

DENMARK RIVER CATCHMENT AREA DRINKING WATER SOURCE PROTECTION ASSESSMENT

DENMARK TOWN WATER SUPPLY



2004

Acknowledgements

This ASSESSMENT was prepared by the Infrastructure Planning Branch of the Water Corporation at the request of the Department of Environment.

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Cover Photograph: Denmark Dam and Reservoir [taken by David Boyd]

Purpose of this Assessment

A safe drinking water supply is critical to the wellbeing of the community. Effective catchment protection is fundamental to minimising risks to public health and the cost of supplying water to consumers.

This document presents an initial assessment of the risks to water quality in Denmark River Catchment Area. It is the first stage in the production of a Drinking Water Source Protection Plan for the catchment.

The Water Corporation is committed to supplying the safest drinking water to its customers that is practicable. It recognises protecting Public Drinking Water Source Areas (PDWSA - i.e. surface water and groundwater catchments) is the most critical component of its Drinking Water Quality Management System. Statutory responsibility for managing PDWSA in Western Australia belongs to the Department of Environment (DoE) and for public health with the Department of Health (DoH). The Water Corporation, as water service provider, has a responsibility to work with both organisations to protect drinking water supplies.

The Australian Drinking Water Guidelines (ADWG), developed by the National Health and Medical Research Council provide a framework for management of drinking water quality, and propose a multiple barrier ('catchment to consumer') approach as the most effective method of protecting drinking water. Management of the drinking water source catchment is considered the first important barrier and involves:

1. Understanding the catchment, and the hazards and events that can compromise drinking water quality; and
2. Developing and implementing preventive strategies and operational controls necessary to ensure the safest possible raw water supply (i.e. before treatment).

Western Australia is meeting the ADWG framework by producing Drinking Water Source Protection Plans (DWSPP) for all PDWSAs. This process involves:

Stages in development of a DWSPP	Comment
1 Prepare Drinking Water Source Protection Assessment	Assessment document prepared following catchment survey and preliminary information gathering from State and Local Government Agency stakeholders.
2 Conduct stakeholder consultation	Advice sought from key stakeholders using the Assessment as a tool for background information and discussion.
3 Prepare Draft DWSPP	Draft DWSPP developed taking into account inputs from stakeholders and any additional advice received.
4 Release Draft DWSPP for public comment	Draft DWSPP released for a six week public consultation period.
5 Publish DWSPP	Final DWSPP published after considering advice received in submissions on the Draft. Includes recommendations on how to protect the drinking water catchment.

DoE requested the Water Corporation undertake Stage 1 and prepare this assessment document because it is the licensed water service provider for Denmark Town Water Supply Scheme. The Water Corporation has a good understanding of the water quality issues in the PDWSA and a strong desire to ensure water quality is protected. DoE will undertake Stages 2 to 5.

This PDWSA should be recognised in the Shires of Denmark and Plantagenet Town Planning Schemes, consistent with the Western Australian Planning Commission's Statement of Planning Policy No. 2.7 - *Public Drinking Water Source Policy*. Where a DWSPP has not been completed for a PDWSA, State and Local Government planners should use this assessment document together with the DoE's Water Quality Protection Note – *Land use compatibility in Public Drinking Water Source Areas* when planning or approving land use developments and activities proposed within current or future PDWSAs. Other stakeholders should use the document as a guide for protecting the quality of water in our limited drinking water catchments.

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1 Town water supply overview

Denmark Dam and Reservoir are located on Denmark River, approximately 410 km south of Perth and about 5 km north of the town of Denmark. It is one of two surface water sources currently operated by the Water Corporation for supply of public drinking water to Denmark. Figure 1 shows the location of the Denmark Dam and Catchment.

Denmark Dam Catchment has an area of 567 km² and is located within the Shires of Denmark and Plantagenet.

Denmark is in the Great Southern region of Western Australia, 54 km west of the regional centre of Albany. The town services local rural industries that are based on beef, bacon and dairy production, and is the administrative centre for the Shire of Denmark. It has a permanent population of about 4 000, but population increases significantly during tourist season. Tourism is the town's main economic industry.

1.1 Existing water supply system

Denmark Dam was constructed in 1961 and consists of an 8 metres high concrete gravity wall. The reservoir covers an area of 21.9 ha and has a storage volume of 451 Megalitres (ML). Annual inflow to the reservoir is estimated to be 37 Gigalitres (GL) (Marchesani, 1993).

The reservoir was the sole source for Denmark's water supply until the late 1980s, when increasing salinity necessitated supplementation from fresher sources located on Quickup River and Scotsdale Brook. Denmark Reservoir has been used sparingly over the last several years. Water is generally not taken from the reservoir during winter when salinity is highest and scheme demand is lowest. When used, water is transferred to the on-site water treatment plant, where it is blended with the supply from Quickup Reservoir before being pumped to the Horsley Road service reservoir. With the recent upgrade of the treatment plant, Quickup Reservoir now operates as the prime source. Scotsdale has been decommissioned and Denmark Reservoir is temporarily off-line because of concerns about the risks from cattle grazing on land close to the reservoir.



Photo. 1 Denmark Dam and Reservoir

1.2 Water treatment

When used, water from Denmark Reservoir is transferred to the water treatment plant adjacent to the dam, where it undergoes sedimentation, clarification and filtration to reduce colour, iron, aluminium and turbidity levels. The treated water is blended on-site in the clear water tank with treated Quickup Reservoir water and chlorinated before being pumped to Horsley Road service reservoir. Further disinfection occurs when it is pumped up to the summit tank. The water is then distributed into the town reticulation system and to other service tanks around the townsite, where additional chlorination occurs before being supplied to the town.



Photo. 2 Water treatment plant adjacent to dam

1.3 Catchment details

1.3.1 Physiography

Denmark catchment is a laterite plateau consisting of sands and ironstone gravels over mottled clays. The hilly uplands of mottled soils and gravels comprise 20% of the catchment, which are dissected by incised valleys that have moderate to steep slopes of yellow podsollic soils and red earths, covering about another 15%. Swampy flats with poor drainage, found mainly in the west and north west sectors, cover 10% of the catchment (Moulds & Bari, 1995).

The natural vegetation of the catchment is dominated by forests of jarrah and marri, with some stands of karri in the lower reaches. Sheoak and banksia cover the western part of the upper catchment. About 17% of the catchment has been cleared for agriculture (Moulds & Bari, 1995).

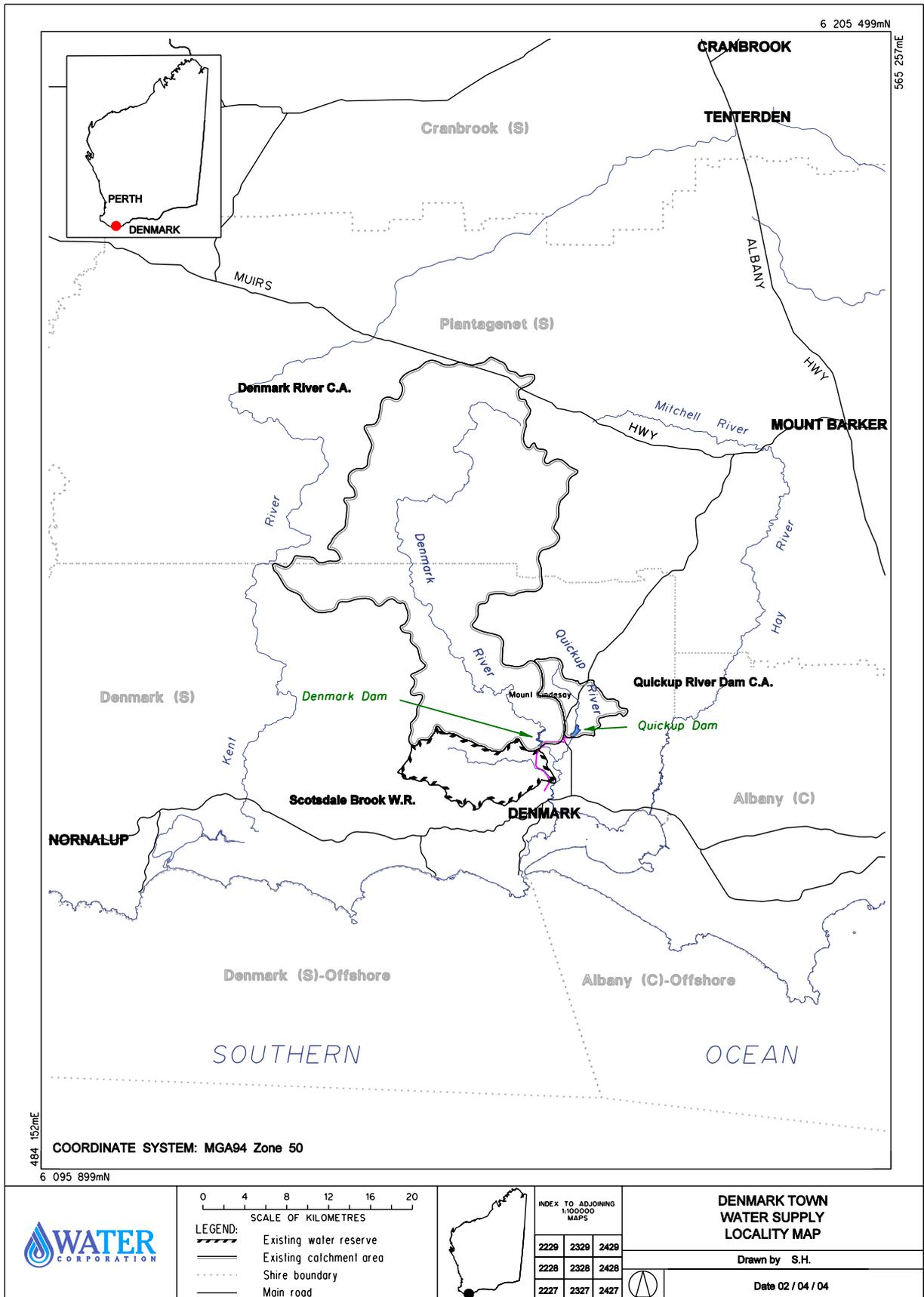


Figure 1 Denmark locality map

1.3.2 Climate

The area has a Mediterranean climate, characterised by warm, dry summers and cool, wet winters.

The long-term average annual rainfall varies across the catchment from about 1 000 mm at the dam site to 700 mm at the northern boundary. Most of the rain falls between May and September. Annual average evaporation is 1 300 mm.

1.3.3 Hydrology

The catchment for Denmark Dam has an area of 567 km² and varies in elevation from 30 m AHD at the reservoir to 240 m AHD at the head of the catchment. The highest point in the catchment is Mt Lindesay at just over 450 m.

Surface runoff over the winter months and subsurface flow all year round contribute almost equally to water inflow to the reservoir (Moulds & Bari, 1995).

The long-term average volume of water entering Denmark Reservoir is 37 GL/year and the current long-term average yield is 25.9 GL/year (Marchesani, 1993).

1.4 Future water supply requirements

The current estimate of the ultimate number of water services for Denmark is 3 900 in 2050 (Di Prinzio, 2000). The projected demand of 1 300 ML/year is well within the existing capacity of Quickup and Denmark Dams. It is anticipated the Denmark River catchment will need to be developed to its full supply capacity to provide additional water to the Lower Great Southern Town Water Supply Scheme to meet the demand for Albany and surrounding localities beyond 2050 (Rymarski, 2001).

1.5 Protection and allocation

1.5.1 Existing water source protection

Denmark River Catchment Area was proclaimed in 1978 under the *Country Areas Water Supply Act 1947* to ensure protection of the water source from potential contamination. The catchment area is shown in Figure 2.

There is no existing priority protection classification assigned to the Catchment Area.

1.5.2 Current allocation licence

Water resource use and conservation in Western Australia is administered by the Department of Environment in accordance with the *Rights in Water and Irrigation Act 1914*. This Act requires a licence to draw water from surface water and groundwater areas proclaimed under the Act (except for domestic and stock use) and all artesian wells throughout the State.

Denmark River catchment is yet to be proclaimed under the *Rights in Water and Irrigation Act 1914*.

The Water Corporation has applied for a licence from the Department of Environment to draw a total of 1 150 ML/year from the scheme's three surface water sources. DoE has not issued licences because none of the catchments have been proclaimed. The pending allocation for Denmark Dam is 200 ML. The current number of water services in Denmark is 1 670 and annual production from all sources in 2002/03 was close to 429 ML. There has been no draw from Denmark Dam for the last three years.

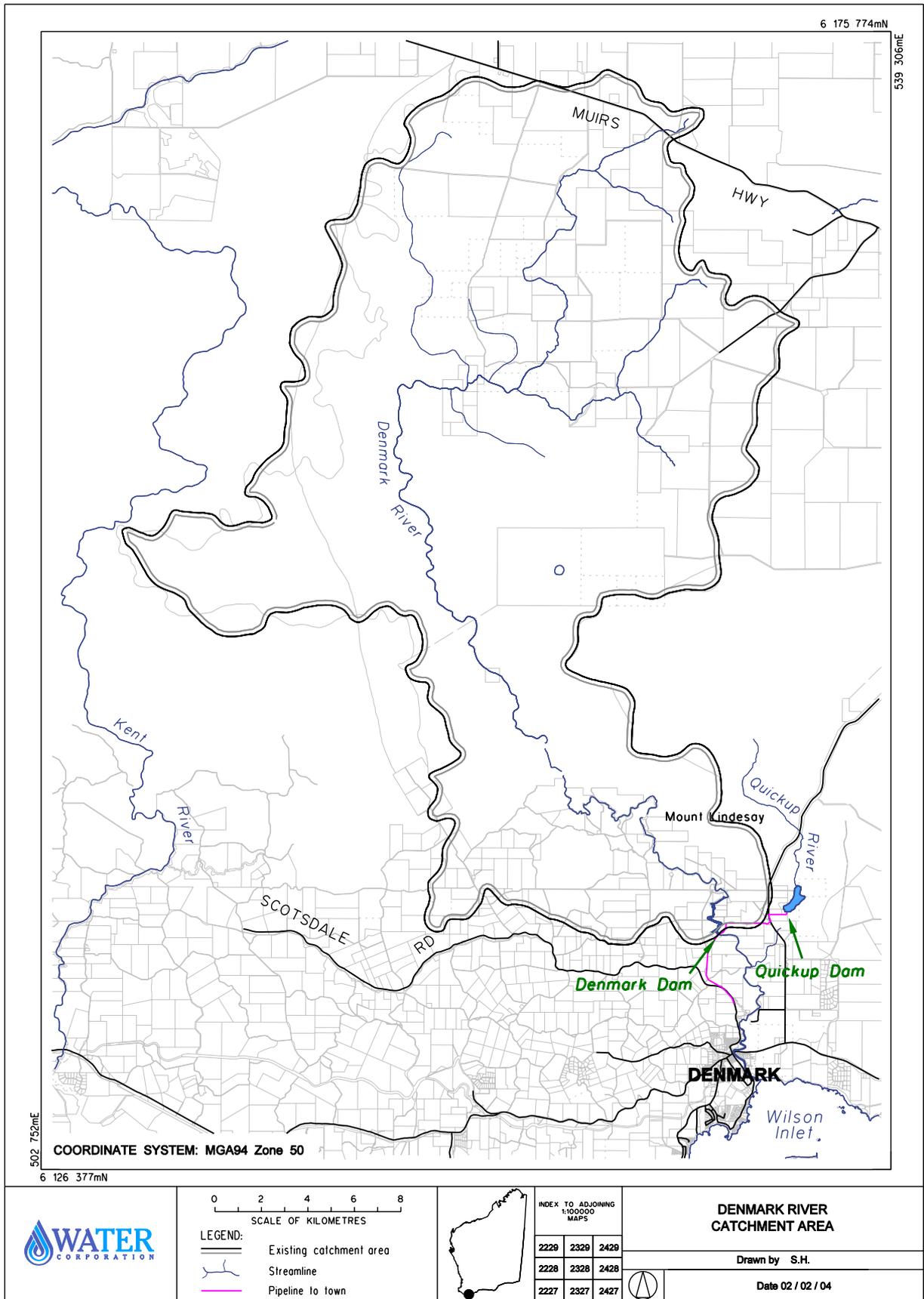


Figure 2 Denmark Dam catchment

2 Water quality

The quality of raw water from Denmark Reservoir is monitored in accordance with the Australian Drinking Water Guidelines (ADWG) and the program set out in the Denmark Town Water Supply Water Resource Management Operation Strategy (Tran, 1998). It is regularly monitored for microbiological contamination, health related chemicals and aesthetic chemicals and parameters.

ADWG gives guidance on the quality of water that should be provided to consumers at the point of use.

Historically, salinity, colour, iron and aluminium in the raw water from Denmark Reservoir have often exceeded ADWG values. All other chemical components are within guideline values, with the exception of manganese, turbidity and pH at times been outside guideline values.

Marked increases in salinity levels were observed in the 1960s-70s following large scale clearing of vegetation in the catchment for agricultural production. Salinity peaked at around 3000 mg/L Total Dissolved Solids (TDS) in the 1980s. Clearing controls put in place in 1978 and extensive revegetation undertaken over the last 30 years have arrested the trend of increasing salinity. There has been significant improvement in river salinity in recent years. Typically, salinity now peaks at about 1 000 mg/L and levels as low as 600 mg/L are observed during the summer months.

Acidity, elevated aluminium and the aesthetic issues of colour, iron, hardness and turbidity relate to natural occurrence and are not a result of land use impacts. However, there is concern about regular recording of thermotolerant coliforms. E Coli counts of up to 100 are common in the raw water. This suggests microbiological contamination of reservoir water may be occurring. Further investigation into the high E Coli counts and potential sources of contamination is required to determine need for additional catchment management barriers.

Summary details of water quality from Denmark Reservoir are shown in Appendix 2.

3 Hazard identification and risk assessment

Hazards associated with existing and proposed land uses and activities in the Catchment Area have been identified. The risk posed by each hazard has been assessed and a catchment management priority of *High*, *Medium* or *Low* assigned.

The priority level assigned to identified hazards was determined by assessing the likelihood and consequences of the source being contaminated, taking into account current catchment preventive and management strategies. The risk assessment process was conducted in accordance with ADWG 2003 recommendations. DoE is preparing a document to further explain risk assessment in drinking water catchments. It will soon be available on its website at <http://www.wrc.wa.gov.au/protect/policy/WQPN.htm>.

Potentially hazardous land uses and activities are shown in Figure 3 and drinking water quality risks assessment details are provided in Table 1.

3.1 Existing land uses

Land use in the Denmark River catchment is predominantly general agriculture and tree farming on the private land, and State Forest on Crown Land. About 25% the catchment is in private ownership, which has led to about 17% of catchment being cleared for agricultural use (Moulds & Bari, 1995). Most of the cleared land is in the upper catchment.

Private land

Historically, the greatest risk to drinking water quality from private land use has been increased salinity and turbidity from land clearing. Clearing controls put in place in 1978 have seen a significant reduction in this risk and resulted in a shift in agricultural land use over the last decade from sheep grazing to tree plantations. Anecdotal comments indicate up to 40 000 sheep having been replaced by planting of commercial tree crops.

Cattle grazing and cropping for hay and canola now mainly occur in the upper catchment where activity levels are low.

Generally, these agricultural land uses and tree farming pose little threat to drinking water quality. However, on a small number of properties adjacent to Denmark Reservoir, there is uncontrolled movement of cattle in streamlines and on the reservoir banks, which raises concerns about the potential for pathogen and nutrient contamination. Accumulated deposition of animal faeces provides a greater long-term risk to the source and consideration should be given to developing and implementing a program for excluding stock from these areas. There also needs to be a focus on best management practices on these properties, to ensure risk of pollution is minimised and local council land planning controls should support this approach.



Photo. 3 Typical farmland lower catchment
(Mt Lindesay in background)

Crown land

A large part of the Crown Land (about 358 km²) is incorporated within Reserve R24660, held for the purpose of Water Catchment Area for Denmark River. The dominant land use on R24660 is State Forest 64. The Reserve is jointly vested in the Minister for Water Resources and the Conservation Commission of Western Australia and managed by the Department of Conservation and Land Management (CALM) on their behalf. Most of the other Crown Land is part of State Forest 64. Managed uses within the forest can include conservation, recreation, timber production, water catchment protection and other regulated purposes (Conservation Commission, 2002).

Smaller parcels of Crown Land are either owned or managed by DoE or CALM. Land uses include natural bushland, timber sharefarming and National Park.

There is little evidence of organised recreational use of the State Forest, although there is likely to be low level use of the many tracks and trails for individual pursuits such as firewood collection, bushwalking, horse riding and off-road vehicle use. Unauthorised swimming and marroning may occur in the reservoir and measures need to be taken to limit access and to educate the community of the health risks posed by human contact with the water body. Culling of feral animals is targeted through a Landcare program.

Currently approved activities within the State Forest are regulated by CALM with the understanding that public drinking water is a prime beneficial use of the land.

3.2 Proposed land uses

State Government is considering changing the purpose of State Forest 64 to National Park as one of the outcomes from the Regional Forest Agreement. Proposed recreation activities and the park management strategy need to recognise supply of public drinking water as one of the prime beneficial uses of the land. Approval of regulated activities compatible with the protection of drinking water should result in a low risk to water quality.



Photo. 4 Farmland on edge of reservoir



Photo. 5 Cattle in tributary streamline

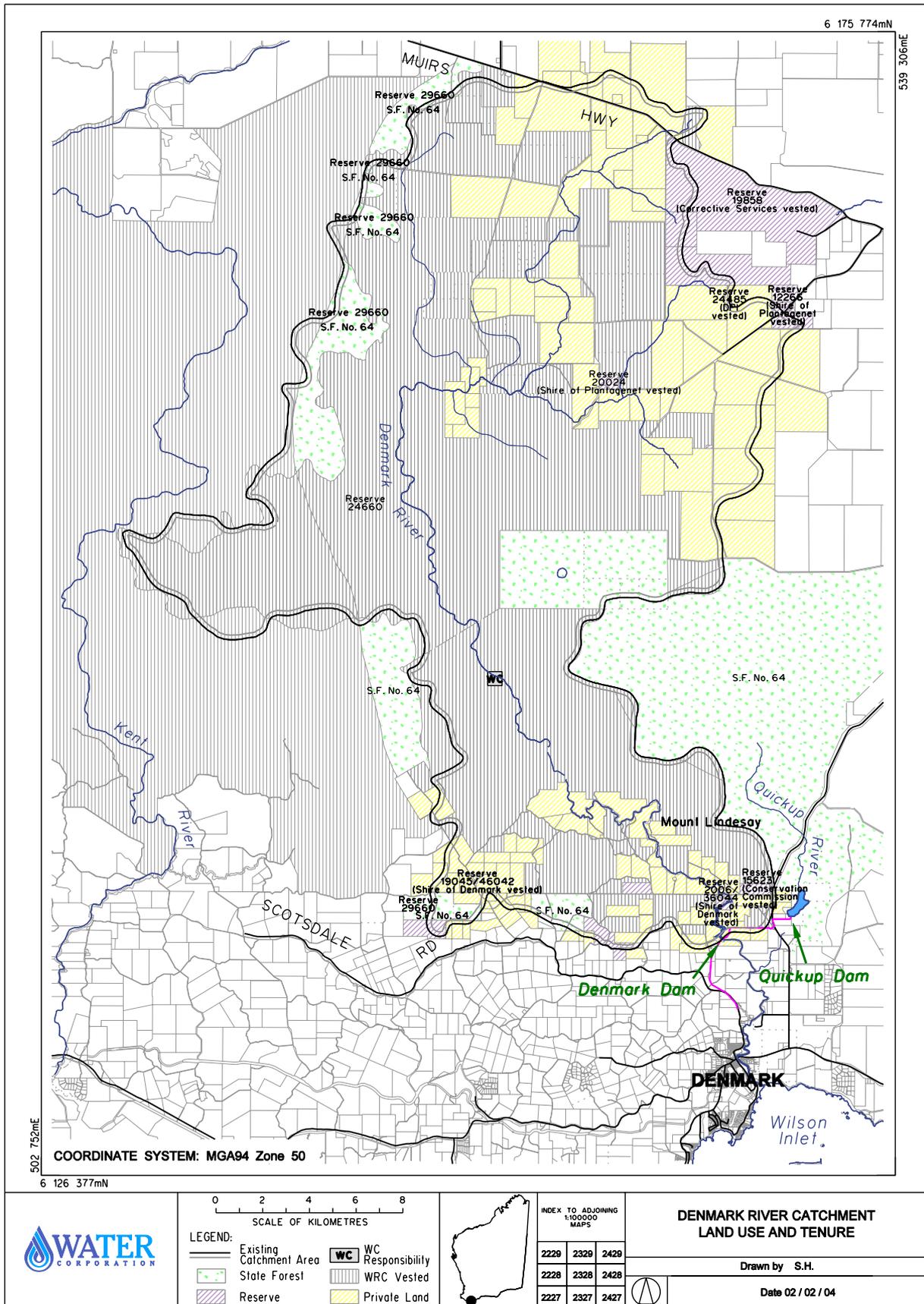


Figure 3 Existing land use and tenure

Table 1 Drinking Water Quality Risk Assessment

Land Use/ Activity	Hazard Event/ Source	Hazard ¹	Considerations	Current Catchment Preventive and Management Strategies	Catchment Management Priority ²
<i>Crown Land</i>					
Farmland purchased under clearing control legislation	Past clearing Erosion and run-off	Salinity Turbidity	Salinised land returned to Government ownership. Majority of land incorporated within State Forest 64 (SF64) under CALM management. Timber sharefarming undertaken on some of DoE's freehold land.	<ul style="list-style-type: none"> Water quality monitoring Forest management plan directs operations in SF64. Timber sharefarming operated under formal Govt agreements. Land not incorporated in SF64 or used for timber farming retained as bush. 	Medium
<i>State Forest</i>					
Off-road vehicle use	Fuel and chemical spills Erosion and run-off Litter	Hydrocarbons and chemicals Turbidity Pathogens	Little activity evident	<ul style="list-style-type: none"> Water quality monitoring HAZMAT emergency response 	Medium
Water based e.g. Swimming Fishing Marroning	Human contact Use of bait Litter	Pathogens Pathogens Pathogens	Not recommended by the Health Department for public water supply sources and not permitted under the by-laws of the CAWS Act. Anecdotal evidence only.	<ul style="list-style-type: none"> Water quality monitoring WC operators on site daily at water treatment plant, adjacent to reservoir. 	Medium
Feral animals	Excreta	Pathogens	Landcare culling program.	<ul style="list-style-type: none"> Water quality monitoring Area patrolled by CALM ranger 	Medium
State Forest Timber production	Fuel and chemical spills Erosion and run-off Pesticide use	Hydrocarbons and chemicals Turbidity Pesticides	CALM Act recognises supply of drinking water as a one of the prime beneficial uses of the resource.	<ul style="list-style-type: none"> Water quality monitoring Operations directed by forest management plan 	Low
Apiarists Wildflower picking Seed collection Firewood collection	Litter Chemical and fuel spills	Pathogens Hydrocarbons and chemicals	Little activity evident.	<ul style="list-style-type: none"> Water quality monitoring CALM approval required for all activities except collection of less than 1tonne of firewood 	Low
Horse riding	Litter Animal excreta	Pathogens Pathogens	Little activity evident	<ul style="list-style-type: none"> Water quality monitoring Organised activities require CALM approval 	Low
Bushwalking	Litter	Pathogens	Trails are away from watercourses and reservoir.	<ul style="list-style-type: none"> Water quality monitoring Area patrolled by CALM ranger 	Low

Land Use/ Activity	Hazard Event/ Source	Hazard ¹	Considerations	Current Catchment Preventive and Management Strategies	Catchment Management Priority ²
<i>Rural land</i>					
Roads	Fuel and chemical spills Erosion and runoff	Hydrocarbons and chemicals Turbidity	Regional roads service local farming community. Muir Hwy crosses the very top end of catchment.	<ul style="list-style-type: none"> Water quality monitoring HAZMAT emergency response 	Medium
Clearing for broadacre farming	Land clearing Erosion and run-off	Salinity Turbidity	Historical clearing has caused salinisation. Land rehabilitation and revegetation over the last 30 years has seen improvement in water quality	<ul style="list-style-type: none"> Water quality monitoring Govt controls on clearing of land. Salt affected land purchased by Government 	Medium
Broadacre cropping and grazing middle and upper catchment Tree farming	Septic systems Fertiliser use Pesticide use Animal excreta Fuel and chemical spills	Nutrients and pathogens Nutrients Pesticides Pathogens Hydrocarbons and chemicals	Low density activity in upper catchment. Further intensification undesirable. Land conservation controls provide a focus for retention of remnant vegetation.	<ul style="list-style-type: none"> Water quality monitoring Land planning controls encourage land conservation practices. 	Low
Broadacre grazing lower catchment	Animal excreta Fuel and chemical spills	Pathogens Hydrocarbons and chemicals	Cattle have unrestricted access to a streamline immediately upstream of reservoir as well sections of the reservoir bank.	<ul style="list-style-type: none"> Water quality monitoring. 	High

1. See Table 2 Water Quality Hazards and Potential Impact on Consumer table.
2. Catchment Management Priority Scale Used: *High, Medium and Low*.

Table 2 Water Quality Hazards and Potential Impact on Consumer

Water Quality Hazards and Potential Impact on Consumer	
Hazard	Potential Impact on Consumer
Health	
Hydrocarbons and Chemicals	May have poor taste and smell. Some may cause cancer after prolonged exposure. Harmful by-products may be formed when combined with chlorine.
Nutrients	Nitrate is toxic to humans at high levels, with infants less than three months old being most susceptible. Nutrients can cause algal blooms.
Pathogens (Bacteria, Viruses, Protozoa)	Can cause disease such as gastro-enteritis or even death.
Pesticides	Most modern pesticides readily degrade in the environment, however in the past, pesticides containing organochlorides could bioaccumulate in humans/ animals causing toxic affects.
Toxins eg Cyanobacteria (blue green algae)	Can result in nerve damage.
Aesthetic	
Colour	Not a health consideration if derived from natural organics. Harmful by-products may be formed when combined with chlorine.
Total Dissolved Solids / Salinity	Poor taste and corrosion to pipe work and household appliances.
Turbidity	Discolouration and cloudiness of water. May reduce the effectiveness of disinfection.

4 Conclusion

Current risks to water quality from activities within Denmark River Catchment Area have been identified and assessed.

Uncontrolled movement of cattle in streamlines close to and on the banks of the reservoir provide a severe risk to drinking water quality because of the potential for pathogen and nutrient contamination. Excluding stock from these areas is rated a **High** management priority. Generally, other agricultural land uses in the catchment are considered a **Low** management priority.

Salinisation from clearing of farmland and management of land purchased by Government under the clearing control legislation remains a significant risk to drinking water quality. They are rated a **Medium** management priority because the significant effort already expended in ameliorating the impacts and the changes in land use that have occurred in support of the drinking water quality objectives.

Although there is low likelihood of water based recreational activities occurring within the State Forest, preventing their occurrence is also considered a **Medium** management priority because the impact of pathogen contamination from these activities can be significant.

Culling for feral animals is also considered a **Medium** management priority because of the potential for pathogen contamination from animals wallowing in streamlines.

There is potential for hydrocarbon and chemical contamination from on and off road vehicular movement throughout the catchment and implementation of HAZMAT emergency procedures is a **Medium** management priority.

Other activities within the catchment are considered to be a **Low** management priority.

Risks identified in this document, and any raised in future public consultation processes, will be further considered during development of the Denmark River Catchment Area Drinking Water Source Protection Plan (DWSPP).

It is essential existing catchment preventive and management strategies be continued and protection measures identified in the forthcoming DWSPP be implemented to ensure the ongoing availability of good quality drinking water. The Water Corporation will continue to implement preventive measures within its assigned responsibility, such as monitoring, signage and surveillance. Other relevant agencies and stakeholders are also encouraged to implement preventive measures prior to development of the DWSPP wherever possible. Examples of potential strategies used in other PDWSAs for managing drinking water quality risks can be found in Appendix 3.

Planning and other land use decision-makers should recognise the significance of this drinking water catchment in the decisions they make in accordance with the Western Australian Planning Commission's Statement of Planning Policy No 2.7 – *Public Drinking Water Source Policy* and with reference to DoE's Water Quality Protection Note – *Land use compatibility in Public Drinking Water Source Areas*. Further advice on drinking water catchment protection issues is available from the Water Corporation, DoE and DoH.

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Glossary and Acronyms

Abstraction	Pumping groundwater from an aquifer.
ADWG	Australian Drinking Water Guidelines, published by the National Health and Medical Research Council and Agriculture and Resource Management Council of Australia and New Zealand under rolling review.
Aesthetic	Relating to the physical characteristics of water (taste, clarity, smell and feel).
Allocation	The quantity of water permitted to be abstracted by an allocation licence, usually specified in kilolitres/year (kL/a).
Alluvium (alluvial)	Detrital material which is transported by streams and rivers and deposited.
Aquifer	A geological formation or group of formations able to receive, store and transmit significant quantities of water.
Bore	A narrow, lined hole drilled to monitor or withdraw groundwater.
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Confined Aquifer	An aquifer that is confined between shale and siltstone beds and therefore contains water under pressure.
Diffuse Source Pollution	Pollution originating from a widespread area, e.g. urban stormwater runoff, agricultural runoff.
DWSPA	Drinking Water Source Protection Assessment
DWSPP	Drinking Water Source Protection Plan
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
Groundwater	Water which occupies the pores and crevices of rock or soil.
Health Related Chemical	Water quality characteristic that may pose a health risk to consumers.
Hydrogeology	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.
Leaching / Leachate	The process by which materials such as organic matter and mineral salts are washed out of a layer of soil or dumped material by being dissolved or suspended in percolating rainwater; the material washed out is known as leachate. Leachate can pollute groundwater and waterways.
m AHD	Australian Height Datum. Height in metres above Mean Sea Level +0.026 m at Fremantle.

Microbiological Contaminant	Micro-organisms which can either directly cause disease (pathogens) or indicate the possible presence of other pathogens.
Nutrient Load	The amount of nutrient reaching the waterway over a given time (usually per year) from its catchment area.
Nutrients	Minerals dissolved in water, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorus (phosphate) which provide nutrition (food) for plant growth. Total nutrient levels include the inorganic forms of an element plus any bound in organic molecules.
PDWSA	Public Drinking Water Source Area
Pesticides	Collective name for a variety of insecticides, fungicides, herbicides, algacides, fumigants and rodenticides used to kill organisms.
Point Source Pollution	Specific localised source of pollution, e.g. sewage or effluent discharge, industrial waste discharge.
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.
Recharge	Water infiltrating to replenish an aquifer.
Recharge Area	An area through which water from a groundwater catchment percolates to replenish (recharge) an aquifer. An unconfined aquifer is recharged by rainfall throughout its distribution. Confined aquifers are recharged in specific areas where water leaks from overlying aquifers, or where the aquifer rises to meet the surface.
Runoff	Water that flows over the surface from a catchment area, including streams.
Saltwater Intrusion	The inland intrusion of saltwater into a layer of fresh groundwater.
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 that has run off the ground surface, roads, paved areas etc and is usually carried away by drains.
TDS	Total Dissolved Solids, a measure of salinity, calculated from TFSS (Total Filterable Suspended Solids) and measured in accordance with ADWG.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.

Unconfined Aquifer	An aquifer containing water, the upper surface of which is lower than the top of the aquifer. The upper surface of the groundwater within the aquifer is called the watertable.
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.
Watertable	The upper saturated level of the unconfined groundwater.
Wellfield	A group of bores to monitor or withdraw groundwater.

Appendices

- Appendix 1** Department of Environment - Water Quality Protection Note:
Land use compatibility in Public Drinking Water Source Areas.
- Appendix 2** Water Quality
- Appendix 3** Example protection strategies used in drinking water catchments in
Western Australia.
- Appendix 4** Department of Environment -Water Quality Protection Note:
Overview on protecting Public Drinking Water Source Areas.

Appendix 1

DoE WQPN Land use compatibility in Public Drinking Water Source Areas

Refer to DoE website <http://www.wrc.wa.gov.au/protect/policy/WQPN.htm> for latest version.

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Water Quality Protection Note

Land use compatibility in Public Drinking Water Source Areas

Purpose

The Department of Environment (DOE) is responsible for managing and protecting the State's water resources. This note provides advice on the acceptability of land uses and activities within specific catchments that are the water source for schemes supplying cities and towns. These are termed Public Drinking Water Source Areas (PDWSAs). These areas require comprehensive water resource quality and land planning protection measures to ensure the ongoing availability of a safe, good quality drinking water supply to protect the health of consumers.

The note also forms an integral part of the Western Australian Planning Commission's *Statement of Planning Policy No. 2.7- Public Drinking Water Source Policy* 2003 (relevant to approximately 140 existing PDWSAs in Western Australia) prepared by the Department for Planning and Infrastructure under Section 5AA of the *Town Planning and Development Act 1928*. It is also intended to support the proposed Statement of Planning Policy for *Water Resources* designed to guide planning decisions in future PDWSAs. This note should be used by Local Government when developing local planning strategies, structure plans and town planning schemes. It should also be used in the assessment of subdivision and other development applications. The note will also assist the development of formal guidelines on land use activities in PDWSA prepared in liaison with key stakeholders such as the Water Corporation, Department of Health, Department of Conservation and Land Management, Department of Agriculture, Department of Industry and Resources, Department for Planning and Infrastructure and local government.

A review of this note may occur within 12 months (depending on feedback) to reflect DOE's policy position (which is influenced by public consultation undertaken for PDWSAs), advances in technology or land use activity standards, and Government decisions made concerning drinking water quality protection. This note may not consider all the circumstances that exist for planning strategies, plans and schemes across the State. Accordingly, changes to this note will only be considered if they apply broadly across the State. Other means of addressing localised special circumstances may be employed and the DOE will assist in achieving this outcome provided those changes do not place the PDWSA at a higher contamination risk.

The *Department of Environmental Protection* and *Water and Rivers Commission* are presently being combined to form the *Department of Environment*. This process will not be complete until enabling legislation has been passed by Parliament and proclaimed. This note aims to present a generic 'combined agency' position on the nominated topic.

Scope

This note provides the DOE's position on a range of land uses assessed against the Department's water quality protection strategy and management objectives within PDWSAs. Where a specific land use has not been covered in the accompanying tables, it should be referred to the Department's Water Source Protection Branch for assessment and a written response concerning its acceptability or any necessary water resource protection measures.

Public Drinking Water Source Area in Western Australia is the collective description for:

- Underground Water Pollution Control Areas,
- Water Reserves, and
- Catchment Areas,

declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*.

This note is intended to complement the statutory role and policy of State and local government authorities, but it does not override Government policy or the need for proponents to fulfil their legal responsibilities for land use planning, and environmental, health, building or other necessary approvals.

PDWSA protection framework

The protection of PDWSAs relies on statutory measures available in water resource management and land use planning legislation. The DOE policy for the protection of PDWSAs includes three risk management based priority classification areas and two types of protection zones. The priority classification areas and protection zones are determined via specific Drinking Water Source Protection Plans (DWSPP) that are prepared in consultation with State government agencies, landowners, local government, and key industry and community stakeholders. Where a fully consulted DWSPP does not exist for a PDWSA, the DOE initially prepares Drinking Water Source Protection Assessment (DWSPA) documents to reflect readily available information for use in land use planning assessments and decision making.

Priority classification areas

Priority 1 (P1) classification areas are managed to ensure that there is **no degradation** of the drinking water source by preventing the development of potentially harmful activities in these areas. The guiding principle is **risk avoidance**. This is the most stringent priority classification for drinking water sources. P1 areas normally encompass land owned or managed by State agencies, but may include private land that is strategically significant to the protection of the drinking water source (e.g. land immediately adjacent to a reservoir). Most land uses create some risk to water quality and are therefore defined as **“Incompatible”** in P1 areas.

Priority 2 (P2) classification areas are managed to ensure that there is **no increased risk** of water source contamination/ pollution. For P2 areas, the guiding principle is **risk minimisation**. These areas include established low-risk land development (e.g. low intensity rural activity). Some development is allowed within P2 areas for land uses that are defined as either **“Compatible with conditions”** or **“Acceptable”**.

Priority 3 (P3) classification areas are defined to **manage the risk of pollution** to the water source from catchment activities. Protection of P3 areas is mainly achieved through guided or regulated environmental (risk) management for land use activities. P3 areas are declared over land where water supply sources co-exist with other land uses such as residential, commercial and light industrial development. Land uses considered to have significant pollution potential are nonetheless opposed or constrained.

Wellhead and reservoir protection zones

In addition to the three Priority Classification Areas, specific protection zones are defined to protect drinking water sources from contamination in the immediate vicinity of water extraction facilities. Within these zones by-laws may prohibit, restrict or approve defined land uses and activities to prevent water source contamination or pollution. Special conditions, such as restrictions on storage and use of chemicals, may apply within these zones. The legislation is currently being reviewed to simplify and enhance the protection of public drinking water sources.

Wellhead protection zones (WHPZ) are used to protect underground sources of drinking water. They are circular (unless information is available to determine a different shape), with a radius of 500 metres in P1 areas, and 300 metres in P2 and P3 areas. WHPZ do not extend outside PDWSA boundaries. Reservoir

protection zones (or '**prohibited zones**' as they are called in the by-laws) consist of a statutory 2 kilometre wide buffer area around the top water level of storage reservoirs in the Perth water supply area, and include the reservoir water-body. The reservoir protection zones (RPZ) apply over Crown land and prohibit public access to prevent contamination (physical, chemical and biological) of the source water. RPZ do not extend outside PDWSA boundaries. The DoE is currently considering a provision for RPZ buffer areas of less than 2 kilometres, and creation of consistent by-laws for country and Perth PDWSAs.

Special protection measures apply in WHPZ and RPZ (prohibited zones) as described in the By-laws under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* and the *Country Areas Water Supply Act 1947*.

The determination of priority classification areas or protection zones over land in a PDWSA is based on:

- the strategic importance of the land or water source,
- the local planning scheme zoning,
- form of land tenure, and
- existing approved land uses/activities.

The land use tables in this protection note directly apply to the three types of priority classification areas identified in DWSPP or agreed in specific *Land Use and Water Management Strategy* documents. Currently there are 45 DWSPPs available to guide land use planning decisions in PDWSAs, and (nearly 100) others are in development. In the absence of a DWSPP, the DOE recommends that planning decisions within any gazetted or proposed PDWSA are guided by DWSPA documents (where they exist) and the '**potential**' priority classification area or protection zone status of a proposal identified using **Diagram 1: Assessment of potential priority classification areas and protection zones** (overleaf).

Compatibility of land uses within PDWSAs

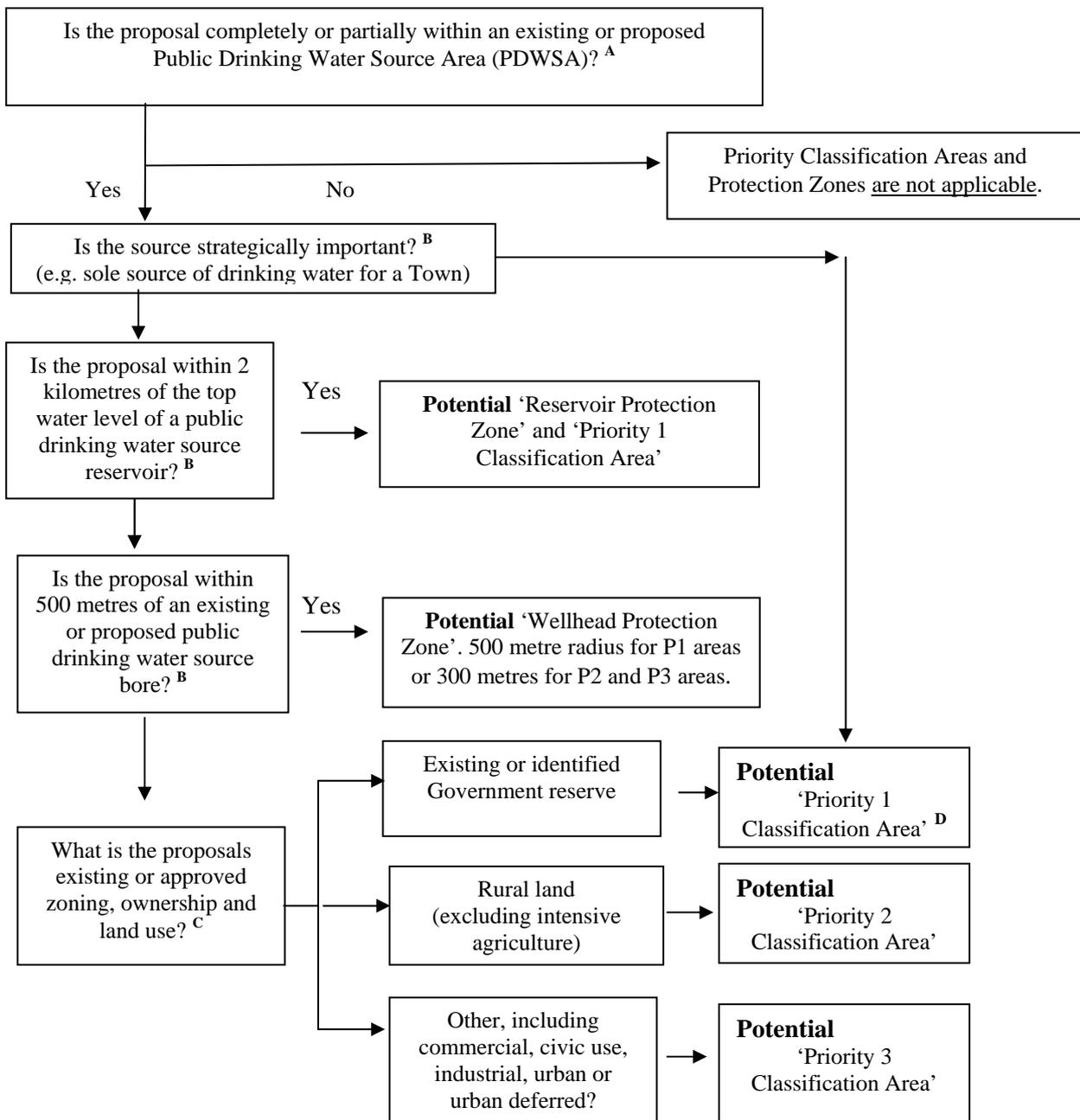
The tables in this note have been prepared for use by local governments, State planners and other agencies as a basis for regulating land use within PDWSAs. The note complements the Western Australian Planning Commission's *Statement of Planning Policy Number 2.7 (June 2003) Public Drinking Water Sources*. These tables define land uses in terms of their compatibility with the sustainable use of the drinking water source. They promote a priority for protection of the environmental value: 'drinking water' within a PDWSA over other values that may exist. The three definitions used are '**Incompatible**', '**Compatible with conditions**' and '**Acceptable**'. In previous versions of this note the definitions were 'Incompatible', 'Conditional' and 'Compatible'.

The DOE recognises that there may be special circumstances which may occasionally result in an '**Incompatible**' land use receiving approval. Where planning decisions result in this outcome it is important for project proponents to have demonstrated an overriding community benefit and that the land use will not increase the risk of contamination to the PDWSA. The DOE expects to have significant, early involvement in planning decisions of this nature to maximise the protection of the drinking water resource. It should be noted that where a water source is the sole supply for a community, or has a particularly high strategic value for the supply of drinking water, then it would be difficult to understand how that source might be put at any risk of contamination.

Detailed information on water quality protection issues and recommended best management practices for '**Compatible with conditions**' land uses are being developed in approved environmental policy, codes of practice, management guidelines and water quality protection notes. These documents, along with the most recent version of this note, can be found on the DOE Internet site <<http://www.environment.wa.gov.au>>. Information on land use and development regulation within PDWSAs can also be obtained from DOE's regional offices.

The DOE's Water Source Protection Branch, presently located in East Perth, is custodian of this water quality protection note and will provide detailed advice on its application and coordinate any suggested amendments.

Diagram 1: Assessment of potential priority classification areas and protection zones



Legend

- A. The location of PDWSAs can be found in DOE’s Drinking Water Source Protection Assessments and Plans or through your regional DOE office, Local Government office, Water Corporation or from the Department for Planning and Infrastructure.
- B. Strategically significant sources and potential contamination from land uses close to drinking water reservoirs or abstraction bores are considered first, due to these involving the highest risk of contamination reaching consumers.
- C. Current zoning or land use information is available from your Local Government office.
- D. Government land is protected to achieve the highest level of safety for drinking water in all parts of a catchment through a Priority 1 classification, wherever this is reasonable and practicable.

Existing approved land uses

Many land uses covered in this note may have been legally established prior to establishment/ gazettal of the PDWSA or modern protection measures being required. The DOE policy is that existing approved land uses/ activities can continue at their presently approved level, provided they operate lawfully. Where necessary, negotiations may be arranged with land owners to acquire property rights in P1 source protection areas. Where practical, this agency will also negotiate with the operators of existing 'Incompatible', or 'Compatible with conditions' activities to implement environmental management practices that minimise risks to water sources.

Proposed land uses

After reading this protection note, please view the DOE Internet site and/ or contact your nearest DOE Regional Office for advice on the location of PDWSAs, priority classification areas, and reservoir or wellhead protection zones. You may discuss with DoE staff any proposed land use activities that may affect water resources. The early identification of water resource protection issues in development stages of land use planning proposals is recommended in both the June 2003 *Statement of Planning Policy for Public Drinking Water Sources* and proposed *Water Resources Policy* by the Western Australian Planning Commission.

Definition of terms used in the following tables

'Acceptable' (equivalent to 'compatible' in previous version of this note)- means the land use is accepted by DoE as not likely to harm the drinking water source, and is consistent with the management objectives of that priority classification. The adoption of best practice environmental management methods for new proposals to protect water quality is expected. Existing land users are also encouraged to adopt best practice environmental management methods to help protect water quality. These land uses generally do not need referral to the DOE.

'Compatible with conditions' (equivalent to 'conditional' in previous version of this note) - means the land use is likely to be accepted by DoE as not likely to harm the drinking water source, (and is consistent with the management objectives of the priority classification) provided best environmental management practices are used. This may result in the application of 'specific conditions' (via the planning or environmental approval processes) that must be complied with to ensure the water quality objective of the priority area is maintained.

Land uses described as 'Compatible with conditions' need ONLY to be referred to DOE for assessment and a written response if the activity does not follow recommendations endorsed by DOE such as those made in policy, environmental management guidelines, protection notes; Ministerial Conditions, Works Approvals, Licenses or agreements (e.g. a 'Memorandum of Understanding' developed between any Local Government and DOE).

'Incompatible'- means the land use is UNACCEPTABLE to DOE as it does not meet the management objectives of the priority classification area. DOE will normally oppose approval of these land uses through the planning decision making process and under legislation administered by DOE. If planning decisions are made to approve these land uses (e.g. as a consequence of a planning appeals process), then DOE should be advised of that decision and have been directly involved in providing advice to the planning decision makers on water quality protection issues. It should be noted that contentious proposals may be referred to the EPA for Environmental Impact Assessment under the *Environmental Protection Act 1986*.

'Extensive'- means limited additional inputs beyond those supplied by nature are required to support the land use, e.g. for agriculture- animal feed supplements only during seasonal dry periods, or during the final preparation of stock for the market.

'Intensive'- means regular additional inputs are required to support the desired land use, e.g. for agriculture-irrigation, fertilisers, pesticides, or non-forage animal feeding dominates.

Interpretation of land use recommendations for planning schemes and development approvals

When using the following land use compatibility tables to guide planning schemes and development approval decisions, the following relationships should be used:

- a) Where the table identifies a land use as '**Acceptable**', this use is permitted by DOE within that priority classification area. It may be identified as a '**P**' (permitted) use in a scheme, providing the use complies with the relevant development standards and requirements of the planning scheme.
- b) Where the table identifies a use as '**Compatible with conditions**', this use should be a discretionary use within the priority classification area and should be identified as either a '**D**' or '**A**' (after special notice) use in the scheme. Proposals for '**Compatible with conditions**' uses should **ONLY** be referred to DOE for assessment and response if they do not meet existing agency policy, guidelines or protection note measures, unless prior agreement has been made between a specific local government and DOE on alternative measures.
- c) Relevant environmental management guidelines, codes of practice, water quality protection notes or agreements should be used in the first instance to define DOE's position on any land-use and limit the need to refer proposals to the DOE. Where these do not exist, site specific advice may be provided by the DOE.
- d) Where the table identifies a use as '**Incompatible**', that use should not be permitted within that priority source protection area, and should be identified as an '**X**' (unacceptable use) in the scheme.

Where the table does not include a proposed land use that could affect water quality, that use should be considered to be '**Incompatible**' until the proponent can demonstrate that it meets the drinking water quality protection objective of the designated priority classification area. Specific advice on the proposed land use should be obtained from the DOE's Water Source Protection Branch.

If the land use planning approval process supports a proposal that is inconsistent with this water quality protection note, then DOE Water Source Protection Branch should be advised of this situation and the reasons for that decision. This advice will trigger DOE's assessment of the significance/ consequence of that decision to the drinking water source and the outcome will be considered in future strategies for water quality protection, and in the periodic review and update of this note. A means to ensure the DOE's effective early involvement with such cases is currently being developed.

Tables defining compatibility of various land uses within PDWSA

It is important to note that this table provides the DOE's recommended compatibility of land uses for the current zoning of land. It must not be used to support rezoning of land to provide for more intensive land uses. For example, although P3 areas provide for high density urban development when the land is already zoned Urban or Urban deferred, this Table must not be read to justify a zoning change within P3 areas to allow for high density urbanisation of rural zoned land.

Model Scheme Text (MST) land uses are shown in **bold** in the first column. Definitions covered in the MST (see note 23) can also be found in the *Town Planning Amendment Regulations 1999*.

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Agriculture– extensive			
- pastoral leases	Compatible with conditions	Acceptable	Acceptable
- floriculture (non irrigated), stock grazing (excluding pastoral leases) and broad hectare cropping,	Incompatible	Compatible with conditions (see notes 11, 12)	Acceptable
Agriculture- intensive			
- aquaculture (fish, plants and crustaceans)	Incompatible	Compatible with conditions	Compatible with conditions
- orchards; production nurseries– potted plants; viticulture– wine and table grapes	Incompatible	Compatible with conditions	Acceptable
- floriculture; market gardens (see note 24); turf farms	Incompatible	Incompatible	Compatible with conditions
- hydroponic plant growing	Incompatible	Compatible with conditions	Compatible with conditions
- plant nurseries / garden centres	Incompatible	Compatible with conditions (see note 2)	Acceptable
Agro-forestry	Incompatible	Compatible with conditions	Acceptable
Amusement parlour	Incompatible	Incompatible	Acceptable (see note 1)
Animal establishment			
- animal saleyards and stockyards (see note 13)	Incompatible	Compatible with conditions (see note 2)	Compatible with conditions (see note 2)
- apiaries	Compatible with conditions	Acceptable	Acceptable
- catteries	Incompatible	Acceptable	Acceptable
- dairy sheds	Incompatible	Compatible with conditions (see notes 2, 3, 12)	Compatible with conditions (see note 3)
- dog kennels	Incompatible	Compatible with conditions	Compatible with conditions
- equestrian centres (see note 17)	Incompatible	Incompatible	Acceptable
- feedlots, intensive outdoor livestock holding	Incompatible	Incompatible	Compatible with conditions
- stables (see note 18)	Incompatible	Compatible with conditions	Acceptable
Animal husbandry- intensive			
- piggeries	Incompatible	Incompatible	Incompatible
- poultry farming - housed	Incompatible	Compatible with conditions	Compatible with conditions
Bed and breakfast (accommodating a maximum of 6 guests)	Compatible with conditions (see notes 6, 16)	Acceptable (see note 23)	Acceptable
- farm stay accommodation, rural chalets)	Compatible with conditions (see notes 6, 16)	Compatible with conditions (see note 4)	Acceptable
Betting agency	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Caravan park	Incompatible	Incompatible	Compatible with conditions (see note 1)
Caretakers dwelling	Compatible with conditions (see note 2)	Compatible with conditions	Acceptable

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Car park	Incompatible	Compatible with conditions (see note 2)	Acceptable
Cemeteries	Incompatible	Incompatible	Compatible with conditions
Child care premises	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Cinema/ theatre	Incompatible	Incompatible	Acceptable (see note 1)
Civic use	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Club premises			
- sporting or recreation clubs	Incompatible	Compatible with conditions	Acceptable (see note 1)
- health centres	Incompatible	Incompatible	Acceptable (see note 1)
Community purpose			
- community halls	Incompatible	Compatible with conditions (see note 2)	Acceptable
- irrigated golf courses or recreational parks	Incompatible	Incompatible	Compatible with conditions (see note 11)
- motor-sports (permanent racing facilities)	Incompatible	Incompatible	Compatible with conditions
- public swimming pools/ aquatic centres	Incompatible	Incompatible	Compatible with conditions
- rifle ranges	Incompatible	Compatible with conditions	Acceptable
Consulting rooms	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Convenience store	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Corrective institution	Incompatible	Incompatible	Compatible with conditions (see note 1)
Educational establishment			
- community education centres, scientific research institution	Compatible with conditions (see note 2)	Compatible with conditions (see note 2)	Acceptable (see note 1)
- primary / secondary schools, tertiary education facilities	Incompatible	Incompatible	Acceptable (see note 1)
Exhibition centre	Incompatible	Incompatible	Acceptable (see note 1)
Family day care	Incompatible	Acceptable (see note 19)	Acceptable (see note 1)
Fast food outlet	Incompatible	Incompatible	Acceptable (see note 1)
Forestry (native forest/ silviculture/ tree farming)	Compatible with conditions (see note 11)	Compatible with conditions (see note 11)	Acceptable
Fuel depot (storage/ transfer)	Incompatible	Incompatible	Compatible with conditions
Funeral parlour	Incompatible	Incompatible	Acceptable (see note 1)
Home business	Incompatible	Acceptable (see note 20)	Acceptable (see note 1)

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Home occupation	Compatible with conditions (see note 15)	Acceptable (see note 21)	Acceptable (see note 1)
Home office	Compatible with conditions (see note 15)	Acceptable	Acceptable
Home store	Incompatible	Compatible with conditions	Acceptable (see note 1)
Hospital	Incompatible	Incompatible	Compatible with conditions (see note 1)
Hotel (includes hotels, hostels, resorts)	Incompatible	Incompatible	Acceptable (see note 1)
Industry			
- abattoirs	Incompatible	Incompatible	Incompatible
- cottage	Compatible with conditions	Compatible with conditions	Acceptable
- drinking water treatment plant	Compatible with conditions	Compatible with conditions	Compatible with conditions
- extractive, includes construction/ mining camps (see note 10)	Compatible with conditions	Compatible with conditions	Compatible with conditions
- food processing, dairy product factories, breweries	Incompatible	Incompatible	Compatible with conditions (see note 1)
- general (chemical manufacture/ formulation, dry cleaners, dye works, laboratories, photo-processors)	Incompatible	Incompatible	Compatible with conditions (see note 1)
- general (metal production/ finishing, pesticide operator depots, heavy or energy industry, petroleum refineries)	Incompatible	Incompatible	Incompatible
- general (concrete batching, cement products, fertiliser manufacture/ bulk storage, wrecking)	Incompatible	Incompatible	Compatible with conditions
- general (mineral processing)	Incompatible	Incompatible	Compatible with conditions (see note 9)
- light industry	Incompatible	Incompatible	Compatible with conditions (see note 1)
- milk transfer depots	Incompatible	Incompatible	Compatible with conditions
- mining (includes mineral and energy exploration, oil or gas extraction / decontamination for transport)	Compatible with conditions (see note 9)	Compatible with conditions (see note 9)	Compatible with conditions (see note 9)
- mining (tailings dams)	Incompatible	Incompatible	Compatible with conditions (see note 9)
- mining (includes construction/ mining camps), (see note 10)	Compatible with conditions	Compatible with conditions	Compatible with conditions
- rural (animal product rendering works, tanneries, wool scours)	Incompatible	Incompatible	Incompatible
- rural (farm supply centres, manure stockpiling/ processing facilities)	Incompatible	Compatible with conditions (see note 2)	Compatible with conditions
- rural (forestry products processing– chip mills, pulp/ paper, timber preservation, wood/ fibre works, composting/ soil blending - commercial)	Incompatible	Incompatible	Compatible with conditions
- service industry	Incompatible	Incompatible	Compatible with conditions
Landfill (solid waste disposal)			
- class I (refer also to 'Storage - used tyres' advice)	Incompatible	Incompatible	Compatible with conditions
- class II or III	Incompatible	Incompatible	Incompatible
- class IV or V	Incompatible	Incompatible	Incompatible

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Lunch bar	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Major transport infrastructure (roads, railways)	Incompatible	Compatible with conditions (see note 14)	Acceptable
Marina (includes boat moorings and servicing)	Incompatible	Incompatible	Compatible with conditions
Marine filling station (boat fuelling)	Incompatible	Incompatible	Compatible with conditions
Market (food; general produce; second-hand goods)	Incompatible	Incompatible	Acceptable (see note 1)
Medical centre	Incompatible	Incompatible	Acceptable (see note 1)
Motel	Incompatible	Incompatible	Acceptable (see note 1)
Motor vehicle, boat or caravan sales (sales yards)	Incompatible	Incompatible	Acceptable (see note 1)
Motor vehicle repair	Incompatible	Incompatible	Compatible with conditions
Motor vehicle wash	Incompatible	Incompatible	Compatible with conditions
National and regional parks and nature reserves	Acceptable	Acceptable	Acceptable
Night club	Incompatible	Incompatible	Acceptable (see note 1)
Office	Incompatible	Compatible with conditions	Acceptable (see note 1)
Park home park	Incompatible	Incompatible	Compatible with conditions (see note 1)
Place of worship	Incompatible	Incompatible	Acceptable (see note 1)
Plantation	Compatible with conditions (see note 11)	Compatible with conditions (see note 11)	Acceptable
Reception centre	Incompatible	Incompatible	Acceptable (see note 1)
Recreation – private (within non-designated recreation areas on Crown land)	Incompatible	Incompatible	Acceptable
Residential building			
- house	Compatible with conditions (see note 16)	Acceptable (see note 4)	Acceptable (see note 1)
- group dwellings (aged and dependent persons)	Incompatible	Incompatible	Acceptable (see note 1)
Restaurant	Incompatible	Incompatible	Acceptable (see note 1)
Restricted premises (adult interests)	Incompatible	Incompatible	Acceptable (see note 1)
Rural pursuit	See Agriculture, Animal establishment or husbandry		
Service station (includes aircraft, automotive repairs, boats, mechanical plant, service stations at transport and municipal works depots)	Incompatible	Incompatible	Compatible with conditions (refer to note 1)
Shop	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Showroom	Incompatible	Incompatible	Acceptable (see note 1)

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Storage			
- used tyres (see note 22)	Incompatible	Incompatible	Incompatible
- chemical storage in under ground tanks	Incompatible	Incompatible	Compatible with conditions
- chemical storage in above ground tanks	Incompatible	Compatible with conditions	Compatible with conditions
Tavern	Incompatible	Incompatible	Acceptable (see note 1)
Telecommunications infrastructure	Compatible with conditions	Compatible with conditions	Compatible with conditions
Toilet blocks and change rooms	Compatible with conditions (see note 2)	Compatible with conditions	Acceptable
Trade display	Incompatible	Incompatible	Acceptable (see note 1)
Veterinary centre	Incompatible	Compatible with conditions (see note 2)	Compatible with conditions (see note 1)
Warehouse	Incompatible	Compatible with conditions (see note 2)	Compatible with conditions (see note 1)
Waste transfer station (includes recycling depots)	Incompatible	Incompatible	Compatible with conditions
Wastewater infrastructure			
- sewerage – gravity sewers	Incompatible	Incompatible	Acceptable
- sewerage – pressure mains	Incompatible	Compatible with conditions	Acceptable
- sewer pump stations	Incompatible	Compatible with conditions	Compatible with conditions
- treatment plants, wastewater disposal to land	Incompatible	Incompatible	Compatible with conditions
- wastewater injection into the ground (see note 25)	Incompatible	Incompatible	Incompatible
Water treatment plants (drinking)	See Industry		
Winery (includes wine tasting facilities)	Incompatible	Compatible with conditions (see notes 3 & 5)	Compatible with conditions (see note 3)

Table recommending compatibility of land subdivision within PDWSA: Note - This table reflects the recommended size of a subdivision based on the existing zoning and the priority classification area status of land. It should be noted that Town Planning Scheme provisions for specific zones and reserves will take precedent over the following recommended lot sizes.

Form of subdivision (specific to current zoning)	P1 areas	P2 areas	P3 areas
Rural subdivision			
- to a lot size of 4 hectares or greater	Incompatible	Acceptable	Acceptable
- to a lot size less than 4 hectares	Incompatible	Incompatible	Incompatible
Special rural subdivision			
- to a lot size of 2 hectares or greater	Incompatible	Compatible with conditions (see notes 7 & 8)	Compatible with conditions (see note 8)
- to a lot size between 1 and 2 hectares	Incompatible	Incompatible	Compatible with conditions (see notes 7 & 8)
- to a lot size less than 1 hectare	Incompatible	Incompatible	Compatible with conditions (see note 7)
Urban subdivision	Incompatible	Incompatible	Acceptable (see note 1)
Industrial subdivision	Incompatible	Incompatible	Acceptable (see note 1)

Explanatory notes related to land uses described the tables:

The following notes provide interpretive information based on the scale or type of development described in the preceding tables. They do not list all the conditions that could apply to any activity or development.

1. Must be connected to deep sewerage, except where exemptions apply under State Government Sewerage Policy. The Policy recognises that sewer connection may be impractical in some areas. Under these circumstances maximum wastewater loadings (based on people/ hectare) apply linked to the management Priority of the site.
2. The land use is normally incompatible, but may be conditionally approved where this facility is consistent with approved State and local government planning strategies or schemes.
3. The land use must incorporate best environmental management practices compatible with the management strategy for the designated priority area defined in the relevant source protection plan.
4. In Priority 2 areas: conditions may apply to density of dwellings (i.e. hectares per dwelling).
5. Size of the grape crush shall not exceed 500 tonnes per year.
6. May be approved if occupancy is of equivalent size to a single dwelling household (i.e. less than 10 people– defined by capacity of a septic tank based on-site wastewater treatment system).
7. An average, rather than minimum, lot size may be accepted if the proponent can demonstrate that the water quality objectives of the source protection area are met, and caveats/memorials are placed on titles of specified blocks stating that further subdivision shall not occur.
8. Lots should only be created where land capability assessment shows that effective on-site soakage of treated wastewater can be achieved. 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 Department of Health, may be accepted with ongoing maintenance requirements.
9. Conditions are likely to be placed via a Department of Industry and Resources mineral tenement lease, and / or as a result of Minister for the Environment's approval after an Environmental Impact Assessment.
10. Conditions apply to the storage of fuels and chemicals, the depth of excavation related to the water table and rehabilitation criteria. Underground fuel or chemical storage tanks are prohibited via DOE by-laws in Priority 1 and 2 areas within Underground Water Pollution Control Areas.
11. Conditions apply to regulate fertiliser and pesticide application.
12. Can be approved if animal stocking levels (animals per hectare, guided by the Department of Agriculture's stocking rate guidelines) are consistent with the priority source protection area objectives.
13. This does not include stockyards occasionally used on farms or pastoral leases for animal husbandry.
14. Conditions may be imposed to cover design, construction of infrastructure and the types of goods.
15. May only be approved if *Home Occupation* relates to an existing residence.
16. Limited to one residential building per property.
17. Includes land or buildings dominantly used for the showing, competition or training of horses, and riding schools.
18. Includes any land, building or structure used for equine (e.g. horses, asses, mules and donkeys) housing, keeping and feeding and associated activities.
19. In accordance with *Community Services (Child Care) Regulations 1988: A child care service provided to a child in a private dwelling in a family of or domestic environment. No more than 5 children of pre-school age and no more than 7 children under 12 years old, including the children of the licensee or permit holder.*

20. No more than 2 employees, and the home business occupies an area up to 50 square metres. Compatible if only an office/ administrative business (i.e. overnight parking of only one commercial vehicle, no refuelling or repair/ maintenance of business vehicles, and no activities involving on-site use storage or disposal of chemicals or process wastewater).
21. Employees shall be members of the household, and the home business occupies an area of up to 20 square metres. No provision for refuelling, repair or maintenance of commercial/ business vehicles or on-site use or storage of chemicals.
22. Used tyre use, storage and disposal are subject to *Used Tyre Regulations 1996*, administered by this agency.
23. As defined in the *Model Scheme Text (1997)* or the *Residential Design Codes of Western Australia (2002)* prepared by the Western Australian Planning Commission, and covering local government planning schemes.
24. Applies to the commercial production of horticultural crops e.g. vegetables, flowers and fruit crops grown in contact with the ground. Does not apply to cereal or oil seed crops, perennials e.g. orchards, vineyards, nuts; or any crop grown separate from contact with soils in the natural environment e.g. hydroponics.
25. The use of recycled (reclaimed) water to address the diminishing level of scheme water supply in Western Australia is currently being investigated by Government. The social, environmental, health and economic issues related to this option are significant and need to be further progressed before its applicability in PDWSA is reconsidered.

More information or feedback

More information about recommended best management practices is available in Environmental Management Guidelines and Water Quality Protection Notes for some of the listed land uses. These are available on DOE's Internet site <<http://www.environment.wa.gov.au>> or by contacting DOE regional offices.

We welcome your comments on this note. The note will be updated from time to time as feedback is received or land-use activity standards change. If you wish to discuss this note, please contact DOE Water Source Protection Branch at the Hyatt Centre in East Perth. Phone: (08) 9278 0300 (business hours); Fax: (08) 9278 0585; or E-mail: use {feedback} section at DOE Internet address <<http://www.environment.wa.gov.au>>, citing the topic and version.



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Appendix 2 Water Quality

The Water Corporation has monitored water quality from Denmark Reservoir in accordance with Australian Drinking Water Guidelines (ADWG) and interpretations agreed to with the Department of Health (DoH). Drinking water criteria that have been monitored together with ADWG health and aesthetic guideline values are available from the Water Corporation on request. Water from this source is chlorinated prior to supply to users.

MICROBIOLOGICAL CONTAMINANTS

Microbiological testing of the raw water from Denmark Reservoir has been conducted on a monthly basis since March 2002. Thermotolerant coliform counts are used as an indicator of the degree of faecal contamination of the raw water from warm-blooded animals. A count less than 20 colony forming units (cfu) per 100 mL is typically associated with low levels of faecal contamination and is used as a microbiological contamination benchmark (WHO, 1996).

Thermotolerant coliform counts were recorded in all raw water samples from Denmark Reservoir. All of these samples had thermotolerant coliform counts greater than 20 cfu per 100 mL, with the highest recorded value being 450 cfu per 100 mL. Further investigation into the high E Coli counts and potential sources of contamination is required to determine need for additional catchment management barriers.

Raw water is treated at Denmark Water Treatment Plant where it undergoes sedimentation, clarification and filtration to reduce colour, iron, aluminium and turbidity. It is blended on-site with treated Quickup Reservoir water and disinfected with chlorine to ensure the microbiological quality of the drinking water supplied to consumers.

HEALTH RELATED CHEMICAL WATER QUALITY DATA

Raw water from Denmark Reservoir is analysed for health related chemicals. Health related chemicals include inorganics, heavy metals, industrial hydrocarbons and pesticides. Health related water quality parameters that have been measured at detectable levels in the sources between January 1999 and May 2004 are summarised in the following table. All values are in milligrams per litre (mg/L).

Parameter	Range of Monitored Values	ADWG Health Value*
	Min-Max Median	
Denmark Reservoir		
Metals		
Barium	0.017 - 0.054 0.025	0.7 mg/L
Boron	0.02 – 0.1 0.05	4 mg/L
Inorganics		
Fluoride	0.1 – 0.25 0.125	1.0 mg/L
Nitrite + nitrate (N)	0.019 – 0.21 0.16	11.3 mg/L

*A health guideline value is the concentration or measure of a water quality characteristic that, based on present knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption.

Barium and boron have been detected in Denmark Reservoir, but at concentrations well below ADWG.

All health related water quality parameters measured at Denmark Reservoir did not exceed health guideline values and therefore present no significant health risk. These parameters will continue to be routinely monitored.

AESTHETIC WATER QUALITY DATA

Aesthetic water quality analyses for raw water from Denmark Reservoir are summarised in the following table. The values are taken from ongoing raw water monitoring for the period January 1999 to May 2004. All values are in milligrams per litre (mg/L) unless stated otherwise. The water quality parameters that have on occasion exceeded the ADWG aesthetic guideline for supplied drinking water are shaded.

Parameter	Range of Monitored Values	ADWG Aesthetic Value
	Min-Max Median	
Denmark Reservoir		
Salinity (TDS)	540 – 953 798	1 000 mg/L
Hardness (CaCO ₃)	110 – 192 166	200 mg/L
Turbidity	1.6 – 14 6.3	5 NTU
pH	6.2 – 7.2 6.7	6.5-8.5
Colour	40 – 200 110	15 TCU
Iron (unfiltered)	0.6 – 3.8 1.9	0.3 mg/L
Manganese (unfiltered)	0.015 – 0.4 0.095	0.1 mg/L
Aluminium (unfiltered)	0.032 – 1.1 0.18	0.2 mg/L

Appendix 3

Examples of Protection Strategies (Used in existing Drinking Water Source Protection Plans)

Activity	Recommended Protection Strategies
<i>State owned (public) Land (PI source protection)</i>	
Reserves State Forest Unallocated	<p><i>Acceptable with best management practices</i></p> <ul style="list-style-type: none"> Encourage government agency that manages the land to include provisions for water quality protection. Review agency management plans regularly to ensure water quality protection objectives met. Inspect protection measures on-site.
Timber Production (State Forest)	<p><i>Acceptable with best management practices</i></p> <ul style="list-style-type: none"> Ensure compliance with the Contractor's Timber Harvesting Manual for water quality protection. Review 1 year and 5 year harvesting plans to ensure water quality protection objectives are met. Inspect protection measures on-site.
Apiarists Wildflower picking Seed collection Firewood collection	<p><i>Acceptable activity with conditions</i></p> <ul style="list-style-type: none"> Activities to be restricted to outside proposed RPZ and away from feeder streams. Apply conditions for Apiarists, Wildflower Picking and Seed collection that meet water quality protection objectives. Promote casual firewood collection areas outside catchment area. Firewood collection is not authorised in vested Reserves.
Roads	<p><i>Acceptable with best management practices</i></p> <ul style="list-style-type: none"> Review road maintenance practices and develop a plan to minimise risk to water quality. Conduct risk assessment survey for transport of fuel and chemicals. Place signs along road with an emergency contact number for spills. Construct sumps at major stream crossings. Ensure emergency response process is in place and local emergency management advisory committee is aware of management requirements for drinking water catchment.
Off-road vehicle use	<p><i>Unacceptable activity</i></p> <ul style="list-style-type: none"> Remove site as a destination in CALM "4WD Days Out of Perth" publication. Recognise activity in regional recreation plan and look at alternative sites. Encourage involvement in organised events. Use signage to promote awareness that off-road driving is not permitted. Undertake surveillance to control off-road driving in the catchment.
Bushwalking	<p><i>Acceptable activity with conditions</i></p> <ul style="list-style-type: none"> Ensure trails outside RPZ, away from streams feeding into reservoir, and cross-streams where culverts and / or bridges are established. Compliance with the Department of Environment's Policy and Guidelines for Recreation within Public Drinking Water Source Areas on Crown Land (Recreation Policy), available via www.wrc.wa.gov.au/protect/policy/policy.htm. Promote bushwalking opportunities as part of a regional recreational plan. Use signage as education tool. Undertake surveillance. Require organised groups to obtain approval for events
Picnicking	<p><i>Acceptable activity with conditions</i></p> <ul style="list-style-type: none"> Locate picnic sites outside the proposed RPZ. Promote use of controlled picnic away from watercourses. Promote picnicking opportunities as part of a regional recreational plan. Prohibit dogs through education/signs, promotional material and surveillance. Compliance with DoE's Recreation Policy available via www.wrc.wa.gov.au/protect/policy/policy.htm.
Horse riding events	<p><i>Acceptable with Best Management Practices</i></p> <ul style="list-style-type: none"> An environmental management plan developed for each event, addressing water quality protection measures. Approval for each event subject to implementation and review of plan. Camping will be restricted to specific sites as developed in regional recreation plan. All events to be staged on roads and trails. Stream crossings to be on made roads at culverts or bridges. Monitor existing events to identify water quality risks to be addressed in the environmental management plan. No new events to operate in the catchment. Refer to Environmental Guidelines for Horse Facilities and Activities, available via www.wrc.wa.gov.au/protect/policy/guidelines.htm<http://www.wrc.wa.gov.au/protect/policy/guidelines.htm>

Activity	Recommended Protection Strategies
Hunting	<p><i>Unacceptable activity</i></p> <ul style="list-style-type: none"> • Catchment to be closed to hunting through the CAWS Act and MWSSDB 1909 By-Laws. • Place signs throughout catchment indicating uncontrolled hunting is illegal. • Undertake surveillance of the catchment. • Control feral animal through managed program.
Swimming	<p><i>Unacceptable activity</i></p> <ul style="list-style-type: none"> • Make public aware that swimming is prohibited under the CAWS Act By-laws. • Signs in the catchment • Undertake surveillance & by-law enforcement. • Compliance with DoE's Recreation Policy, available via www.wrc.wa.gov.au/protect/policy/policy.htm.
Fishing Marroning	<p><i>Unacceptable activity</i></p> <ul style="list-style-type: none"> • Make public aware that fishing and marroning is prohibited under the CAWS Act By-laws. • Place signs throughout catchment indicating fishing and marroning is not permitted. • Undertake surveillance & by-law enforcement. • Signs in the catchment • Compliance with DoE's Recreation Policy, available via www.wrc.wa.gov.au/protect/policy/policy.htm.
Boating	<p><i>Unacceptable activity</i></p> <ul style="list-style-type: none"> • Make public aware that boating is prohibited under the CAWS Act By-laws. • Undertake surveillance & by-law enforcement. • Signs in the catchment • Compliance with the DoE's Recreation Policy available via www.wrc.wa.gov.au/protect/policy/policy.htm.
Motor vehicle rallies Including: Rally Australia Motor bike events	<p><i>Acceptable with best management practices</i></p> <ul style="list-style-type: none"> • No new rallies to operate in the catchment. • An environmental management plan developed for each event, addressing water quality protection measures. Approval for each event subject to implementation and review of plan. Compliance with DoE's Recreation Policy available via www.wrc.wa.gov.au/protect/policy/policy.htm.
Military activities	<p><i>Acceptable activity with conditions</i></p> <ul style="list-style-type: none"> • Restrict military training to outside of the RPZ. • Ensure approval for military activities contains conditions for water quality protection. • Undertake discussions with military to investigate the use of alternative areas. • Undertake surveillance to ensure compliance with approval.
Water supply construction	<p><i>Acceptable with Best Management Practices</i></p> <ul style="list-style-type: none"> • Ensure water quality risk addressed in EMP. • Work with contractors on-site and advice on issues related to water quality protection. • Monitor turbidity and undertake remediation if monitoring shows adverse impact.
Private Land (P1 source protection)	
	<p><i>Long term goal of crown ownership of private land</i></p> <ul style="list-style-type: none"> • Landowners can continue current activities with best practices being encouraged (refer to Quality Protection information. www.wrc.wa.gov.au/protect/policy/WQPN.htm.) • Oppose intensification of land uses through planning approval process. • Offer landowners opportunity to sell or swap their land. Purchased land to become Crown Reserve and re-vegetated. Long-term Crown ownership is preferable
Private Land - Rural (P2 source protection)	
Cropping and grazing Tree farming Viticulture	<p><i>Acceptable with best management practices</i></p> <ul style="list-style-type: none"> • Landowners continue current activities with best practices being encouraged (refer to Quality Protection information www.wrc.wa.gov.au/protect/policy/WQPN.htm.) • Ensure Town Planning Scheme adequately controls development. • Oppose intensification of land uses through planning approval process. • Promote water quality protection.

Activity	Recommended Protection Strategies
Land clearing for broadacre farming in Clearing Control Catchments	<p><i>Manage as non-conforming land use</i></p> <ul style="list-style-type: none"> • Landowner can continue current activities (consistent with <i>Environmental Protection Act 1986</i> and <i>Country Area Water Supply Act 1947</i> approvals), with best management practices being encouraged • Continue to support changes in land use within existing approvals that reduce salinisation. • Oppose intensification of land uses through planning approval process. • Continue re-vegetation initiatives under clearing control legislation. Land transferred to Crown ownership to be re-vegetated.
Rural residential	<p><i>Maintain existing planning controls</i></p> <ul style="list-style-type: none"> • Ensure the Special Provisions for the Rural Residential Zone control development. • Encourage landowners to adopt best management practices for permitted activities (refer to Quality Protection information www.wrc.wa.gov.au/protect/policy/WQPN.htm). • Oppose intensification of land use through planning approval process. • Support changes within existing approvals that reduce groundwater contamination risks. • Encourage connection to deep sewerage through planning approval process. • Promote water quality protection.
Rural development Including: Special rural zones Rural retreats Hobby farms Cottage industries Chalets Bed and breakfasts and farmstays	<p><i>Conditional with best management practices</i></p> <ul style="list-style-type: none"> • Landowners can continue current activities with best practices being encouraged (refer to Quality Protection information www.wrc.wa.gov.au/protect/policy). • Ensure Town Planning Scheme adequately controls development. • Oppose intensification of land uses through planning approval process.
Private Land - (P3 source protection)	
	<p><i>Acceptable with controls</i></p> <ul style="list-style-type: none"> • Landowners can continue current activities, with best practices being encouraged (refer to Quality Protection information www.wrc.wa.gov.au/protect/policy/WQPN.htm and www.wrc.wa.gov.au/protect/policy/guidelines.htm) • Ensure Town Planning Scheme adequately controls development. • Further subdivision and land use to be consistent with water quality objectives. • Oppose incompatible land uses through planning approval process. • Encourage connection to deep sewerage through planning approval process.
Power stations	<p><i>Manage as non-conforming land use</i></p> <ul style="list-style-type: none"> • Landowner can continue current activities, with best management practices being encouraged. • Support changes in land use within existing approvals that reduce groundwater contamination risks.
Disused depots Including: Water Corporation Western Power Shire	<p><i>Unacceptable in current condition</i></p> <ul style="list-style-type: none"> • Remove all infrastructure and contaminant threats including septic system and decontaminate site. • Return site to natural bushland.
Rubbish disposal	<p><i>Unacceptable activity</i></p> <ul style="list-style-type: none"> • Encourage local council to close site and undertake remediation to decontaminate site. • Return site to natural bushland.
Horticulture	<p><i>Maintain existing planning controls</i></p> <ul style="list-style-type: none"> • Landowners can continue current activities with best management practices being encouraged (refer to environmental guidelines for horticulture and/or viticulture via www.wrc.wa.gov.au/protect/policy/guidelines.htm). • Oppose intensification of land use through planning approval process. • Support changes in land use within existing approvals that reduce groundwater contamination risks.
Residential	<p><i>Acceptable activity with controls</i></p> <ul style="list-style-type: none"> • Ensure Town Planning Scheme adequately controls development (refer to Quality Protection information www.wrc.wa.gov.au/protect/policy). • Encourage connection to deep sewerage through planning approval process. • Further subdivision to be consistent with Draft Country Sewerage Policy 2003. • Promote water quality protection.

Activity	Recommended Protection Strategies
Industrial and commercial sites.	<p data-bbox="485 210 807 232"><i>Acceptable activity with controls</i></p> <ul data-bbox="485 241 1430 403" style="list-style-type: none"> <li data-bbox="485 241 1430 315">• Landowner can continue current activities. They are also encouraged to upgrade existing facilities to meet DoE recommendations (refer to Quality Protection information www.wrc.wa.gov.au/protect/policy). <li data-bbox="485 324 1430 376">• Oppose intensification of land use through planning approval process (eg those activities not acceptable in P3 areas). <li data-bbox="485 385 1430 403">• Support changes in land use within existing approvals that reduce contamination risks.

Appendix 4

DoE WQPN Overview on protecting Public Drinking Water Source Areas

Note WQPN subject to change. Refer to the DoE website <http://www.wrc.wa.gov.au/protect/policy/WQPN.htm> for latest version.

Water Quality Protection Note

Overview on protecting Public Drinking Water Source Areas

Introduction

This agency is the custodian of all of the State's water resources. Our role is to ensure the State's water resources are managed to support sustainable development and conservation of the environment for the long-term benefit of the community.

Next to food, water is the most essential element for life, and our aim is to protect Public Drinking Water Source Areas (PDWSA) so that they consistently contain high quality water. This should yield reliably 'safe, good quality drinking water' to protect public health for now and into the future at a reasonable cost to consumers.

This note provides an overview of the present strategy used to protect public drinking water supply sources in Western Australia. The former State Government agencies the *Department of Environmental Protection* and *Water and Rivers Commission* are presently being combined to form the *Department of Environment*. This process will not be complete until enabling legislation has been passed by Parliament and proclaimed. This note aims to present a generic 'combined agency' position on the nominated topic.

Who is involved in protecting our drinking water supplies?

Responsibility for the condition (quality) and availability (quantity) of our drinking water must be shared by the community, land owners/developers, industry, agriculture, local government, water service providers and the State government. All of these groups play a significant role in the development of Drinking Water Source Protection Plans (DWSPP) for PDWSAs (also called drinking water catchments in this note). They also may be involved in the implementation of the recommendations in those plans. Their direct and ongoing involvement in the protection of our drinking water catchments is essential to achieve a successful outcome.

The Department of Environment (DOE), is primarily responsible for defining, proclaiming and protecting the catchments of Public Drinking Water Source Areas (PDWSAs). The PDWSAs are made up of any area proclaimed to protect public drinking water source catchments. These areas are proclaimed as Water Reserves, Catchment Areas or Underground Water Pollution Control Areas under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, and Water Reserves or Catchment Areas under the *Country Areas Water Supply Act 1947*.

The DOE has responsibility to administer the State's catchment protection legislation. This administration includes:

- undertaking and facilitating effective by-law enforcement and catchment surveillance;
- the assessment and permitting of land use developments or activities;
- negotiating protection mechanisms in the land use planning process; and
- advising on the compatibility of land development and use activities.

The DOE also has responsibility for preparing policies and guidelines, drinking water source protection assessments and plans and advising other decision-making agencies on source protection requirements. The Department promotes a coordinated approach to catchment protection encompassing a variety of related measures including regional and local land use planning; health; and environmental legislation.

Where public health is concerned, the Department of Health has primary responsibility. The Department of Health's role is to minimise human exposure to environmental health hazards that pose or have the potential to pose a health risk and to reduce the incidents and impact of communicable disease. To safeguard against unhealthy drinking water, the Department of Health works closely with the DOE and individual Water Service Providers. The Department of Health also chairs an inter-agency committee, called the "*Advisory Committee for the Purity of Water*", established in 1925 and charged with the ongoing responsibility of advising the State on drinking water protection issues. The Office of Water Regulation is another government agency with a key role in regulating drinking water supply issues. It issues licences to individual Water Service Providers such as the Water Corporation, Aqwest (Bunbury) and Busselton Water Board.

The Water Corporation is the largest Water Service Provider in WA, and it was formed in the mid 1990's after the split of the former Water Authority of Western Australia as part of the COAG Water Industry Reform initiatives. The Corporation is the major licensed Water Service Provider in Western Australia, supplying the Perth metropolitan area as well as a further 230 towns across the State. It is a corporation, with the state government being the sole shareholder, and is subject to corporation law. It is managed by a board of directors including the Managing Director (its CEO). The Corporation is required to return a dividend on the Government's investment in the Corporation's assets and in return receives Customer Service Obligation (CSO) payments to subsidise uneconomic services that are required to be provided by the Government. The Corporation also pays federal tax equivalents to the State Government in accordance with the COAG reform agreement.

Source Protection Operational Agreements exist between the DOE and the Water Corporation, which assign roles in catchment protection, clarify responsibilities in catchment protection and ensure the process is carried out effectively. Under the legislation, the DOE may delegate certain catchment management functions to the Water Corporation (or other water service providers). Delegation is appropriate as the Corporation has a strong vested interest in assuring high quality drinking water from the catchments and is also prepared to resource catchment management functions. Currently, delegated functions relate to catchment surveillance, enforcing by-laws regarding transient catchment activities, entry onto land and catchment management planning. The extent of delegated responsibilities may vary between catchments.

Why should we protect our drinking water supplies?

Drinking water should be safe to drink and aesthetically pleasing. Ideally, it should be clear, colourless, pleasant tasting and contain no harmful chemicals or disease-causing microbes. To keep drinking water clean it is important to protect both our surface and underground drinking water sources (e.g. surface dams and groundwater) and the catchments in which they are located.

This advice deals with the water consumed in homes and provided by licensed Water Service Providers (often referred to as 'scheme' supplies). These WSP are responsible for water treatment (including disinfection) and distribution services to the community. Advice on alternative (potentially less safe) drinking water sources, such as private bores or rainwater tanks, is available in other documents. As a rule neither the Department of Health or DOE recommend the use of rainwater or private bore water for drinking water purposes where a scheme water source is available. This is because the catchments of these other sources are generally not protected from contamination and they are not analysed or treated to meet the relevant health guidelines for drinking water. Such sources can however be useful for non-potable uses such as in washing machines, toilets or for gardens. If a scheme supply is not available, then it is important that the consumer implements the necessary measures to ensure their drinking water source is safe to drink (i.e. arrange water analyses and treatment as required).

In the mid 1990's, the Council of Australian Government reforms process took an initiative to pursue the sustainable use of water resources by protecting and enhancing their quality, while maintaining economic and social development. This was achieved through the development of a National Water Quality Management Strategy (NWQMS) presently comprising 21 national guideline documents. Two of these focused on drinking water, the *Australian Drinking Water Guidelines-Summary* and the *Australian Drinking Water Guidelines*, 1996 (an update of the 1987 *Guidelines for Drinking Water Quality in Australia*).

The *Australian Drinking Water Guidelines, 1996* (ADWG) recognised water source protection through catchment management as an effective approach to preventing contamination of drinking water sources and undertook to investigate this issue further.

In May 2001, Western Australia supported the NWQMS (including the ADWG) through the launch of its own State Water Quality Management Strategy (SWQMS). In late 2002, the ADWG were updated and released for public comment. The ADWG 2003 have now been finalised and are planned to be released in late 2003. A 'consumer guide' to the ADWG 2003 called *Water made clear* has also been developed to raise awareness of the need to protect drinking water catchments from 'catchment to consumer'.

Roughly half of Perth's water supplies come from surface sources with the remainder harvested from groundwater. In 1994, a Parliamentary Select Committee reported on the issue of Perth's development and groundwater supplies. The Select Committee considered experience from around the world and overwhelmingly concluded, "*an ounce of prevention is worth a pound of cure*". In his foreword, the chairman of the Select Committee noted: "***experts around the world expressed their envy of our relatively pristine water supply and advised us to protect our groundwater supply at all costs***".

In 2000, the State Legislative Council's *Standing Committee on Ecologically Sustainable Development in relation to the Quality of Perth's Water Supply* expressed confidence in the system managing and operating Perth's water supply. The Standing Committee noted, however, that various activities posed a contamination risk to water supplies. It found as a "***first priority that water sources be protected through good land use planning. It also noted that "Using treatment to deal with contamination is a second-best option. The Committee found support for adopting catchment protection as the major weapon in preventing contamination of water supplies"***". In November 2001, in support of this finding, the Western Australian Planning Commission (in consultation with the Water and Rivers Commission) released a *Public Drinking Water Source Policy* for public comment. The Policy was gazetted in June 2003. This policy will guide State and Local Government land use planning decisions in public drinking water catchments.

Although the above committees were reporting on Perth's water supplies, their findings apply to all public drinking water sources in Western Australia. This is especially true when a community is reliant upon a single drinking water resource (such as the groundwater bore network in Kununurra or surface water dam in Quinninup) rather than an integrated series of sources (such as those that supply Perth). Contamination of a single resource from inappropriate land use planning or polluting activities within the catchment can have significant health and economic impacts, which should be avoided.

In February 2003, the Western Australian Government released its State-wide water strategy. Although prepared in response to a number of forums around State focusing on drought, it did however make a significant statement about protecting our public drinking water sources. It stated unequivocally that ***recognition of the primacy of water quality in the management of drinking water catchments, to protect the long term sustainability of the resource, will be used to guide catchment management decisions.***

This is interpreted to mean, when managing and protecting any public drinking water source catchment, the dominant consideration must be maintenance of water resource quality and the prevention of contamination risk. This objective in most cases may prevent or constrain further land development.

More recently in September 2003, the Western Australian Government also released its State-sustainability strategy document – "Hope for the future". Drinking water catchments are now recognised as important 'natural resources' together with the other more common natural resources (eg. agriculture, fisheries, forestry, mining, tourism, aquatic systems, coastal and marine environments and rangelands). The 'Vision' in the Strategy is that "Drinking water sources are fully protected for future generations.". The Strategy lists the following 'Actions': (number 3.48) that we "Work to ensure all present and future drinking water sources are protected."; and (number 3.51) that we "Ensure the activities in catchments are actively managed and sustainable..." through "...investigation of the impact of active catchment management strategies that enhance water quality and quantity outcomes...".

What are we protecting the drinking water supplies from?

Land use planning decisions and recreational or business activities occurring in drinking water catchments can impact on the quality and quantity of drinking water. Where catchments remain covered with native vegetation with little human activity, the risk of contamination is low. However, contamination risks increase with increased human activity.

Potential contaminants may include:

- physical contaminants e.g. colour, foaming agents and suspended solids;
- chemical contaminants e.g. salts, heavy metals and poisons; or
- microbiological contaminants e.g. bacteria, protozoa and pathogenic viruses.

Although many contaminants can be removed by treatment processes, such treatment increases the cost of the water supply, and continuous effective removal of all contaminants is not considered technically or economically feasible. If contamination does occur, the opportunity to locate and develop a replacement source is often limited, and the provision of alternatives, e.g. bottled drinking water, is costly and can only be considered a short-term solution. Stopping contamination before it occurs prevents the need for costly treatment or the development of often more costly alternative sources. It should also be appreciated that there is a substantial ongoing financial cost to be borne in sampling and testing for contaminants if they become prevalent in drinking water sources. The benefits (environmental, social and economic) of avoiding contamination through best management decisions and practices are recognised in the ADWG 2003.

Clearly drinking water quality and safety cannot be taken for granted. Appropriate State and Local Government controls are required in consultation with, and the support of the community and other stakeholders. These controls are needed to manage a number of threats to drinking water areas, including inappropriate:

- land use planning processes and decisions resulting in high risk developments in catchments;
- recreational activities where the impact of human wastes and damage to natural protective measures associated with higher intensity land use is often underestimated; and
- use and/or disposal of chemicals, animal and domestic wastes and pesticides.

We should also appreciate that beyond the actual catchment and water storage area, drinking water that is not properly treated, or which travels through an inadequately maintained distribution system, also poses a serious public health risk.

Several recent events that have occurred nationally and internationally that highlight the importance of protecting drinking water, especially at the source.

The main finding of an inquiry into the well-publicised Sydney Water Crisis in 1998 was that the catchments were seriously compromised by many possible sources of contamination, and that there was insufficient regulatory control to guarantee safe drinking water. The Sydney Water Catchment Authority was set up in response to this event which transferred responsibility for land use decisions within the catchment from the Planning Authority to the new catchment Authority.

In Walkerton (Canada), in 2000 a drinking water catchment related tragedy unfolded where a pathogenic E-coli outbreak resulted in over 2300 cases of illness amongst 4,800 residents, 70 people were hospitalised and 7 deaths were attributed to the outbreak. A judicial inquiry concluded that the likely initial cause of the outbreak was from manure application on farmland (a common practice even in WA) that resulted in bacterial contamination finding its way into the shallow underground water-body which was used to supply drinking water. Other contributing factors to the outbreak included a high rainfall event just prior to the contamination outbreak, and an inadequate disinfectant dose rate and monitoring issues related to the distribution system. It is important to appreciate that the drinking water system at Walkerton operated for more than 8 years without major incident up until the year 2000. The over-reliance on treatment to provide a safe drinking water supply was highlighted and a new approach adopted that considered both catchment protection and improved treatment (in combination) to provide a more reliably-safe supply to consumers.

How do we protect public drinking water source areas in WA?

A 'catchment to consumer' multiple barrier approach is used in the management of drinking water quality in Western Australia. Catchment management for protection of the water source (held in storage in surface dams or underground aquifers) is considered the first important barrier. Historically, a heavy reliance was placed on treating water to achieve the desired level of safety, but it is now recognised that treatment alone does not remove all hazards to public health. Therefore, to maximise public health safety effective catchment protection is also essential. Other barriers include:

- selection of an appropriate safe high quality source (where alternatives exist);
- controls over land uses and high risk human activities in catchments underpinned by statutory measures;
- protective undeveloped buffer zones to supply bores, reservoirs and feeder streams;
- catchment protection strategies for education, surveillance, enforcement and monitoring/reporting;
- pre-treatment of drinking water, for example use of detention and settling in reservoirs to induce microbes to die off;
- protection of water storage works, for example water tanks and reservoirs;
- disinfection of drinking water before it enters the distribution system and provision to ensure an adequate disinfectant residual throughout that system;
- maintaining the distribution system as a whole including the pipe system, vermin-proofing of water tanks and preventing back-flow; and
- Promotion of source protection measures in local government planning schemes using the WA Planning Commission's *Statement of Planning Policy– Public Drinking Water Source Policy* (June 2003).

A key process employed by this agency to protect drinking water sources involves the preparation of Drinking Water Source Protection Plans (DWSPP) for the State's PDWSAs.

Drinking Water Source Protection Plans (and Drinking Water Source Protection Assessments)

Drinking Water Source Protection Plans are a key component of the 'catchment-to-consumer' protection strategy for Western Australia's drinking water supplies. This is reflected in the Government's report "*Securing our water future - A State Water Strategy for Western Australia (2003)*" which states that **water source protection plans should be completed for all public drinking water supply catchments throughout the State**. A DWSPP aims to identify existing and potential threats to a drinking water source and to provide risk management strategies and programs for the ongoing management/protection of that source. They are prepared in consultation with the community, potentially affected stakeholders (especially landowners), local government and the State government. Stakeholders are strongly encouraged to consider the risks and potential consequences of inappropriate land-use planning or human activities in the catchment (e.g contamination of the resource and costs to clean-up or establish a new drinking water source). It should be noted that decisions made following consultation may result in some land use/activity restriction in order to achieve a safe, good quality drinking water supply.

Providing a basis for establishing compatible land uses within PDWSAs, the DWSPP is only one of a suite of measures used by this agency to meet its drinking water protection responsibilities. As at June 2003, there were approximately 139 plans listed for completion. Of this number, 50 are complete and 89 are in production.

While the full suite of DWSPPs await completion, land planners and developers need to be aware of the location of and risks to existing drinking water catchments. To this end the DOE is preparing Drinking Water Source Protection Assessments (DWSPA). These Assessments will provide a broad overview of catchment risks, planning and land uses; and a basic understanding of the drinking water catchment and supply system. They are not intended to include extensive data, but to characterise the drinking water system by providing useful information for decision makers. Generally, the DWSPA will be a desktop assessment followed by a site visit and discussions with local government. In some circumstances the DWSPA may be all that is required to achieve good land planning/activity controls (e.g. through planning schemes or strategies) for the protection of drinking water source areas. Otherwise, the DWSPA will be considered base information for development of the DWSPP described above.

Priority classification system

This agency has also implemented policies to protect public drinking water source areas that includes a differential 'priority classification area' system that includes special 'protection zones' around bores and reservoirs. Through development of a DWSPP (or possibly the DWSPA), land in a PDWSA is identified as a mix of Priority 1 (P1), Priority 2 (P2) or Priority 3 (P3) classification areas, with appropriate protection zones.

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 high quality public drinking water is the prime beneficial land use. P1 areas would typically include land under public ownership but may in a limited number of cases include private land.

P1 areas are managed in accordance with the principle of **risk avoidance**, and hence land development is generally not permitted. Where P1 land is in private ownership this agency may make an offer to the owner to sell their land at agreed market values subject to available funding and priority order purchasing rules. There is no obligation on the owner to sell their land.

Priority 2 (P2) 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 relative to other land use values in these areas.

P2 areas are managed in accordance with the principle of **risk minimisation**, and as such only limited conditional development is supported. Such development must be consistent with the protection of waters within the drinking water catchment. A proposed change in land use from a relatively low to a more intensive use may result in contamination of the PDWSA, and would not be supported.

Priority 3 (P3) areas are defined where it is practical to **manage the risk of pollution** to the water source, and where water supply sources need to co-exist with other generally existing 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. Key elements in protection of P3 areas are the provision of deep sewerage and land users using best environmental management practices for their activities. In P3 areas, compared to P1 and P2 areas, it is likely that the direct cost of providing the drinking water to consumers is greater, given the need to monitor and treat the water more comprehensively due to the variety of existing and allowable land uses/risks. If water from P3 areas becomes contaminated, then that water may need to be further treated or an alternative water source found.

In these priority areas there is a strong reliance on landowners, developers, regulators and other users to be acutely aware of the drinking water resource and risks, such that the adoption and implementation of best management practices will help protect the drinking water source. Existing lawfully established but non-conforming land uses in PDWSAs are allowed to continue, however land users will be encouraged to adopt environmentally responsible/best practice land use practices. This agency has prepared a "*Water Quality Protection Note -Land Use Compatibility table in PDWSAs*" that provides guidance on the type of land uses appropriate within P1, P2 and P3 areas.

Reservoir and wellhead protection zones

As noted above, reservoir protection zones (RPZ) are also defined to protect the surface water source from contamination in the immediate vicinity of reservoirs. Reservoir protection zones consist of up to a 2 kilometre buffer around the top water level of a reservoir and includes the reservoir itself. These zones do not extend outside the catchment area (i.e. downstream from a dam wall). This agency provides a high level of protection in these zones and does not support land uses or activities that may add to the risk of contamination of the water source. Generally conditions apply in these zones aimed at preventing people from entering the RPZ to avoid the risk of contamination (consistent with the P1 areas).

For underground water sources, well-head protection zones are defined around the abstraction bores and allowable activities/ land uses in these areas are also restricted and subject to approval processes. Well-head protection zones in P1 areas are set at a 500 metre radius around a bore, and in P2 or P3 areas they are set at a 300 metre radius around a bore.

Conclusion

We can improve the availability of ‘safe, good quality drinking water’ to protect public health if we continue to combine catchment protection and water treatment approaches. This ‘catchment to consumer’ approach to drinking water protection is the basis of the recently updated *Australian Drinking Water Guidelines 2003*.

Many land uses and activities can pose a risk to water quality, so in undeveloped drinking water catchments strict management controls are proposed to ‘avoid the risk’ of contaminating the source. In catchments with some level of development, management controls recognise the existing development but may place restrictions on alternative land uses or expansion of existing land uses. This approach looks to ‘minimise’ or ‘manage the risk’ of contamination in the catchment. These management controls help protect public health, lower the costs of supplying drinking water to consumers and provide a long term source of safe, good quality drinking water.

More information

We welcome your thoughts on this note. Feedback on this topic is retained our file No. 13256. The note will be updated from time to time as comments are received, or industry standards change.

If you wish to comment on the note or require more information, please contact our Program Manager, Protection Planning (Stephen Watson) at the Resource Quality Branch in our head office in the Hyatt Centre. Phone: (08) 9278 0454 (business hours), Fax: (08) 9278 0585.



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