments are within the area baited by CALM with 1080 under Operation Foxglove. The risk posed by baiting is minimal as 1080 is a naturally occurring poison from a native plant. The natural quantity of this poison in the catchment would far exceed the quantity used in baiting. However, the carcasses of poisoned animals may pose a risk of bacterial contamination Feral pig control: The degree to which feral pigs are a problem in the catchments is unknown. However, feral pigs are known to inhabit areas of the State Forest and have the potential to pose a risk 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 water courses they can result in a risk to water quality. The Water Corporation has been involved with CALM's Operation Foxglove in PDWSAs. Feral pig control would help to reduce the risk to water quality posed by these animals and is an activity required by CALM. However, to minimise the risk to water quality it would need to be undertaken in a well-managed and organised manner.	*Feral animal control is an acceptable activity in the catchment with conditions.* • Controlling fox numbers with 1080 is acceptable. • Where feasible, rangers should remove any carcasses which may pose a risk to water quality. • Develop guidelines for the managed-control of feral pigs, which may include hunting under strict conditions.
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. However, the numbers of people involved are low; all these activities, except the collection of less than 1 tonne of firewood, are subject to conditional approval by CALM.	The risk posed by these activities is less than that posed by other activities such as fishing, marroning and swimming as they do not essentially involve direct body contact with the water.	*Acceptable with controls through CALM - licence conditions.* • Establish and apply approval conditions for apiarists, wildflower picking and seed picking that meet water quality protection objectives. • Establish firewood collection areas taking account of water quality protection.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Strategy
Water Corporation Property and Operations			
Future construction of West Dwellingerup source and pipeline to existing TWS source.	Future construction of source and pipeline will result in disturbance of soil and hence increase the risk of erosion and turbidity. In addition, the presence of machinery in the catchment may increase the risk of a fuel spill from either machinery or stored fuel.	Construction activities are necessary for augmentation of Dwellingup drinking water supply. Construction over any stream crossings poses an increased risk to water quality and needs to be specifically addressed.	*Acceptable activity with measures to minimise impact on water quality* • Ensure risk to water quality is addressed during planning, design and construction and commissioning. • Ensure on-site contractors adhere to water quality protection requirements.
Excessive sediment build-up in the existing TWS dam	Excess sediment in the dam will detrimentally affect the quality of water through increased turbidity.	This needs to be addressed for long-term water quality protection. Sediment removal will have to be carried out in a managed way to ensure there is no impact on water quality supplied to the town during the cleaning process.	*Acceptable activity with measures to minimise impact on water quality* • Plan and manage cleaning process to ensure there is no impact on water quality supplied to the town.
Lot 101 - owned by the Water Corporation.	There are a number of risks to water quality associated with the management of this property. These include: • pesticide contamination (from weed and blackberry control on the land); • turbidity (erosion from dirt roads and burning for fire control. Also erosion from poor vegetation coverage of the ground); and • pathogen contamination from cattle grazing on Lot 101.	Blackberry and weed control is necessary in a farming area to stop the spread of these nuisances but must be done in a way that minimises impact on water quality. A contractor is employed to spray for blackberries. Turbidity in the existing dam is of concern and preventing erosion on this lot (which surrounds the dam) is important. Vegetating this land will improve the water quality and reduce turbidity. Cattle grazing so close to a TWS dam is unacceptable. Need to prevent cattle from accessing this property.	*Actions need to be taken to minimise risk* • Avoid the use of herbicides or disruptive weed control measures. If herbicides are required, it must be in accordance with the Health Department guideline PSC88. • Ensure the contractor is using herbicides that are compliant with PSC88. • Extensively vegetate Lot 101 using native vegetation. • Inform neighbouring landowners that Lot 101 will have restricted access and will be managed as a Reservoir Protection Zone. • Improve fencing to prevent stock access to Lot 101.
Recreation on Crown land			
Bushwalking, walking domestic pets and cycling	This activity occurs in the State Forest area. There is potential risk from this activity with regard to pathogen contamination from human and animal faeces and litter if people walk in/near the dam and watercourses in the catchments.	Any human or domestic pet activity in direct contact with the water body poses a risk to water quality. However, if trails are away from watercourses, existing dam and proposed dam areas, the risk is negligible. Bushwalking through organised groups can be managed through approval and education.	*Acceptable activity with conditions* • Ensure trails, especially any promoted, are away from the dam, proposed dam area and watercourses and developed recognising water quality protection issues. • Use signs to inform people that they are in a drinking water supply catchment and the need to protect water quality. • Discourage the presence of dogs in State Forest using signage to warn owners of the risk associated with dogs in the catchment, especially if the dogs have access to water courses.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Strategy
Fishing and Marroning	The potential risk from fishing and marroning is from pathogen contamination through direct human contact with the water body and from people being in and around the dam for extended periods without toilet facilities. There are also contamination risks from the use of bait, litter and erosion through vehicle use.	Fishing and marroning are not an acceptable activity in a town water supply dam. Fishing or marroning in the existing TWS dam has not been witnessed, but there is evidence of people in or near the dam so fishing or marroning is a possibility. Access to the existing dam and the water supply from West Dwellingerup, when developed, will need to be controlled to prevent these activities. The Dwellingerup Brook is a tributary of the Murray River system, which is popular for fishing and marroning. The Water Corporation plans to install a water treatment plant.	*Fishing and marroning are not acceptable in water supply dams* • Prohibit fishing and marroning in the Dwellingup dam under the *CAWS Act* By-laws. • Install signage to indicate that fishing and marroning are prohibited in the dam and for educational purposes, outline the importance of protecting water quality in drinking water supply. • Discourage the use of meat baits through educational material and general surveillance. • Enforce by-laws through surveillance.
Swimming in dams and other watercourses on Crown land in the catchments.	There is a high potential risk of pathogen contamination through body contact with water and faecal contamination. Associated activity around the water body may provide a risk from litter.	Swimming is a primary water contact activity and hence poses an extremely high risk to water quality.	*Swimming is not an acceptable activity.* • Prohibit swimming in both the dam and watercourses in Crown Land areas of the catchment under the *CAWS Act* By-laws. • Install signage to indicate that swimming is prohibited and for educational purposes outline the importance of protecting the quality of drinking water supply. • Enforce by-laws through surveillance.
Vehicle use off-road	The potential risks associated with driving off made roads are erosion, spread of weeds and dieback, pathogen, fuel and litter contamination. Erosion associated with disturbance of soil leading to turbidity. Disease and weeds spread through vehicle use. Pathogen and litter risk 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 dam and the risk of human contact with water bodies. Therefore it is an undesirable activity in the catchment. Approvals for this activity are administered by CALM.	*Unapproved off-road driving is not acceptable in the catchment.* • Use signage to promote awareness that off-road driving is not permitted. • Undertake surveillance.
Recreational Hunting	Hunters in the catchment increase the risk of pathogen contamination from animal carcasses, human waste, dogs, litter and turbidity through erosion from vehicles. These risks are high if the hunting is uncontrolled.	The risk to water quality presented by uncontrolled hunting is considered unacceptable. Feral pigs pose a threat to water quality but control should be part of an organised and managed feral animal control program.	*Uncontrolled hunting is not an acceptable activity.* • Catchments to be closed to uncontrolled hunting on Crown land through the *CAWS Act* by-laws. • Signs should be placed throughout the catchments indicating that hunting is illegal on Crown land. • Undertake surveillance of the catchments. • Control pig numbers through feral animal control program.

Activity	Potential Water Quality Risks	Consideration for Management	Recommended Strategy
Camping	The risks associated with this activity are pathogen contamination from human waste and litter resulting from people staying for extended periods.	There are no designated camping areas in the catchment. Other managed camp sites are available in the area.	*Not acceptable activity* • Catchment to be closed to camping though the *CAWS Act* By-laws. • Signs should be placed through the catchments indicating that camping is illegal. • Undertake surveillance of the catchments.
Other Activities			
Railway line	The train is operated by the Hotham Valley Tourist Railway and is purely a passenger train (Scott, *pers. comm.*, 1999). The railway tracks are also the property of the same group. The risks associated with this activity are: • Spillage of hazardous material (in the event of an accident). • Pesticide contamination (from any pesticides used on the railway tracks).	The only risk in the event of an accident is a fuel spill. Train drivers need to be aware of entering a water supply catchment so they can take appropriate action in the event of an accident. Weed control is currently carried out using burning and not herbicides.	*Acceptable activity with measures to minimise risk* • Ensure the operators of the railway are aware when they are entering the catchment through signs clearly displaying a contact number to contact in the event of an accident or spill. • Ensure weed control measures are compatible with water quality protection.
Roads - Shire of Murray	The principal shire roads in the catchment are Williams Road (sealed) and Oro Road (unsealed). There are other unsealed roads in the catchment. The main risk presented by roads is from a spill of a contaminating substance such as oil, a build-up of oil and heavy metals present in runoff and the risk from herbicides used to control weeds on the side of the roads. Erosion from stormwater runoff poses a turbidity risk from unsealed roads.	These roads are necessary for transportation and operations in the area so the appropriate approach would be to take measures to minimise the impact of a spill or erosion.	*Best Management Practices are required for all roads in the catchment.* • Undertake risk assessment of roads and develop a road maintenance and management plan that minimises risk to water quality, especially for unsealed roads. • Ensure any spillage can be contained where Oro Road crosses the stream in West Dwellingerup catchment. Also need to facilitate the containment of turbid water which runs off Oro Road, as it is an unsealed road. If possible, make the offtake upstream of road crossing. • Signs along roads to both inform people that they are driving through a drinking water supply catchment and indicate emergency contact numbers (in case of a spill). • Ensure emergency response process is in place. • Ensure weed control measures are compatible with water quality protection.

Recommendations

1. The existing Dwellingerup Catchment Area should be modified as proposed under the *Country Areas Water Supply Act 1947.*

2. The proposed Dwellingerup Catchment Area should be recognised as a Special Control Area in the Peel Region Scheme.

3. The Dwellingup Town Planning Scheme and Dwellingup Structure Plan should incorporate the management principles outlined in this plan and reflect the Priority 1 and Priority 2 classifications given to the proposed Dwellingerup Catchment Area.

4. All development proposals in the proposed Dwellingerup Catchment Area, which are likely to impact on water quality, should be referred to the Water and Rivers Commission for advice and recommendations.

5. 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.

6. Incidents covered by WESTPLAN-HAZMAT in the proposed Dwellingerup Catchment Area should be addressed through the following measures:

- The Local Emergency Management Advisory Committee (through the Bunbury Emergency Management District) being familiar with the location and purpose of the Dwellingerup Catchment Area.
- The locality plan for the Dwellingerup 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 Dwellingerup 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.

7. Surveillance and by-law enforcement responsibilities in the proposed Dwellingerup Catchment Area should be delegated to the Water Corporation.

8. Continue monitoring program and review to ensure water quality risks are covered.

9. Adopt strategies as detailed in Section 6 table "Land Use, Water Quality Risks and Recommended Strategies".

10. 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	Suggested Timing
1	The proposed Dwellingerup Catchment Area should be gazetted under the *Country Areas Water Supply Act 1947.*	Program Manager, Protection Planning (WRC).	Following diversion of town stormwater.
2	The proposed Dwellingerup Catchment Area should be recognised as a Special Control Area in the Peel Region Scheme.	Ministry for Planning/Western Australian Planning Commission.	Following gazettal of Scheme.
3	Dwellingup Town Planning Scheme and Dwellingup Structure Plan should incorporate the management strategies outlined in this plan. The scheme should reflect the Priority 1 classification given to Crown Land and Priority 2 classification given to private property in the proposed Catchment Area.	Shire of Murray.	Begin in 2000/01 then ongoing.
4	Referral of development proposals: (i) WRC to provide Shire of Murray with guidelines for referral of development proposals. (ii) Referral of development proposals. In particular, application for mining exploration licence number 70/2274.	(i) Program Manager, Protection Planning (WRC). (ii) Shire of Murray, Ministry for Planning, Department of Minerals and Energy and Department of Environmental Protection.	(i) 2000/01. (ii) Ongoing.

No	Description	Implemented by	Suggested Timing
5.	Signs:		
	(i) develop guidelines for signage.	(i) Program Manager, Protection Planning (WRC).	(i) 2000-01
	(ii) determine number and location of signs required.	(ii) Regional Manager, South West region (WRC) / Regional Business Manager, South West region Water Corporation (WC).	(ii) 2000-01
	(iii) erect signs.	(iii) Regional Manager, South West region (WRC) / Regional Business Manager, South West region Water Corporation (WC).	(iii) 2000-01
6.	Incidents covered by WESTPLAN – HAZMAT in the Dwellingerup Catchment Area should be addressed through the following measures:		
	(i) the Local Emergency Management Advisory Committee (through the Bunbury Emergency Management District) being familiar with the location and purpose of the Dwellingerup Catchment Area.	(i) Local Emergency Management Advisory Committee (through the Bunbury Emergency Management District).	(i) 2000/01.
	(ii) the locality plan for the Dwellingerup Catchment Area being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team.	(ii) WRC (South West region).	(ii) 2000/01.
	(iii) the Water Corporation advising the HAZMAT Emergency Advisory Team during incidents in the Dwellingerup Catchment Area.	(iii) Water Corporation.	(iii) Ongoing.
	(iv) personnel dealing with WESTPLAN – HAZMAT incidents in the area are given ready access to a locality map of the Dwellingerup Catchment Area and training to understand the potential impacts of spills on the surface water source.	(iv) Local Emergency Management Advisory Committee.	(iv) Ongoing.
7.	Surveillance program:		
	(i) develop guidelines for the surveillance of Catchment Areas.	(i) Program Manager, Protection Planning (WRC).	(i) 2000/01
	(ii) delegate by-law enforcement to Water Corporation.	(ii) Program Manager, Protection Planning (WRC)	(ii) 2000/01
	(iii) implement the surveillance program.	(iii) Water Corporation.	(iii) on delegation.

No	Description	Implemented by	Suggested Timing
8.	Review water quality monitoring program so that risks identified in the catchment, are monitored at appropriate intervals.	Water Corporation.	ongoing.
9a.	Guidelines for agricultural activities: (i) Develop Environmental Guidelines for agricultural activities in drinking water catchments with industry groups and relevant agencies. The use of Best Management Practices in agricultural activities will be encouraged. (ii) In the interim, provide advice to landowners on activities, particularly Best Management Practices with respect to pesticide use.	(i) Water and Rivers Commission, Agriculture WA, peak industry groups, Land owners and managers. (ii) WRC (South West region).	(i) ongoing. (ii) ongoing.
9b.	Establish infrastructure to divert runoff from North Dwellingerup catchment to North Dwellingerup Brook downstream of Dwellingup Dam in the event of either a major storm event that is likely to cause turbidity problems in the dam or in the event of catchment contamination.	Water Corporation.	2000/2001.
9c.	Encourage and support revegetation of key streamlines in the catchment.	WRC (South West region), Shire of Murray, Water Corporation.	ongoing.
9d.	Alter stormwater drainage to remove the town of Dwellingup from the catchment.	Shire of Murray, Water Corporation, WRC (South West region).	2001/2002.

No	Description	Implemented by	Suggested Timing
9e.	State Forest Management Activities: (i) Manage roads in accordance with applicable Codes of Practice, including closing roads when no longer used. (ii) A prescribed burning program to include provisions for water quality objectives. Suitable provisions for accessing water courses in the Dwellingerup Catchment Area for emergency fire-fighting operations. (iii) Inform Water and Rivers Commission and Water Corporation of logging plans and review all proposed harvesting plans for the catchment, both long term and immediate plans. (iv) Surveillance of operating performance of water quality protection measures on the ground.	(i) CALM. (ii) WRC (Water Quality Protection Branch), Water Corporation, CALM. (iii) CALM. (iv) Water Corporation.	(i) ongoing. (ii) 2000/01. (iii) ongoing. (iv) ongoing.
9f.	Feral animal control: Develop and implement CALM guidelines for control of feral animals on Crown Land.	CALM, Water Corporation, Water and Rivers Commission.	Begin 2000/2001 then ongoing.
9g.	The Regional Fire Management Strategy to be reviewed to ensure there is effective fire management on private property that accounts for water quality protection.	Shire of Harvey, Water Corporation, Bush Fires Board, Landowners.	Begin 2000/2001 then ongoing.
9h.	Ensure transitory activities (ie. organised bushwalking, apiarists, wildflower collection, and seed collection) are approved with appropriate water quality protection conditions. Establish firewood collection areas recognising water quality protection.	CALM, Water and Rivers Commission.	Ongoing.

No	Description	Implemented by	Suggested Timing
9i.	Upgrade of water source:		
	(i) Include management for water quality protection in the upgrade of water sources (both design and construction of the new water source on West Dwellingerup Brook and any cleaning of the existing town water supply. For the new source, consider offtake upstream of where road crosses stream).	(i) Water Corporation.	(i) To be arranged.
	(ii) On-site checks to ensure adherence to water quality protection objectives during construction and commissioning.	(ii) Water Corporation.	(ii) To be arranged.
9j.	Management of Lot 101:		
	(i) Review management of Lot 101.	(i) Water Corporation.	(i) 2001/02.
	(ii) If pesticide use is essential, regulate herbicide contractor to only use herbicides in accordance with PSC88.	(ii) Water Corporation.	(ii) 2001/02.
	(iii) Ensure Lot 101 forms a buffer around the Dwellingup Dam through revegetation and improving fencing to ensure there is no stock access to the lot.	(iii) Water Corporation.	(iii) 2001/02.
	(iv) Inform surrounding landowners that Lot 101 is private land and cattle grazing is not acceptable and inform them about of risk of animals so close to a TWS dam.	(iv) Water Corporation.	(iv) 2001/02.

No	Description	Implemented by	Suggested Timing
9k.	Recreation: (i) Invoke provisions of CAWS Act By-Laws to prohibit swimming and hunting on Crown land and fishing and marroning in the public water supply dam. (ii) Erect signs in both catchments to promote public awareness of the need to protect water quality and define prohibited activities, provisions for permitted activities and undesirable activities. (iii) Ensure any walking trails are developed away from Dwellingup Dam, the proposed dam and any watercourses in the catchment.	(i) Water and Rivers Commission. (ii) Water Corporation, Water and Rivers Commission in consultation with CALM. (iii) CALM.	(i) 2000/01. (ii) 2000/01. (iii) ongoing.
10.	Review of this plan and implementation strategy.	Program Manager, Protection Planning (WRC).	Review implementation annually. Full review of plan after 5 years.

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Glossary

Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
m AHD	Australian Height Datum. Height in metres above Mean Sea Level +0.026 m at Fremantle.
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.
Pollution	Water pollution occurs when waste products or other substances e.g. 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 Drinking Water Source Area	An area defined under the Country Areas Water Supply Act, 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	Water quality monitoring results
Appendix 2	Pesticide monitoring results
Appendix 3	Analysis of pesticide use
Appendix 4	Land use compatibility in Public Drinking Water Source Areas

Appendix 1. Water quality monitoring results

The values in the table below have been taken from ongoing raw water monitoring at the dam. The 'snapshot' of typical results was between 3/1/96 and 1/10/97. The samples from West Dwellingerup Brook were taken between 4/3/98 and 15/7/98 as shown in Water Corporation Main File 10 A 32592M.
All values in mg/L unless stated otherwise and shading means that the parameter has on occasion exceeded the guideline.

Parameter	Guideline Value	Dwellingup Dam	West Dwellingerup Brook
pH (lab)	6.5-8.5	6.42-6.85	6.22-6.73
Turbidity (NTU)	5	1.9-7.2	0.4-0.9
Colour (TCU)	15	5-29	4-10
Conductivity at 25°C (mSm^{-1})		20-27	23-33
Total Filterable Solids* (sum)	1000	110-150	130-170
Total Filterable Solids –CO_2		110-140	120-160
Iron (unfiltered)	0.3	0.16-0.45	0.07-0.15
Manganese (unfiltered)	0.1	0.005-0.011	0.004-<0.04
Aluminium (unfiltered)	0.2	0.064-0.4	<0.01-0.035
Aluminium (filtered)		0.12[ς]	
Sodium	300	24-34	34-46
Potassium		0.75-1.4	0.05-1.2
Calcium		3.2-5.0	2.6-2.8
Magnesium		3.8-5.5	4.2-6.0
Hardness as $CaCO_3$	500	25-30	25-30
Alkalinity (milli equivalent L^{-1})		0.14-0.26	0.1-0.16
Chloride	400	45-68	60-86
Sulphate	400	5-7	4-7
Alkalinity as HCO_3		9-16	6-9
Silica as SiO_2		7.4-12.5	7.5-9.1
Filterable Organic Carbon		0.8-3.7	1.1-2.2
Nitrite and nitrate as nitrogen	10	<0.05-1.15	<0.05

* One sample only taken on 9/7/97

Bacteria Sampling Results

Microbiology data that has been sampled from raw water each month from January 1996 to December 1997 indicate that the Total Coliform and Thermo-tolerant Coliform count was 0/100mL for all samples - with the exception of a sample taken in May 1997 which indicates a Total Coliform count of 100/100mL and Thermo-tolerant coliform count of 29/100mL.

Appendix 2. Pesticide monitoring results

The Dwellingup Dam and a private orchard dam in the catchment are sampled monthly for pesticides. The results below are a 'snapshot' from the ongoing monitoring program for organochlorine pesticides from 1995 to 1998 and are summarised in the table.

Pesticide	Dwellingup Dam	Private Orchard dam	Health Value*
Aldrin	<0.001-0.002	not detected	0.3
Chlordane and metabolites	<0.001-0.002	<0.001-0.006	1
Chloropyrifos	not detected	<0.001-0.001	0.01
DDT and metabolites	<0.001-0.006	<0.001-0.007	20
Dieldrin	<0.001-0.001	<0.001-0.002	0.3
HCB	not detected	not detected	None given
Heptachlor and its epoxide	<0.001-0.026	0.002-0.007	0.3
Lindane	not detected	not detected	20
Atrazine	not detected	not detected	20
Demeton-S	not detected	not detected	None given
Diazinon	not detected	not detected	3
Dimethoate	not detected	not detected	50
Fenamiphos	not detected	not detected	0.3
Maldison	not detected	<0.05-0.08	50
Methyl Azinphos	not detected	not detected	3

* Concentration at which the pesticide is of a health concern in drinking water (ADWQ Guidelines NHMRC, 1996).

All measurements are in µg/L (micrograms per litre)

Appendix 3. Analysis of pesticide use

Details of herbicide and pesticide use in the catchment

The orchards in the catchment are either apple or summer fruit (such as peach, nectarine, plum and apricot) and there is one raspberry plantation. Agriculture Western Australia has a recommended spraying program for these fruits (Woods, *et.al.*, 1996).

All the commercial orchard lots in the catchment belong to one family. Other properties in the catchment have a small number of fruit trees but are unlikely to use a range of pesticides, with the possible exception of those used to eradicate fruit fly. Commercial orchards use a number of pesticides for the eradication of unwanted insects, funguses, diseases and weeds. These are detailed in the following table including some properties such as solubility in water, tendency to transfer from soil to water and their half-lives in soil and water according to Bush and Wilmot (1994).

The following pesticides are also used on the orchards in the catchment but their properties are not detailed in the study done by Bush and Wilmot (1994):

Hydrated Lime	Azinphos-methyl
Elofentezine	Winter Oil
Pyridaban	Tebufenpyrad

Pesticides are applied using a spray.

Monitoring of herbicides and pesticides

The Water Corporation monitors the TWS dam and the private orchard dam monthly for the following organochlorine pesticides:

- Aldrin
- Chlordane and metabolites
- Chloropyrifos
- DDT and metabolites
- Dieldrin
- HCB
- Heptachlor and its epoxide
- Lindane

With the exception of chlorpyrifos, which is still used, organochlorines are now illegal to use due to their persistence in the environment.

Consequently, it is important that the monitoring program include the pesticides currently used in the catchment.

Guidelines for pesticides

There is no specific information on the pesticides that can be used in drinking water catchments. However, there are guidelines for the application of herbicides in water catchment areas which are detailed in the "Use of Herbicides in Water Catchment Areas", PSC 88 (Health Department of WA, 1993) which is shown at the end of this appendix. The only herbicide used in the orchards is Glyphosate, which is one of the herbicides allowed under PSC 88, as long as it is used in accordance with the methods outlined in that publication.

With regard to pesticides in drinking water, the Australian Drinking Water Quality (ADWQ) Guidelines (NH&MRC, 1996) have a Health Value, which is 10% of the Acceptable Daily Intake and a Guideline Value, which is the analytical limit of determination and less than or equal to the health limit.

Risks associated with pesticides in the catchment

The following table shows, that of the pesticides being used in the catchment, most have short half-lives and are not readily transmitted from soil to water. However, some are readily transmitted from soil to water, some have half-lives in soil (in the order of several months) and some pesticides have both these characteristics. Consequently, while the risk of pesticides reaching the TWS dam is low, there is not an insignificant risk of pesticides occasionally reaching the TWS dam - even if concentrations are well below health guidelines.

It is important that the water in the dam is tested for the presence of the pesticides currently being used in the catchment. Consideration should be given to monitoring for pesticides immediately after a significant rainfall event.

Key to following table

Solubility

Solubility of a pesticide in water (mg of pesticide soluble in one litre of water).

Koc

Water/sediment partition coefficient. A high Koc value means the pesticide will 'stick' to the sediment well and not easily move into the groundwater or be carried by surface water runoff.
As a general guide, a pesticide with a log Koc value of below 3 will readily move from soil to water and a pesticide with a log Koc value of 5 or greater will tend to "stick" to soil and not move into groundwater or be carried by surface water. The actual Koc value is also dependent on the type of soil (Wilmot, *pers. comm.*, 1999).

Soil $t_{1/2}$

Half-life of the pesticide in soil (days). The value will vary with conditions so a minimum and maximum value is given.

Water $t_{1/2}$

Half-life of the pesticide in water (days). The value will vary with conditions so a minimum and maximum value is given.

Water Contamination Potential (WCP)

The WCP of pesticides is linked to, among other things, mobility of the pesticide and persistence in soil and water (Bush and Wilmot, 1994).

Toxicity

The toxicity of the pesticide.

Pesticides used in the Dwellingup Catchment

Pesticide	Class	Type	Solubility mg/L	Log Koc (min)	Log Koc (max)	Soil t1/2 (min)	Soil t1/2 (max)	Water t1/2 (min)	Water t1/2 (max)	WCP ranking	Toxicity
Aldrin *	organochlorine	insecticide	0.02	2.61	5.36	20	100			1	
Carbaryl	carbamate	insecticide	32	2.24	2.81	7	28	<1	10	1	2
Chlordane *	organochlorine	insecticide	0.1	4.72	4.88	360	1200			3	
Chlorothalonil	phthalimide	fungicide	0.6	2.5	2.99	45	90			2	2
Chlorpyrifos	organophosphorus	insecticide	2	3.78	4.23	60	120	21	78	1	3
DDT *	organochlorine	insecticide	0.005	5.11	5.56	3800	3800			3	
Dieldrin *	organochlorine	insecticide	0.17	3.6	4.15	1100	2500			3	
Fenthion	organophosphorus	insecticide	2	2.98	3.34					2	2
Fluvalinerate	pyrethroid	insecticide		3.47	3.78	6	8			1	2
Glyphosate	phosphinic acid	herbicide	12000	3.42	3.68	1	21	50	>84	2	1
Heptachlor *	organochlorine	insecticide	0.18	4.05	5.24	150	300			1	
Lindane *	organochlorine	insecticide	7.3	2.59	3.09	266	266	30	300	3	
Malathion	organophosphorus	insecticide	145	2.33	3.65	4	6	<1	14	1	2
Mancozeb	dithiocarbamate,O/Mn,O/Zn	fungicide	20	2.92	3.07	6	15			1	2
Methidathion	organophosphorus	insecticide	250	2.2	2.66					2	2
Metsulphuron	urea,sulphonylurea,triazine	herbicide	9500	1.54	2.31	7	28	<1	7	2	3
Thiram	dithiocarbamate	fungicide	30	2.83	3.39	98	105			1	3
Ziram	dithiocarbamate,O/Zn	fungicide	65							2	2

* The pesticides highlighted by shading are Organochlorines and are included in this table for comparison, and not because they are used in the catchment.

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
Dog kennels	Incompatible	Conditional	Conditional
Drive in / take-away food shops	Incompatible	Incompatible	Compatible[6]

Land use	Priority 1	Priority 2	Priority 3
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
Drinking water treatment plants	Conditional	Conditional	Conditional
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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