GOVERNMENT OF WESTERN AUSTRALIA

MOORA WATER RESERVE

WATER SOURCE PROTECTION PLAN

Moora Town Water Supply

WATER RESOURCE PROTECTION SERIES

WATER AND RIVERS COMMISSION REPORT WRP 20

1999

WATER AND RIVERS COMMISSION

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Cover Photograph: Moora townsite

MOORA WATER RESERVE
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Water and Rivers Commission
Policy and Planning Division

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WATER RESOURCE PROTECTION SERIES
REPORT NO WRP 20
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Acknowledgments

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Foreword

Water Source Protection Plans

Water Source Protection Plans establish the level of protection required within Water Reserves. The plans identify sources of contamination that should be investigated and set out programs for management of the resource. Water Source Protection Plans are developed in consultation with affected landowners and industry groups and relevant Government agencies.

Proclaiming Water Reserves under the *Country Areas Water Supply Act (1947)* protects the quality of water sources in country Western Australia. The Act's by-laws enable the Water and Rivers Commission to control potentially polluting activities, to regulate land use, inspect premises and to take steps to prevent or clean up pollution.

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

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

Water quality protection framework

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

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

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

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

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

Contents

Summary

The Moora town water supply is obtained from two Water Corporation wellfields: the Moora eastern wellfield and the Moora western wellfield.

The eastern wellfield derives groundwater from the shallow unconfined Noondine Chert, and the western wellfield obtains groundwater from the confined Leederville Formation aquifer. The Moora eastern wellfield is used intermittently to supply peak requirements during summer.

The Moora Eastern Water Reserve was proclaimed in 1988 but its boundaries do not conform to the Noondine Chert outcrop that is a recharge zone of the aquifer from which the wellfield derives groundwater. Therefore, it is proposed to extend the existing Moora Eastern Water Reserve and classify it for Priority 2 source protection.

The proposed Moora Eastern Water Reserve should be managed to minimise the risk of the pollution to the water source. Therefore, signs indicating the location of the reserve should be erected, and any development proposals within the reserve should be assessed for their impact on water quality.

The Moora western wellfield draws water from the Lower Cretaceous Leederville Formation. A Water Reserve for the Moora western wellfield has not yet been declared.

This plan has undergone extensive consultation during the development process. Prior to the preparation of the draft plan, discussions were held with key stakeholders. The draft plan was released for comment to key stakeholders including the Water Corporation, Ministry for Planning, Department of Environmental Protection, Department of Land Administration, Department of Conservation and Land Management, Shire of Moora, affected landowners and the Conservation Council. Comments received were considered and have been addressed in the preparation of this plan. On endorsement of the plan the local members, the Shire and other key stakeholders will be briefed on the recommendations.

1. Introduction

This report provides a plan to protect the groundwater resources, used to supply the town of Moora, from possible contamination.

The town of Moora is located 172 km north of Perth, and can be reached by the Midlands Road (Figure 1). It is the administrative centre of the local Shire.

The water scheme supplying Moora consists of two wellfields located to the east and west of the townsite.

2. Physiography

The town of Moora lies within the Yarra Yarra Region at the foot of the Darling Scarp between the Darling and Dandaragan Plateaus. The soil type is mainly alluvium of the Moore and Coonderoo River system. The eastern wellfield is situated in the Yarra Yarra Region.

The topography of the Dandaragan Plateau, where the western wellfield is situated, is undulating and covered with sand and laterite.

Moora has a temperate climate with rainfall occurring mainly in winter. The average rainfall at Moora is about 460 mm per year.

3. Hydrogeology

Moora is situated on the western margin of the Yilgarn Craton, adjacent to the Perth Basin. The two wellfields supplying groundwater to Moora are the Moora eastern wellfield and the Moora western wellfield that obtain groundwater from different geological environments.

3.1. Moora eastern wellfield

The Moora eastern wellfield derives groundwater from the Proterozoic Noondine Chert. The Noondine Chert consists of chert and quartzite, with minor siltstone, sandstone, claystone and dolomite. The Noondine Chert is part of the Coomberdale Subgroup.

Groundwater in Noondine Chert occurs in fractures, joints and interstitial voids. It may also occur in fractures adjacent to doleritic dykes that intrude the Noondine Chert.

Regional groundwater flow is to the west. Groundwater recharge is by direct infiltration of rainfall, however, the recharge rate is probably low.

The depth to groundwater ranges from about 6 to 15 m below ground level.

The aquifer is shallow and unconfined, therefore considered vulnerable to contamination. Groundwater from the eastern wellfield is about 500 years old (^{14}C age dating).

3.2 Moora western wellfield

The Moora western wellfield is located at Victoria Loc 3543, a privately owned property (Figure 2), about 13 km to the west of the townsite.

The wellfield obtains groundwater from the Lower Cretaceous Leederville Formation (Kolburn source) which is part of a sequence of deep Phanerozoic sediments that forms the Perth Basin.

Regional groundwater flow is toward the south and southwest. The recharge areas of the Leederville Formation, from where groundwater flows to the Moora western wellfield, are some distance to the north where the formation outcrops near Agaton. The recharge areas have not been clearly delineated. The potentiometric surface in the Western wellfield is approximately 55 to 60 m below ground level.

The Leederville Formation aquifer is confined in the area of the Moora western wellfield and is, therefore, not considered to be vulnerable to contamination. Groundwater from the Leederville Formation aquifer is about 16 300 years old (^{14}C age dating).

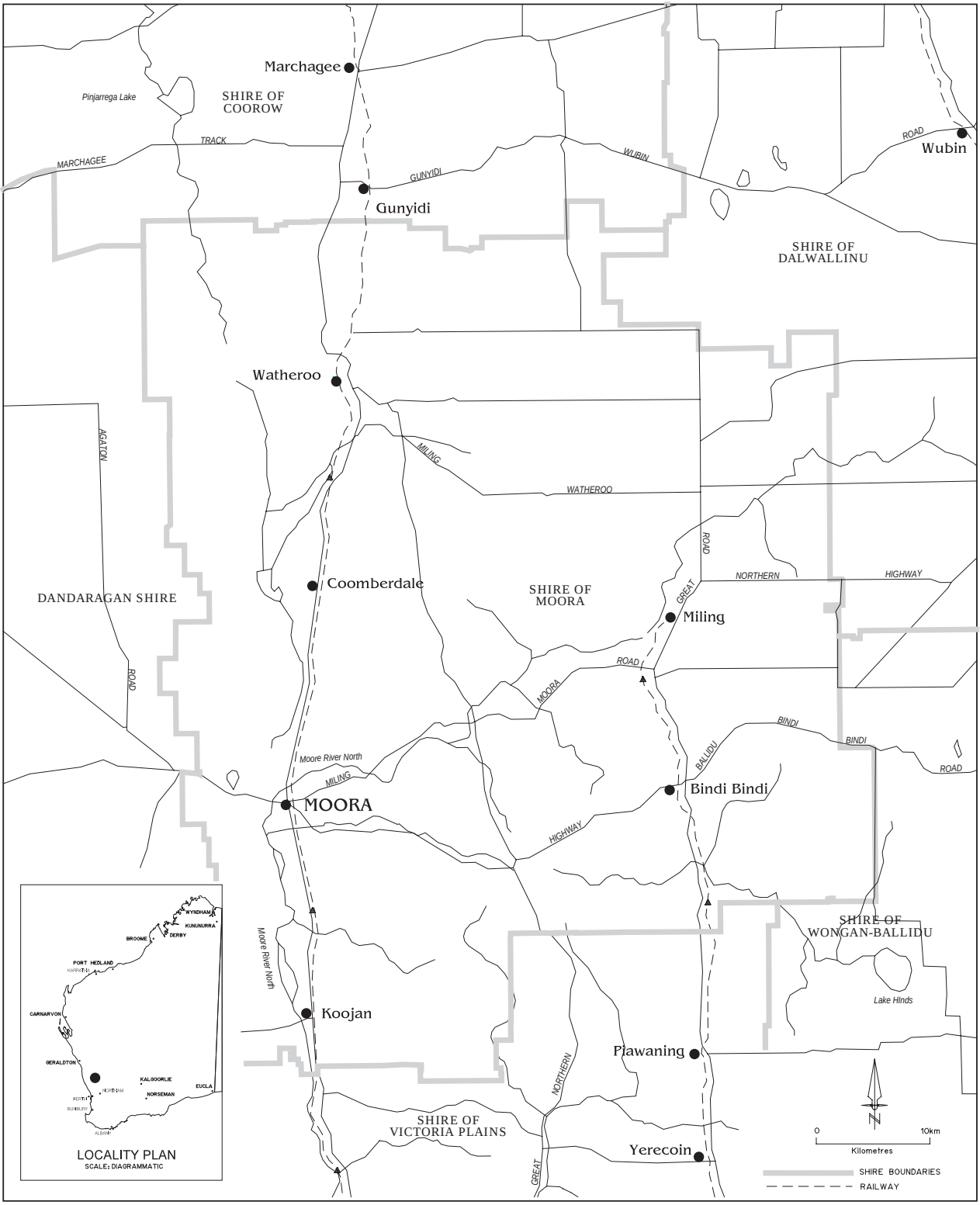


Figure 1. Moora locality map.

4. Scheme description

4.1 Moora eastern wellfield

The Moora eastern wellfield is located about 1.5 km east of the townsite within the Land Act Water Supply Reserve 40089, which is vested in the Water Corporation.

It consists of two production wells (6 and 9), three abandoned production wells and four monitoring wells (Plate 1). Well 6 is screened to a depth of 61 m below ground level (bgl), while well 9 is screened to a depth of 68 m bgl. This wellfield is used intermittently to meet peak requirements during summer. Six water tanks are located within the wellfield.

Since 1988/89 the Moora eastern wellfield has only been used during peak periods. Groundwater abstraction has decreased considerably from 137 000 kL in 1987/88 to 4 100 kL in 1989/90.

Groundwater salinity from the Moora eastern wellfield fluctuated between 600 and 1200 mg/L Total Dissolved Solids (TDS) over the period of record. Increase in salinity has corresponded to high pump rates and low water levels.

The results of major component analyses of the water indicate that levels of chloride and hardness exceed the Australian drinking water guideline limits (NH&MRC and ARMCANZ, 1996).

4.2 Moora western wellfield

The Moora western wellfield is the main water source for the Moora townsite. It comprises two production wells (1/82 that was upgraded in 1989 and 1/89) and one observation well (1/78) (Plate 2). Two production wells (1/73 and 2/73) have been abandoned due to casing failure. Production well 1/89 is screened from 297 to 342 m bgl, while well 1/82 is screened from 292 to 310 m bgl . Well 1/89 operates as a duty well and 1/82 is a standby well.

Water from Moora western wellfield is treated and then pumped to the Moora storage outlet tanks. High concentrations of iron and manganese are reduced by aeration and filtration. The water is also fluoridated.

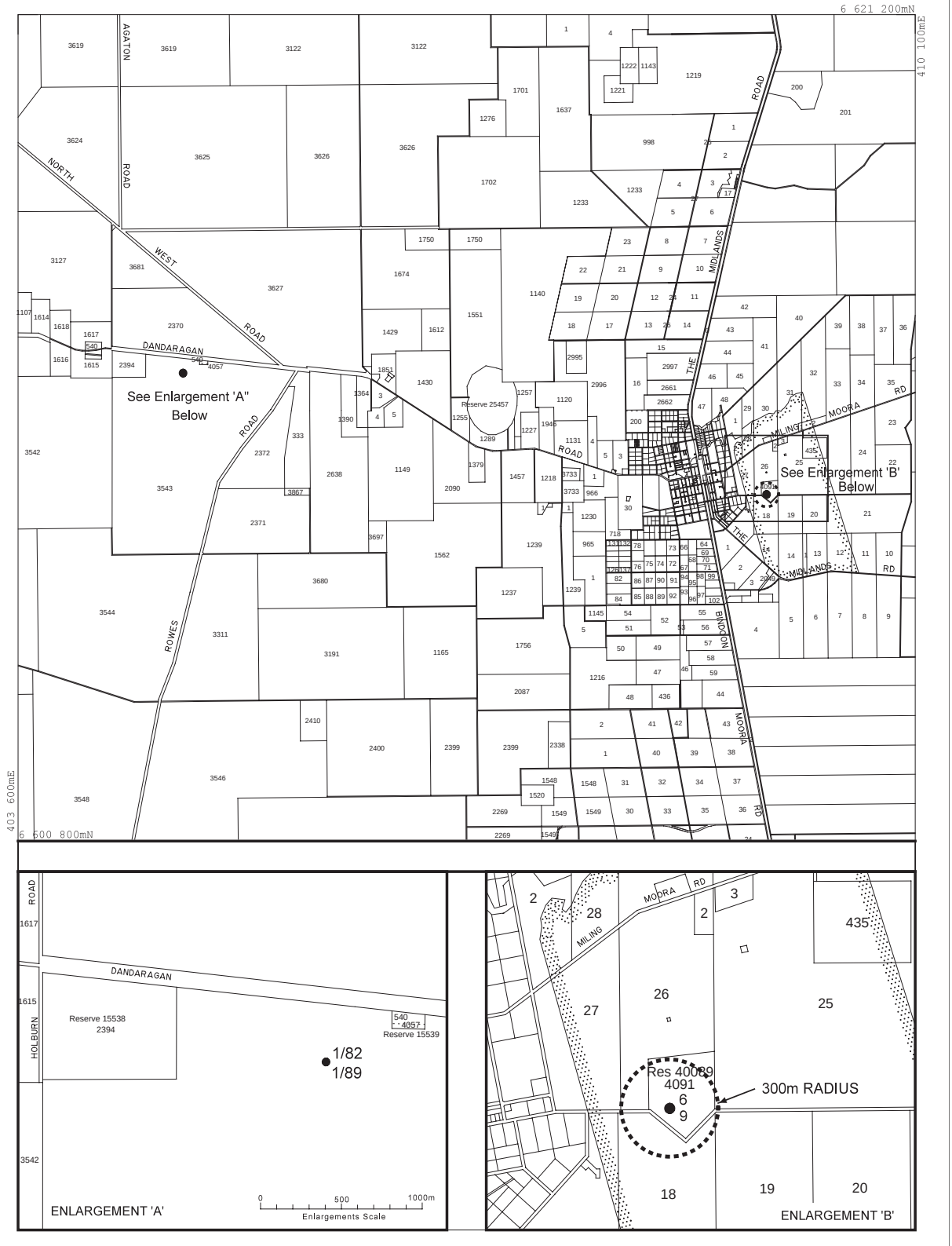
Water abstraction from Moora western wellfield has increased in the past from 436 460 kL in 1985/86 to 513 707 kL in 1989/90.

Groundwater salinity in this wellfield has remained stable between 400-600 mg/L TDS since 1987. The results of major component analyses of the water in production wells meet the current Australian drinking water guidelines.

Plate 1. The Moora eastern wellfield.

Plate 2. The Moora western wellfield.

Plate 3. The Moora eastern wellfield is located on a ridge of outcropping chert.



WATER AND RIVERS COMMISSION

1 0 1 2 3
Kilometres (Large Map)

LEGEND:

- Production bore
- Existing Water Reserve boundary

INDEX TO ADJOINING 1:100000 MAPS

1937	2037	2137
1936	2036	2136
1935	2035	2135

FIGURE 2.
MOORA WELLFIELDS

Drawn by N.J.A. Date 20/02/98

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5. Existing and proposed land use

The Moora eastern wellfield is located on a ridge of outcropping chert elevated from the surrounding farmland as shown in Plate 3. The area surrounding the wellfield is covered with native vegetation and the adjacent land is predominantly used for cropping and grazing of sheep on stubble after harvest. A piggery and a gravel pit are situated close to the eastern wellfield. The future land use is most likely to be a continuation of the present agricultural activities.

The Moora western wellfield is surrounded by land used for agriculture and the future land use is likely to remain the same.

A four-wheel drive recreation area exists over most of the proposed Water Reserve that is used by dune buggies and other four-wheel drive vehicles.

An industrial subdivision has been established along the southwestern boundary of the Water Reserve. The industrial subdivision is unsewered and has been mostly developed. Activities include a concrete batching plant, fuel depot, mechanical servicing facility, houses and storage sheds.

DOLA have recently released some residential land along the western portion of the Water Reserve. Only a couple of these lots have been developed. The subdivision is sewered.

6. Potential for contamination

The Moora eastern wellfield could be contaminated by a number of current land uses (Figure 3).

A piggery is situated about 100 m to the west of the wellfield and is a major threat to the water quality (Plate 4).

A gravel pit, located further upslope from the piggery, is of concern due to above ground storage of fuel in tanks.

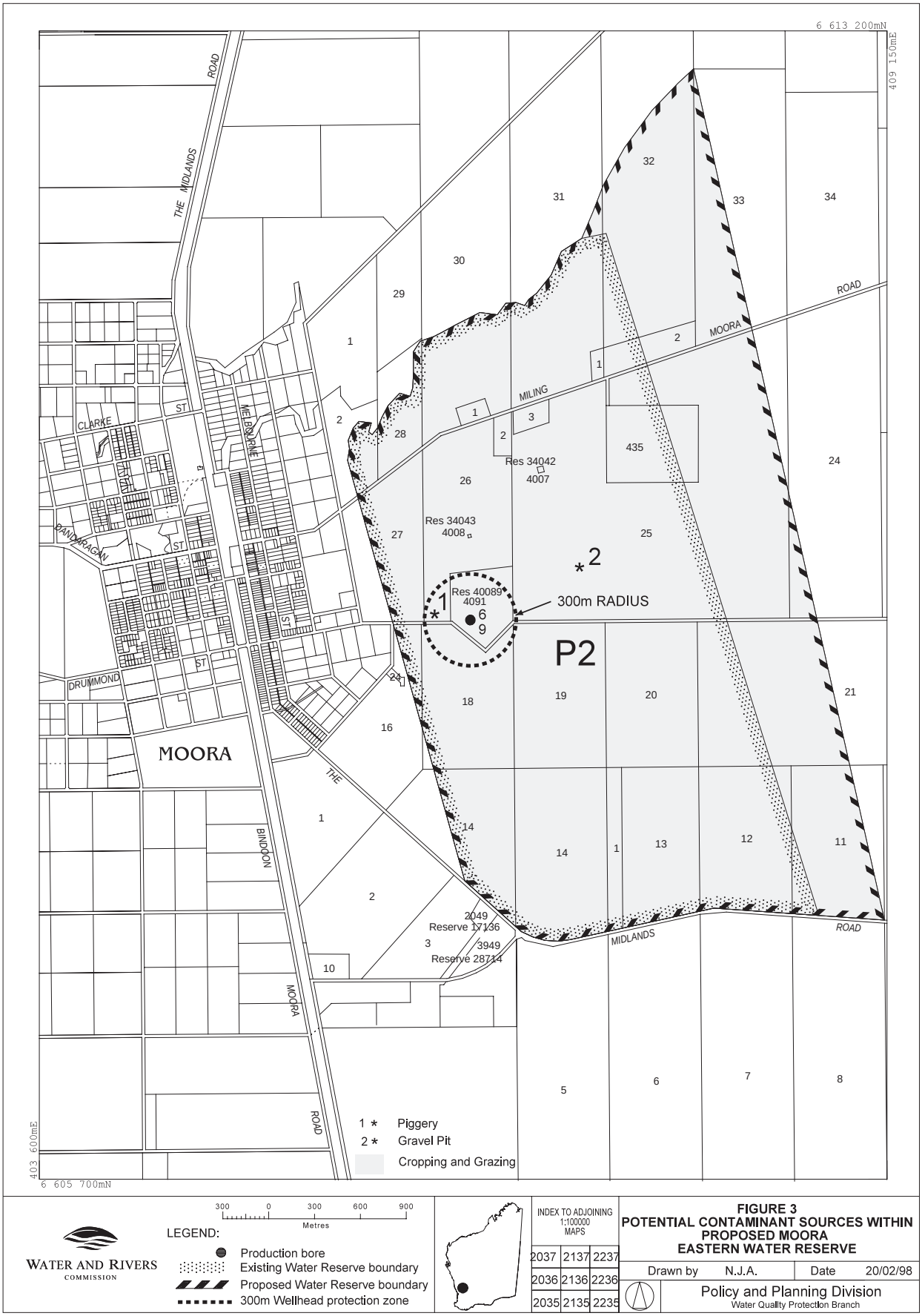
An above ground diesel storage tank that supplies fuel to a backup pump at the wellfield is of concern due to its poor bunding. Plans to remove the tank are forthcoming.

The Moora western wellfield, although located within agricultural land (Plate 5), is not considered to be threatened by contamination due to the confined nature of the aquifer in this area and considerable depth to the groundwater.

6.1 Emergencies

Escape of chemicals during unforeseen incidents and use of chemicals during emergency response can cause groundwater contamination. The Shire of Moora Local Emergency Management Advisory Committee through the *DEMAC Group* Emergency Management District *(check Emergency Management Protocol)* should be familiar with the location and purpose of the Moora Water Reserve. A locality plan should be provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team. The Regional Manager Water and Rivers Commission should have an advisory role to any HAZMAT incident in the Moora Water Reserve. [NB on occasions the Regional Operations Manager Water Corporation may be more suitable, depending on distances]

Personnel who deal with WESTPLAN - HAZMAT incidents within the area should be given ready access to a locality map of the Water Reserve. These personnel should receive training to ensure an understanding of the potential impacts of spills on the groundwater resource.


6 613 200mN
409 150mE
403 600mE
6 605 700mN
THE MIDLANDS ROAD
MOORA ROAD
MILING
CLARKE ST
MELBOURNE ST
BANDJARAGAN ST
DRUMMOND ST
MOORA
THE
BINDOON
MOORA ROAD
MIDLANDS ROAD
Res 34042
4007
Res 34043
4008
Res 40089
4091
300m RADIUS
P2
Reserve 17136
Reserve 28714
1 * Piggery
2 * Gravel Pit
Cropping and Grazing
300 0 300 600 900
Metres
LEGEND:
Production bore
Existing Water Reserve boundary
Proposed Water Reserve boundary
300m Wellhead protection zone
WATER AND RIVERS COMMISSION
INDEX TO ADJOINING 1:100000 MAPS
2037 2137 2237
2036 2136 2236
2035 2135 2235
FIGURE 3
POTENTIAL CONTAMINANT SOURCES WITHIN PROPOSED MOORA EASTERN WATER RESERVE
Drawn by N.J.A.
Date 20/02/98
Policy and Planning Division
Water Quality Protection Branch

7. Proposed proclaimed area

7.1 Moora eastern water reserve

The Moora eastern water reserve was proclaimed in 1988. As its boundaries do not coincide with the Noondine Chert outcrop, the recharge areas are not adequately covered by the present water reserve. It is, therefore, proposed to extend the boundary of the Water Reserve as shown in Figure 4.

The proposed Moora eastern water reserve should be classified for Priority 2 source protection according to the following criteria:

- The groundwater is of strategic importance to the community of Moora as it provides the peak summer demand when the western wellfield pipeline is operating at maximum capacity.
- The area is a recharge zone for groundwater.
- The soil conditions and the depth to the water table are such that more intensive development would lead to the degradation of the water quality.

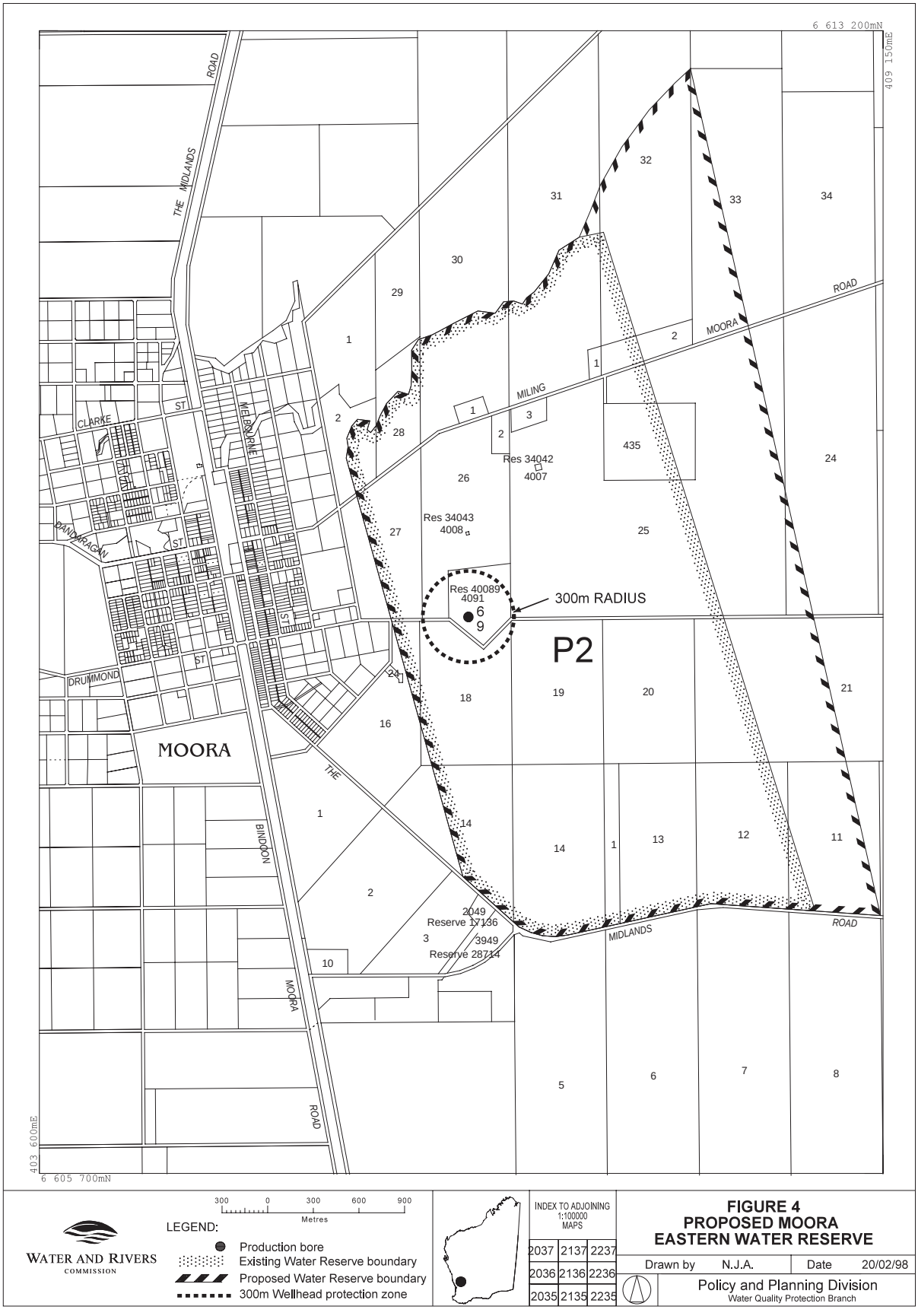
The immediate wellfield should be secured by a circular protection zone of 300 m radius centred on each well as illustrated in Figure 4.

7.2 Moora western wellfield

It is not considered necessary to proclaim a protection area for the Moora western wellfield.

The recharge areas for the Leederville Formation aquifer in the proximity of the Moora western wellfield have not been clearly delineated. However, the multi-layered structure and presence of confining overlying strata of the aquifer provide adequate protection from contamination.

Plate 4. Piggery next to the Moora eastern wellfield.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409 150mE
403 600mE
6 605 700mN
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MOORA ROAD
MILING
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MELBOURNE ST
BANDYRAGUN ST
DRUMMOND ST
MOORA
BINDOON
THE MIDLANDS ROAD
MOORA ROAD
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4007
Res 34043
4008
Res 40089
4091
300m RADIUS
P2
Reserve 17136
Reserve 28714
2049
3949
435
300 0 300 600 900
Metres
LEGEND:
Production bore
Existing Water Reserve boundary
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300m Wellhead protection zone
WATER AND RIVERS COMMISSION
INDEX TO ADJOINING 1:100000 MAPS
2037 2137 2237
2036 2136 2236
2035 2135 2235
FIGURE 4
PROPOSED MOORA
EASTERN WATER RESERVE
Drawn by N.J.A.
Date 20/02/98
Policy and Planning Division
Water Quality Protection Branch

Recommendations

1. The modified Moora eastern water reserve should be gazetted under the *Country Areas Water Supply Act 1947*.

2. Planning strategies should incorporate the management principles outlined in the Water and Rivers Commission's *Land Use Compatibility in Public Drinking Water Source Areas* (Appendix) and reflect the Priority 2 classification given to the Moora eastern water reserve.

3. All development proposals in the modified water reserve that are likely to impact on water quality should be referred to the Water and Rivers Commission.

4. When proclaimed, signs should be erected along the boundaries of the water reserve to define the reserve and promote public awareness of the need to protect water quality.

5. A process should be put in place to address spillage of pollutants within the modified Water Reserve.

6. A surveillance program should be established to identify incompatible land uses or potential contaminant threats within the modified water reserve.

7. The operation of the piggery should be investigated.

8. Nutrient levels in the Water Corporation production wells located within the Moora eastern wellfield should be monitored to ensure drinking water quality criteria are not compromised.

9. The fuel storage facilities at the gravel pit operation should be investigated and, if necessary, upgraded to comply with the requirements outlined in Water and Rivers Commission Water Quality Protection Note for Above ground chemical storage tanks in Public Drinking Water Source Areas.

10. The bunding of the above ground diesel storage tank located within the Moora eastern wellfield should be upgraded to comply with the requirements outlined in the Water and Rivers Water Quality Protection Note for Above ground chemical storage tanks in Public Drinking Water Source Areas, or alternatively removed.

11. Implementation of these recommendations should be reviewed one year after this plan is endorsed. A full review of this protection plan should be undertaken approximately every five years.

Implementation strategy

No	Description	Implemented by	Timing
1.	Gazettal of Water Reserve.	Program Manager, Protection Planning (WRC).	2000
2.	Incorporation into land planning strategies.	Shire of Moora.	Ongoing
3.	Referral of development proposals: (i) WRC to provide the Shire of Moora with guidelines for referral of development proposals. (ii) referral of development proposals.	(i) Program Manager, Protection Planning (WRC) (ii) Shire of Moora, Ministry for Planning and Department of Environmental Protection.	(i) 2000 (ii) Ongoing
4.	Erection of signs: (i) Development of guidelines for signage. (ii) Determine number and location of signs required. (iii) Erect signs.	(i) Program Manager, Protection Planning (WRC). (ii) Regional Manager, Mid-West Gascoyne Region (WRC) in consultation with WC. (iii) Regional Manager, Mid-West Gascoyne Region (WRC).	(i) 2000 (ii) To be arranged (iii) To be arranged

(continued)

5.	Incidents covered by WESTPLAN – HAZMAT in the Moora Water Reserve should be addressed through the following measures: (i) The Moora Local Emergency Management Advisory Committee (through the Northam Emergency Management District) being familiar with the location and purpose of the Moora Water Reserve. (ii) The locality plan for the Moora Water Reserve being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team. (iii) The Water Corporation advising the HAZMAT Emergency Advisory Team during incidents in the Moora Water Reserve. (iv) Personnel dealing with WESTPLAN - HAZMAT incidents in the area given ready access to a locality map of the Water Reserve and training to understand the potential impacts of spills on the groundwater resource.	(i) Moora Local Emergency Management Advisory Committee (through WRC Mid-West Gascoyne region) (ii) WRC (Mid-West Gascoyne region) (iii) Water Corporation (iv) Moora Local Emergency Management Advisory Committee	(i) 2000 (ii) 2000 (iii) Ongoing (iv) Ongoing
6.	Surveillance program: (i) Develop guidelines for the surveillance of Water Reserves. (ii) Implement the surveillance program.	(i) Program Manager, Protection Planning (WRC). (ii) Regional Manager, Mid-West Gascoyne Region (WRC).	(i) 2000 (ii) On completion of surveillance guidelines
7.	Monitoring program: (i) Incorporate monitoring requirements as condition of groundwater well licence.	(i) Manager, Water Allocation (WRC)	(i) To be arranged
8.	Review of this plan and recommendations.	Water Quality Protection Branch (WRC).	(i) Initial review-2001 (ii) Full review-2005/06

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Water Authority of Western Australia, 1991, *Groundwater Scheme Review Moora*, Report No. WG 126.

Water Authority of Western Australia, 1993, *Gingin Groundwater Area Management Plan*, Report No. WG 160.

Water and Rivers Commission, 1998, *Water Quality Protection Note for Above ground chemical storage tanks in Public Drinking Water Source Areas.*

Glossary

Abstraction	Pumping groundwater from an aquifer.
Allocation	The quantity of groundwater permitted to be abstracted by a well 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.
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.
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.
Nutrient Load	The amount of nutrient reaching the waterway over a given time (usually per year) from its catchment area.
Nutrients	Minerals dissolved in water, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorus (phosphate) which provide nutrition (food) for plant growth. Total nutrient levels include the inorganic forms of an element plus any bound in organic molecules.

Pesticides	Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms.
Point Source Pollution	Specific localised source of pollution 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.
Public Water Source Area	(PWSA) As for UWPCA, but allowing the taking of groundwater for public supplies.
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 which has run off the ground surface, roads, paved areas etc and is usually carried away by drains.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.
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.
Underground Water Pollution Control Area	UWPCA) An area defined under the Metropolitan Water Supply Sewerage and Drainage Act, in which restrictions are put on activities that may pollute the groundwater.
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.

Appendix

Land use compatibility in Public Drinking Water Source Areas

LAND USE COMPATIBILITY IN PUBLIC DRINKING WATER SOURCE AREAS

Purpose

To provide information on land use and activities that may impact on the quality of the State's water resources.

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

Scope

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

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

Preamble

The following notes reflect the Commission's current position. They are recommendations only, and may be varied at the discretion of the Commission.

Overview of Protection Framework

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

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

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

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

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

Tables showing Land Use Compatibility with the Commission's PDWSA protection strategy

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

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

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

Definitions used in the following tables

Compatible	The land use is compatible with the management objectives of the priority classification.
Incompatible	The land use is incompatible with the management objectives of the priority classification.
Restricted	The land use may be compatible with the management objectives of the priority classification, with appropriate site management practices. All restricted developments / activities should be referred to the Commission for assessment on a case specific basis.
Extensive	Where limited additional inputs are required to the land to support the desired land use. eg supplementary animal feed only during seasonal dry periods.
Intensive	Where regular additional inputs are required to support the desired land use. eg irrigation, fertilisers and non forage animal feed dominates.

More information

We welcome your comment on these notes. They will be updated from time to time as comments are received or activity standards change. The Commission is progressively developing Water Quality Protection Notes and Guidelines covering land uses described in the attached tables. Advice on available guidance documents may be obtained by contacting the Commission.

If you wish to comment on the notes or require more information, please contact the Commission's Water Quality Protection Branch at the Hyatt Centre in East Perth.
Phone: (08) 9278 0300 (business hours) or Fax:(08) 9278 0585

Tables showing Land use compatibility with PDWSA protection objectives

AGRICULTURE - ANIMALS

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

AGRICULTURE - PLANTS

Land use	Priority 1	Priority 2	Priority 3
Broad acre cropping i.e. non-irrigated	Incompatible	Restricted[1]	Compatible
Floriculture (extensive)	Incompatible	Restricted	Compatible
Floriculture (intensive)	Incompatible	Incompatible	Restricted
Horticulture- hydroponic	Incompatible	Restricted	Restricted
Horticulture - market gardens	Incompatible	Incompatible	Restricted
Orchards	Incompatible	Restricted	Compatible
Nurseries (potted plants)	Incompatible	Restricted	Compatible
Silviculture (tree farming)	Restricted	Restricted	Compatible
Turf farms	Incompatible	Incompatible	Restricted
Viticulture (wine & table grapes)	Incompatible	Restricted	Compatible

DEVELOPMENT - COMMERCIAL

Land use	Priority 1	Priority 2	Priority 3
Aircraft servicing	Incompatible	Incompatible	Restricted[6]
Airports or landing grounds	Incompatible	Incompatible	Restricted[6]
Amusement centres	Incompatible	Incompatible	Compatible[6]
Automotive businesses	Incompatible	Incompatible	Restricted[6]
Boat servicing	Incompatible	Incompatible	Restricted[6]
Catteries	Incompatible	Compatible	Compatible
Caravan and trailer hire	Incompatible	Incompatible	Restricted[6]
Consulting rooms	Incompatible	Incompatible[7]	Compatible[6]
Concrete batching and cement products	Incompatible	Incompatible	Restricted
Cottage Industries	Restricted	Restricted	Compatible
Dog kennels	Incompatible	Restricted	Restricted
Drive in / take-away food shops	Incompatible	Incompatible	Compatible[6]
Drive -in theatres	Incompatible	Incompatible	Compatible[6]
Dry cleaning premises	Incompatible	Incompatible	Restricted[6]
Farm supply centres	Incompatible	Incompatible[7]	Restricted
Fuel depots	Incompatible	Incompatible	Restricted
Garden centres	Incompatible	Incompatible	Compatible
Laboratories (analytical , photographic)	Incompatible	Incompatible	Restricted[6]
Markets	Incompatible	Incompatible	Compatible[6]
Mechanical servicing	Incompatible	Incompatible	Restricted[6]
Metal production / finishing	Incompatible	Incompatible	Incompatible
Milk transfer depots	Incompatible	Incompatible	Restricted
Pesticide operator depots	Incompatible	Incompatible	Incompatible
Restaurants and taverns	Incompatible	Incompatible	Compatible[6]
Service stations	Incompatible	Incompatible	Restricted[6]
Shops and shopping centres	Incompatible	Incompatible[7]	Compatible[6]
Transport depots	Incompatible	Incompatible	Restricted
Vehicle parking (commercial)	Incompatible	Incompatible	Compatible
Vehicle wrecking and machinery	Incompatible	Incompatible	Restricted
Veterinary clinics / hospitals	Incompatible	Incompatible[7]	Restricted[6]

DEVELOPMENT - INDUSTRIAL

Land use	Priority 1	Priority 2	Priority 3
Heavy Industry	Incompatible	Incompatible	Incompatible
Light or general Industry	Incompatible	Incompatible	Restricted[6]
Power Stations	Incompatible	Incompatible	Incompatible

DEVELOPMENT – URBAN

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

EDUCATION / RESEARCH

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

MINING AND MINERAL PROCESSING

Land use	Priority 1	Priority 2	Priority 3
Extractive industries (sand mining, quarries)	Restricted[2]	Restricted[2]	Restricted[2]
Mineral exploration	Restricted[4]	Restricted[4]	Restricted[4]
Mining	Restricted[4]	Restricted[4]	Restricted[4]
Mineral processing	Incompatible	Incompatible	Restricted[4]
Tailings dams	Incompatible	Incompatible	Restricted[4]

PROCESSING OF ANIMALS / ANIMAL PRODUCTS

Land use	Priority 1	Priority 2	Priority 3
Animal product rendering works	Incompatible	Incompatible	Incompatible
Abattoirs	Incompatible	Incompatible	Incompatible
Dairy product factories	Incompatible	Incompatible	Restricted[6]
Food Processing	Incompatible	Incompatible	Restricted[6]
Tanneries	Incompatible	Incompatible	Incompatible
Wool-scourers	Incompatible	Incompatible	Incompatible

PROCESSING OF PLANTS / PLANT PRODUCTS

Land use	Priority 1	Priority 2	Priority 3
Breweries	Incompatible	Incompatible	Restricted[6]
Composting / soil blending (commercial)	Incompatible	Incompatible	Restricted
Vegetable / food processing	Incompatible	Incompatible	Restricted[6]
Wineries	Incompatible	Incompatible	Restricted

SUBDIVISION

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

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

SPORT AND RECREATION

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

STORAGE/ PROCESSING OF TOXIC AND HAZARDOUS SUBSTANCES (THS)

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

TOURISM ACCOMMODATION.

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

WASTE TREATMENT AND MANAGEMENT

Land use	Priority 1	Priority 2	Priority 3
Injection of liquid wastes into ground water	Incompatible	Incompatible	Incompatible
Landfills -Class I, II or III	Incompatible	Incompatible	Restricted
Landfills -Class IV and V	Incompatible	Incompatible	Incompatible
Recycling depots	Incompatible	Incompatible	Restricted

Land use	Priority 1	Priority 2	Priority 3
Refuse transfer stations	Incompatible	Incompatible	Restricted
Sewers (gravity)	Incompatible	Incompatible	Compatible
Sewers (pressure mains)	Incompatible	Restricted	Compatible
Sewage pump stations	Incompatible	Restricted	Restricted
Used tyre storage / disposal facilities	Incompatible	Incompatible	Incompatible
Wastewater treatment plants	Incompatible	Incompatible	Restricted
Water treatment plants	Restricted	Restricted	Restricted

OTHER DEVELOPMENTS

Land use	Priority 1	Priority 2	Priority 3
Caretaker's housing	Incompatible[7]	Restricted	Compatible
Communications receivers / transmitters	Restricted	Restricted	Restricted
Construction projects (not shown elsewhere)	Restricted	Restricted	Restricted
Forestry	Restricted[1]	Compatible	Compatible
Major transport routes	Incompatible	Restricted[10]	Compatible
National and Regional Parks[13]	Compatible	Compatible	Compatible
Nature reserves	Compatible	Compatible	Compatible

Table reference notes:

1. Restrictions include fertiliser and pesticide application.
2. Restrictions include the storage of fuels and chemicals, the depth of mining in relation to the mining table with strict guidelines for rehabilitation.
3. Restrictions include the storage and use of fuel and other chemicals.
4. Subject to conditions placed on the mining lease and / or environmental approval.
5. Special rural development must have appropriate provisions under the Town Planning Scheme, to prevent introduction of land uses and practices that pose an unacceptable risk to water resources.
6. Must be connected to deep sewerage, except where exemptions apply under the current Government Sewerage Policy.
7. Only permitted if this use is incidental to the overall land use in the area and consistent with planning strategies.
8. Lots should only be created where land capability allows on-site soakage disposal of treated wastewater. Restrictions apply to siting of wastewater disposal systems in areas with poor land capability and / or a shallow depth to groundwater, animals are held or fertiliser is applied. Alternative wastewater treatment systems, where approved by the Health Department, may be appropriate if well maintained.
9. An average rather than minimum lot size may be acceptable if the proponent can demonstrate that the water quality objectives of the source protection area are met, and caveats are placed on titles of larger blocks stating that further subdivision cannot occur.
10. Restrictions include road design, construction and the types of goods that may be carried.
11. May be permitted if animal stocking levels (number of animals per hectare) are consistent with source protection objectives.
12. May be permitted if the type, volume and storage mechanisms for chemicals are compatible with water quality protection objectives.
13. Visitor and management infrastructure and facilities must be appropriately sited and maintained.
14. This does not include on-farm / pastoral lease stock-yards used for animal husbandry
15. Waste management practices must be compatible with source protection objectives.
16. Restrictions apply on density of accommodation in Priority 2 areas