Department of Water
Government of Western Australia


# Mount Peron Water Reserve and Leeman (Midway) Water Reserve Drinking Water Source Protection Plan

## Leeman Town Water Supply
## Greenhead Town Water Supply

Water Resource Protection Series

REPORT NO. 83
February 2008

Department of **Water**
Government of **Western Australia**

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Leeman and Green Head Town Water Supply

*Looking after all our water needs*

Department of Water

Water Resource Protection Series

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Cover photograph: *Leeman (Midway) Bore 3/91 and surrounding compound*
(F.Guest photo)

# Contents



# Appendices

# Figures



# Tables

# Preface

The Department of Water has prepared this drinking water source protection plan to report on the activities and risks to water quality within the Mount Peron and Leeman (Midway) water reserves and to recommend management strategies to address those risks.

A safe drinking water supply is critical to the wellbeing of the community and catchment protection is necessary to help avoid, minimise or manage risks to water quality. The department is committed to protecting drinking water sources to ensure the continued supply of safe, good quality drinking water to consumers.

The Australian Drinking Water Guidelines recommend a risk based, multiple barrier approach to protect public drinking water sources. Protection of drinking water catchments is the first barrier, with subsequent barriers implemented at the water storage, treatment and distribution stages of a water supply system. Catchment protection includes understanding the catchment, the hazards and hazardous events that can compromise drinking water quality, and developing and implementing preventive strategies and operational controls to ensure the safest possible water supply from our surface water dams and groundwater aquifers.

This plan details the location and boundary of the drinking water area, which provides potable water to the Leeman and Green Head Town Water Supply System. It describes the water supply system, discusses existing and future usage of the water source, identifies risks and recommends management approaches to protect water quality.

This plan should be used to guide state and local government land use planning decisions. It should be recognised in the Shire of Coorow Town Planning Scheme, consistent with the Western Australian Planning Commission's Statement of Planning Policy No. 2.7 - *Public Drinking Water Source Policy*. Other stakeholders should use this document as a guide for protecting the quality of water in the gazetted Mount Peron and Leeman (Midway)Water reserves.

The stages involved in preparing a drinking water source protection plan are:

| Stages in development of a plan | | Comment |
|---|---|---|
| **1** | Prepare drinking water source protection assessment | Prepared following catchment survey and preliminary information gathering. |
| **2** | Conduct stakeholder consultation | Advice sought from key stakeholders using the assessment as a tool for information and discussion. |
| **3** | Prepare draft drinking water source protection plan | Draft plan developed taking into account input from stakeholders and any additional advice received. |
| **4** | Release draft drinking water source protection plan | Draft plan released for a six week public consultation period. |
| **5** | **Publish approved drinking water source protection plan** | **Final plan published after considering advice received in submissions. Includes recommendations on how to protect water quality.** |

# Summary

The coastal settlements of Leeman and Green Head are located about 290km north of Perth, in the Shire of Coorow (see Figure 1). These towns receive their water from the Mount Peron wellfield with a second source, the Leeman (Midway) wellfield acting as an emergency source.

The Mount Peron Water reserve and Leeman (Midway) water reserve were proclaimed in 1985 and 1992 respectively under the *Country Areas Water Supply Act 1947* for the purpose of protecting the public drinking water source from potential contamination.

The Mount Peron wellfield area (see Figure 2) is a leaky semi-confined aquifer. Recharge occurs south-east of the wellfield within the Lesueur National Park, which is covered in native vegetation. The risk of contamination of the local aquifer from land uses in the recharge area are considered low due to the distance from the wellfield and the storage capacity of the aquifer.

The Midway (emergency source) bore 3/91 (see Figure 2) draws groundwater from an unconfined aquifer. Recharge to this aquifer is by direct infiltration of rainfall and the quality of water from this source is lower than that from Mount Peron.

This drinking water source protection plan aims to protect the quality of these public drinking water supplies. This is proposed to be achieved through the identification of potential contamination risks associated with land use practices in and around the water reserves and the recommendation of protection strategies to ensure these are effectively managed.

The Leeman (Midway) water reserve is located in the Lesueur National Park, which is vested in the Conservation Commission and managed on their behalf by the Department of Environment and Conservation (DEC). The Coorow-Green Head Road (see Appendix B, Photo 2), which leads to the Brand Highway, bisects the Leeman (Midway) water reserve and is adjacent to the Mount Peron water reserve (see Figure 3).

The Mount Peron water reserve is located on private land owned by the Water Corporation (see figure 3) and is zoned ‘rural’ under the Shire of Coorow Town Planning Scheme No. 2. Surrounding land is zoned rural and used for cereal cropping and low intensity stock grazing (see Appendix B, Photo 4). It also contains pockets of uncleared native vegetation. Best management practices on the rural land surrounding the Mount Peron water reserve will help ensure this aquifer is not contaminated.

Based on advice from the Water Corporation, the emergency source bore 3/91 in the Leeman (Midway) water reserve is low yielding as well as having a lower water quality compared to bore 1/91 in the Mount Peron water reserve. Nonetheless, bore 3/91 will remain in service until it is no longer required or a new emergency bore can be established, possibly within the Mount Peron water reserve. If a new bore is established the Leeman (Midway) water reserve would be de-proclaimed.

To protect emergency bore 3/91, a 500m radius wellhead protection zone (WHPZ) will be established and the water reserve will be protected as a Priority 1 (P1) area. The Mount Peron water reserve (bore 1/91), on the other hand, is the main water supply bore and has a good yield and water quality. The depth of this bore, 157m, is such that the risk of contamination from rural land uses surrounding the area is low. Additionally, the main recharge area for this water reserve is in the National Park, south-east of the bore, which also has a low contamination risk. Accordingly, the existing Mount Peron water reserve boundary will be retained, a WHPZ for the whole water reserve will be established and it will be protected as a P1 area (see Figure 4).

# 1 Drinking water source overview

## 1.1 Existing water supply system

The coastal settlements of Leeman and Green Head are located about 290km north of Perth and about 40km south-west of Eneabba, in the Shire of Coorow (see Figure 1). The town sites, which are about 6 km apart, are primarily ports for the rock lobster fishing industry and holiday centres. Leeman has a population of approximately 650 and Green Head 350.

Leeman and Green Head have a shared water supply sourced from the Mount Peron wellfield with the Midway wellfield acting as an emergency source only, due to poor water quality. The Mount Peron wellfield consists of one bore (1/91) drawing from the Lesueur Sandstone aquifer. It is screened between 121 and 152m below the natural surface with a static water level of 15 m. The Midway wellfield consists of one bore (3/91) drawing from the Tamala Limestone aquifer. It is screened between 11 and 14m with a static water level of 11m. The location of the bores can be seen in Figure 2.

Water abstracted from the Mount Peron wellfield is treated before passing into the Mount Peron storage tank (see Appendix B, Photo 3). From the Mount Peron tank water gravitates to Green Head reticulation. The Green Head elevated tank, supplied through the reticulation, acts as a balancing storage for the town. Water for Leeman gravitates into either a ground level storage or elevated storage. Water from the Leeman ground tank is pumped to the elevated tank before being gravity fed into the Leeman reticulation.

When operating, chlorinated water from the Midway wellfield enters the public water supply system between the Mount Peron tank and the reticulation. This wellfield is currently not fully equipped and is an emergency source only (see Appendix B, Photo 1).

## 1.2 Water treatment

Raw water from Mount Peron bore 1/91 is aerated to raise pH then disinfected by chlorination prior to supply as drinking water. When used, raw water from Midway bore 3/91 is chlorinated only.

It should be recognised that although treatment and disinfection are essential barriers used to ensure a safe, good quality drinking water supply, catchment management and water source protection are fundamental first barriers for the protection of water quality. This approach is endorsed by the Australian Drinking Water Guidelines (ADWG) (NHMRC & NRMMC, 2004) and reflects a risk-based catchment-to-consumer, multiple-barrier approach for the provision of safe drinking water to consumers.

## 1.3 Catchment details

### 1.3.1 Physiography

The Mount Peron and Midway wellfields are located on the Coastal Belt unit of the Swan Coastal Plain, a low-lying, gently undulating area covered largely by Quaternary coastal dune and marine shoreline deposits. The Coastal Belt extends up to 20km inland and contains the Quindalup, Spearwood and Eneabba Plain dune systems. The Quindalup Dunes form steep-sided unconsolidated calcareous sand dunes parallel and close to the present coastline. Behind the active foredune area, the dunes are typified by shallow brown sand overlying limestone. The Spearwood Dunes lie inland of the Quindalup Dunes and form an undulating landscape that consists of a core of limestone overlain by yellow sand (Water Authority, 1995). The Eneabba Plain dune system lies inland of the Spearwood Dunes and is bound by the Gingin Scarp.

The Midway wellfield is located in the Lesueur National Park. The native vegetation (Northern Coastal Plain or Kwongan heath) is rich in diversity. Within the Kwongan heathland there are also pockets of Wandoo/Powderbark woodland and Acacia/Banksia scrubland.

### 1.3.2 Climate

The Leeman/Green Head area experiences a mild Mediterranean-type climate with hot, dry summers and cool, wet winters. The average annual rainfall recorded since 1983 is about 622mm and is received mainly during winter.

### 1.3.3 Hydrogeology

The Mount Peron wellfield is located within the Cadda Terrace and the Midway wellfield is within the Beagle Ridge in the northern Perth Sedimentary Basin. The terrace is bounded on the east by the Coomallo Fault and on the west by the Beagle Fault system (Mory and Lasky, 1996). The ridge is bounded on the east by the Cadda Terrace and on the west by the Abrolhos Sub-basin. The Beagle Fault system, located about 10 km inland divides the scheme's two wellfields. Quaternary Tamala Limestone overlies the Triassic Lesueur Sandstone east of the fault. To the west, Quaternary superficial formations, comprising predominantly Tamala Limestone and Safety Bay Sand, overlie the Triassic Woodada Formation and Kokatea Shale.

The Lesueur Sandstone is a medium to very coarse-grained sand and sandstone with minor layers of siltstone, claystone and conglomerate (Baddock and Lach, 2003). Regionally, the aquifer within the Lesueur Sandstone varies from unconfined, where it outcrops, to confined, where it is overlain by the superficial formations. Locally in the Mount Peron wellfield area, it is a leaky semi-confined aquifer with upward hydraulic head. Recharge occurs south-east of the wellfield where the

formation outcrops on the Gingin Scarp. Groundwater within the Lesueur Sandstone flows north westerly towards the wellfield discharging via upward leakage into the overlying superficial sediments (Kern, 2005).

The Midway bore 3/91 draws groundwater from the unconfined Tamala Limestone, which comprises mainly calcareous sand, commonly cemented into limestone. Recharge to the superficial aquifer at this location is by direct infiltration of rainfall and groundwater flow from the Lesueur Sandstone in the east where it comes up along the impermeable boundary at Beagle Fault (Baddock and Lach, 2003). Regional groundwater flow within the superficial formations is westerly towards the coastal lakes.

## 1.4 Future water supply requirements

The existing Mount Peron water reserve is suitable for current water supply needs of Leeman and Green Head. The Leeman (Midway) water reserve is not ideal and Water Corporation have advised that it is considering a new emergency source. However, until the necessary assessments and decisions are made, the Leeman (Midway) water reserve needs to be protected.

One option being considered is the installation of a second bore within the Mount Peron water reserve. If bore 3/91 in the Leeman (Midway) water reserve is no longer required the water reserve would be deproclaimed.

## 1.5 Protection and allocation

### 1.5.1 Existing water source protection

Leeman (Midway) water reserve and Mount Peron water reserve were proclaimed in 1985 and 1992 respectively under the *Country Areas Water Supply Act 1947* for the purpose of protecting the public drinking water source from potential contamination. The water reserves are shown in Figure 2.

### 1.5.2 Current allocation licence

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

The Mount Peron and Midway groundwater resources lie within the Arrowsmith Groundwater Area, which was proclaimed in 1975 under the *Rights in Water and Irrigation Act 1914.* The resource is managed in accordance with this Department's Interim Sub-Regional Allocation Strategy titled *Managing the Water Resources of the Arrowsmith Groundwater Area, WA (2002).*

The Water Corporation is licensed to draw 470 000 kilolitres (kL) per annum from the Mount Peron wellfield and 10 000 kL from the Midway wellfield for public water supply purposes via Groundwater Well Licences 65700 and 65317 respectively. The number of services for 2006 is approximately 654 (Water Corporation, 2005).

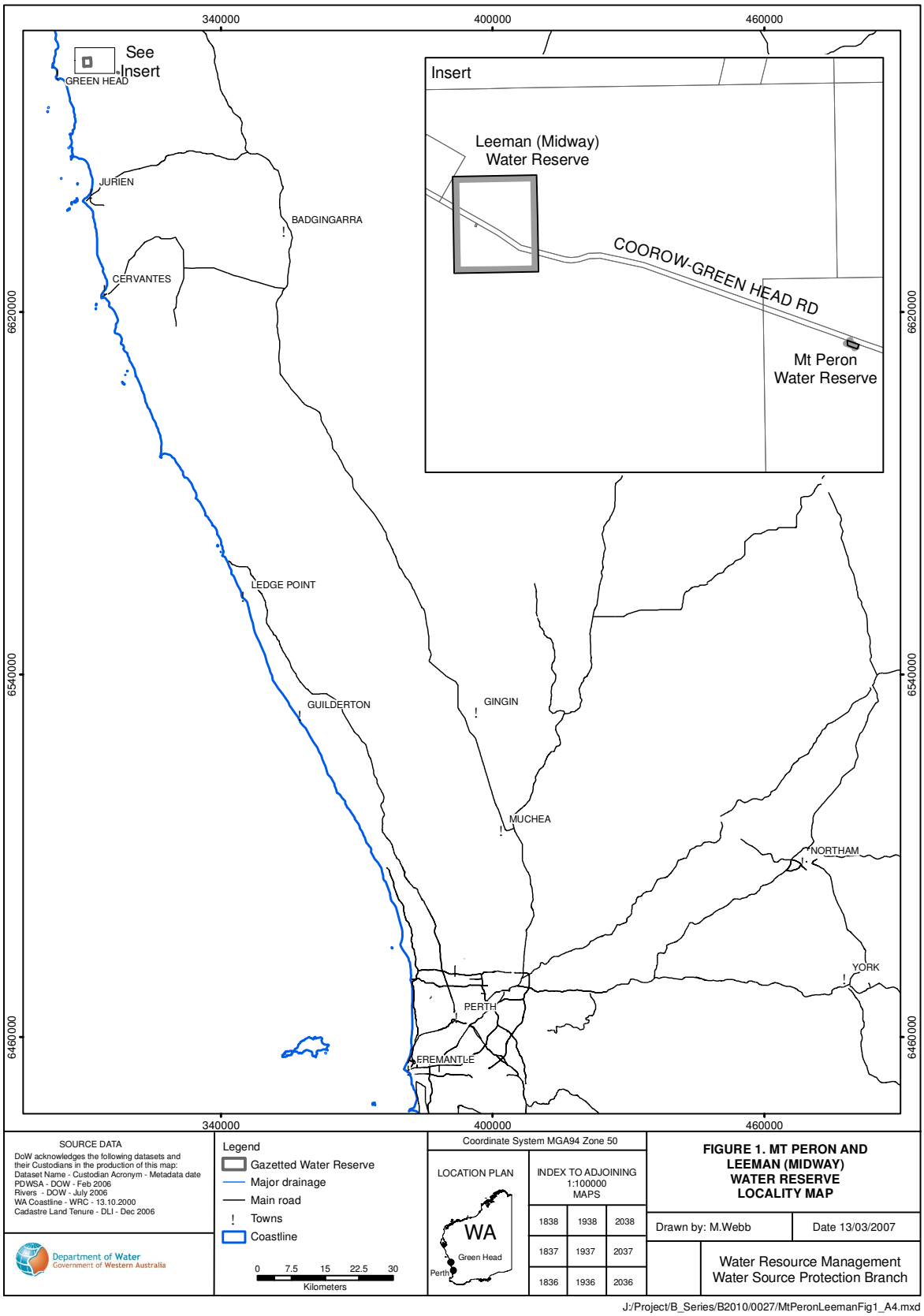


*Figure 1 Mount Peron Water Reserve and Leeman (Midway) Water Reserve locality map*

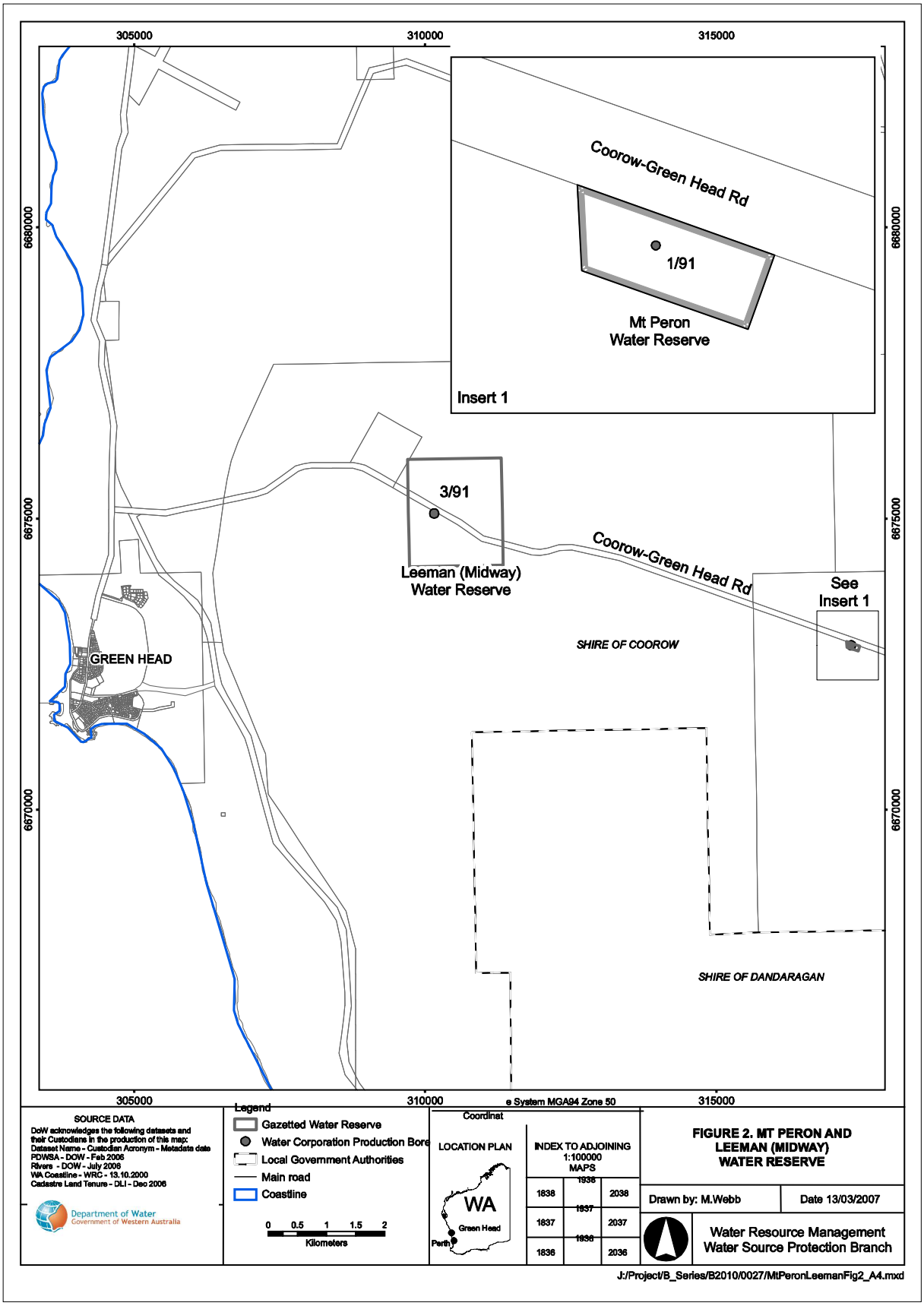


*Figure 2 Mount Peron Water Reserve and Leeman (Midway) Water Reserve*

# 2 Water quality monitoring and contamination risks

The Water Corporation regularly monitors the raw water quality from the Mount Peron and Midway wellfields for microbiological contamination, health related and aesthetic (non-health related) characteristics in accordance with the ADWG. The results of this monitoring are then reviewed by an intergovernmental committee, chaired by the Department of Health, called the Advisory Committee for the Purity of Water.

Following aeration to raise pH the drinking water supplied to the Leeman-Green Head Scheme complies with ADWG for microbiological, health and aesthetic requirements with the exception being chloride. Chloride marginally exceeds the aesthetic guideline value but **does not** exceed the health guideline value so it poses no health risk to consumers.

A water quality report has been prepared by the Water Corporation for both the Mount Peron and Midway wellfields from January 2002 to June 2007. This is presented in Appendix A. For more information on water quality, see the Water Corporation's most recent Drinking Water Quality Annual Report at www.watercorporation.com.au, select Water > Water Quality > Downloads > access the most recent Annual Report.

It should be noted that testing is conducted on raw water, and that all Australian Drinking Water Guideline limits are met following treatment before supply to consumers.

## 2.1 Microbiological contaminants

Pathogens are types of micro-organisms that are capable of causing diseases. These include bacteria (such as *Escherichia coli*), protozoa (such as *Cryptosporidium* and *Giardia*) and viruses. In water supplies the pathogens of concern that can cause illness, such as stomach upset, diarrhoea and even death, are mostly found in the faeces of humans and domestic animals. *Escherichia coli* counts are a way of measuring these pathogens and are an indicator of faecal contamination.

There are a number of pathogens that are commonly known to contaminate water supplies worldwide. These include bacteria (e.g. *Salmonella*, *Escherichia coli* and *Cholera*), parasitic protozoa (e.g. *Cryptosporidium*, *Giardia*) and viruses. The percentage of humans in the world that carry various pathogens varies. For example, it is estimated that between 0.6 to 4.3 per cent of people are infected with *Cryptosporidium* worldwide, and 7.4 per cent with *Giardia* (Geldreich, 1996).

Preventing the introduction of pathogens into the water source is the most effective barrier in avoiding this public health risk.

During the review period of January 2002 to June 2007, positive *Escherichia coli* counts were not recorded in any of the samples collected from the Mount Peron borefield. In the past, low levels of thermotolerant coliforms have been detected in the raw water from Midway wellfield, however production sampling of this emergency use bore ceased in 2002 as. For further information on microbiological contaminants within the Mount Peron and Midway wellfields, please refer to Appendix A.

## 2.2 Health-related characteristics

A number of chemicals (organic and inorganic) are of concern in drinking water from a health perspective because they are potentially toxic to humans. Chemicals usually occur in drinking water sources attached to suspended material such as soil particles and may result from natural leaching from mineral deposits or from different land uses (NHMRC & NRMMC, 2004b)

Pesticides include agricultural chemicals such as insecticides, herbicides, nematicides, rodenticides and miticides. Contamination of a drinking water source by pesticides may occur as a result of accidental spills, incorrect or over use and leakage from storage areas. In such cases, prompt action is required to notify relevant authorities and clean up the spill.

Nutrients (such as nitrogen) can enter drinking water supplies from leaching of fertiliser, septic tanks, and from faeces of domestic animals (such as cattle grazing on the land). Nitrate and nitrite (ions of Nitrogen) can be toxic to humans at high levels, with infants less than 3 months old being most susceptible (NHMRC & NRMMC, 2004).

Hydrocarbons (fuels, oils, solvents) are potentially toxic to humans, and harmful by-products may be formed when they are combined with chlorine in water treatment processes. Hydrocarbons can occur in water supplies from pollution events related to vehicle accidents, refuelling and leakage from storage areas.

For information on the health related characteristics of the water within the Mount Peron and Midway wellfields, please refer to Appendix A.

## 2.3 Aesthetic characteristics

Impurities in drinking water can affect the aesthetic qualities of water such as appearance, taste, smell and ‘feel’. Such impurities are not necessarily hazardous to human health, for example water that is cloudy and has a distinctive colour may not be harmful (NHMRC & NRMMC, 2004b).

Iron and dissolved organic matter can affect the colour and appearance of water, and salinity can affect the taste. The ADWG have set limits on water quality characteristics to meet aesthetic requirements of consumers.

Some properties such as pH can contribute to the corrosion and encrustation of pipes. The ADWG also sets out aesthetic guidelines for these types of water quality characteristics. The raw water from the Mount Peron wellfield typically has a pH below the ADWG guideline values, however once treated the water complies with ADWG values.

Raw water from the Midway wellfield is usually of high salinity and hardness, which is a contributing reason as to why this is used as an emergency source.

For more information on the aesthetic characteristics of the water within the Mount Peron and Midway wellfields, please refer to Appendix A.

## 2.4 Groundwater bores

Under the provisions of sections 26D and 5C of the *RIWI Act,* a licence is required to construct a bore or extract water (unless exempt under the *RIWI* Exemption and Repeal (Section 26C) Order 2001) within a proclaimed groundwater area. The Leeman (Midway) and Mount Peron water reserves are located within the proclaimed Arrowsmith Groundwater Area.

Any bore drilled near to a public drinking water supply bore has the potential to contaminate the drinking water source. For example, a poorly constructed bore may introduce contaminants through surface leakage down the outside of the bore casing into an aquifer. If a public drinking water source bore is nearby, it may abstract the contaminated water.

It is important to ensure that any bores are appropriately located and constructed in order to prevent contamination and other impacts on the public drinking water source. This matter will be considered through the Department of Water's water licensing process under the *RIWI Act.*

All bores should be constructed in accordance with *Minimum Construction Requirements for Water Bores in Australia* (National Minimum Bore Specifications Committee 2003).

# 3 Land use assessment

## 3.1 Existing land uses

### 3.1.1 Mount Peron water reserve

The Mount Peron water reserve is located on private land owned by the Water Corporation (see Figure 3) and zoned rural under the Shire of Coorow Town Planning Scheme No. 2. Surrounding land is also zoned rural and used for cereal cropping and low intensity stock grazing, and contains pockets of uncleared native vegetation. The recharge area, approximately 10 km to the south-east, is located in the Lesueur National Park (see Figure 3), which is covered in native vegetation.

Provided the wellhead remains sealed, the current land uses do not pose a significant risk to the source because the semi-confined nature and upward hydraulic head within the aquifer at this location results in groundwater within the Lesueur Sandstone discharging into the overlying superficial formations (Water Corporation, 2005). The risk of contamination to the recharge area is low due to the native vegetation cover. The use/adoption of best management practices on the rural land surrounding the Mount Peron water reserve will also help protect the water quality.

### 3.1.2 Leeman (Midway) water reserve

The Leeman (Midway) water reserve is located in the Lesueur National Park, which is managed by the Department of Environment and Conservation (DEC). The Coorow-Green Head Road, which leads to the Brand Highway, bisects the Leeman (Midway) water reserve (see Figure 3).

The Midway wellfield draws groundwater from an unconfined aquifer and is vulnerable to potential contamination from inappropriate land uses or activities such as fuel spillages (see Table 1).

## 3.2 Proposed land uses

Land use zonings and activity levels in and around both water reserves are not expected to change in the foreseeable future. Future land uses should be in accordance with this Department's water quality protection note *Land use compatibility in Public Drinking Water Source Areas.*

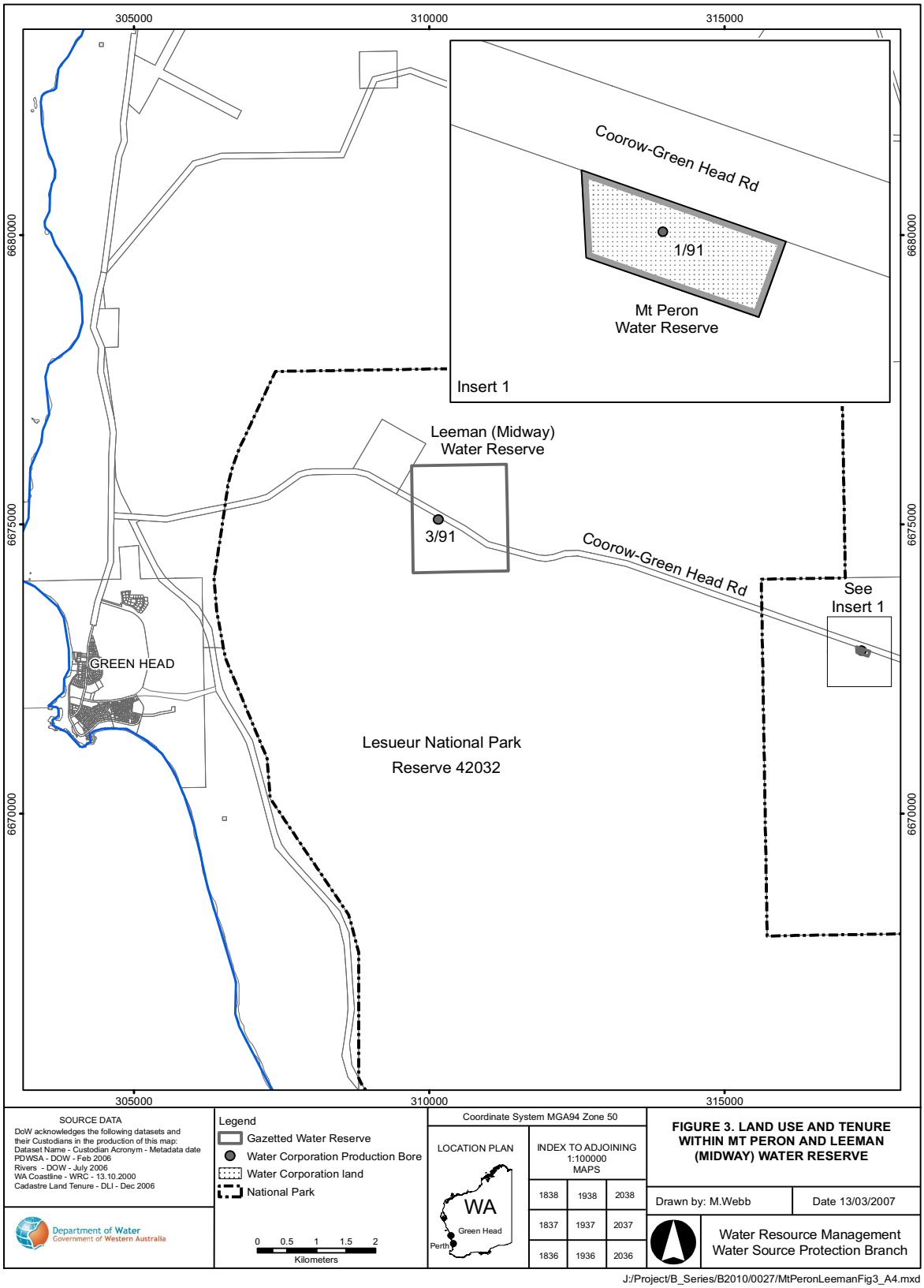


*Figure 3 Land use and activities in the Mount Peron and Leeman (Midway) Water Reserves*

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

| Land use / activity | Potential water quality risks | | Consideration for management | Current preventative measures | Recommended protection strategies |
|---|---|---|---|---|---|
| | Hazard | Management priority | | | |
| Major Roads | The potential risks to water quality include:<br>• Fuel and chemical spills from vehicles and their loads; and<br>• Herbicides from weed control on road verges | Medium<br><br>Low | The Coorow-Green Head Road bisects the Leeman water reserve (including the WHPZ) and is adjacent to the Mount Peron water reserve. The road connects the towns of Green Head and Leeman to the Brand Highway.<br>There is the potential for contamination of either aquifer from fuel and chemical spills.<br>Plans to connect Lancelin and Jurien Bay via a coastal road will increase the number of vehicles using the Coorow-Green Head Rd and therefore the risk to the water reserves. | Water quality monitoring.<br><br>HAZMAT emergency response.<br><br>Application of pesticides conducted in accordance with the Department of Health (DoH) Public Service Circular (PSC) No. 88. | *Acceptable activity with best management practices*.<br>• Ensure road upgrades follow alignments and incorporate measures to avoid water source contamination.<br>• Restrict development of new roads through the water reserves.<br>• Undertake road construction and maintenance in a manner which avoids water source contamination risks.<br>• Encourage adherence to this Department's water quality protection note *Roads near sensitive water resources.*<br>• Ensure herbicides are applied in accordance with DoH PSC-88 and Statewide Policy No 2: *Pesticide use in PDWSA's* |

| Land use / activity | Potential water quality risks | | Consideration for management | Current preventative measures | Recommended protection strategies |
|---|---|---|---|---|---|
| | **Hazard** | **Management priority** | | | |
| General farming<br>• Livestock grazing<br>• Cereal crops<br>• Orchards<br>• Residences | The potential risks to water quality include:<br>• Pathogen and nutrient contamination from household wastewater disposal systems and stock grazing;<br>• Nutrient and pesticide contamination from application to crops and inadequate storage and disposal of containers; and<br>• Hydrocarbon contamination via fuel spills from storage, refuelling, mechanical servicing and waste oil disposal. | Medium<br><br>Low<br><br>Low | Private land surrounding the Mount Peron water reserve is zoned rural under the Shire of Coorow Town Planning Scheme No 2. There is cereal crops and low intensity stock grazing.<br><br>It is recognised that the use of private land for existing approved land uses is essential for the livelihood of residents. The risks associated with these activities can be managed through education and the adoption of best management practices | The Mount Peron water reserve is located on land owned by the Water Corporation and the bore is sealed.<br><br>There are still small pockets of native vegetation on privately owned land that act as a vegetation buffer. | *Acceptable activity with best management practices*<br>• Encourage landowners to adopt best management practices such as those outlined in this Department's water quality protection notes: *Stockyards, Toxic and hazardous substances – storage and use* and *Agriculture – dryland crops near sensitive water resources.*<br>• Refer development proposals within the water reserves that are likely to impact on water quality to the Department of Water for advice and recommendation.<br>• Ensure pesticides are applied in accordance with the DoH PSC-88 and Statewide Policy No 2: *Pesticide use in public drinking water source areas*. |

| Land use / activity | Potential water quality risks | | Consideration for management | Current preventative measures | Recommended protection strategies |
|---|---|---|---|---|---|
| | **Hazard** | **Management priority** | | | |
| Park management and recreation<br>• Fire management<br>• Bee keeping<br>• Weed control | The potential risks to water quality include:<br>• Fuel and chemical spills from vehicles and their loads; and<br>• Pesticides from firebreak maintenance | Medium<br><br>Low | The National Park is managed by DEC. Activity levels in the Leeman water reserve are very low. They potentially include fire management, bee keeping, and low levels of weed control including chemically constructed fire control lines. | Water quality management.<br><br>DEC land management practices.<br><br>The Midway bore is sealed. | *Acceptable activity with best management practices*<br>• Ensure pesticides are applied in accordance with the DoH PSC-88 and Statewide Policy No 2: *Pesticide use in public drinking water source areas*.<br>• Develop a strategy to ensure that fire management undertaken by DEC aims to protect any physical assets associated with the Leeman (Midway) water reserve. |

# 4 Catchment protection strategy

## 4.1 Protection objectives

The objective of this plan is to protect the Mount Peron and Leeman (Midway) water reserves to provide safe drinking water to the towns of Leeman and Green Head, while recognising the rights of existing approved land uses to continue.

## 4.2 Proclaimed area

The boundary of the current gazetted Mount Peron water reserve and Leeman (Midway) water reserve (see section 1.5.1) will remain the same (see Figure 4).

## 4.3 Protection classifications

Both the Mount Peron and Leeman (Midway) water reserves are to be managed as Priority 1 (P1) areas (see Figure 4).

An explanation of the priority area system and the detail of land use compatibility within each priority area is provided in the water quality protection note *Land use compatibility in public drinking water source areas*.

## 4.4 Protection zones

The Department of Water defines wellhead protection zones (WHPZ) around each production bore (500m radius in P1 areas and 300m radius in P2 and P3 areas) in which activities are to be managed to protect water quality. There will be a WHPZ with a radius of 500m for the Leeman (Midway) water reserve and a WHPZ that covers the entire area of the Mount Peron water reserve (approximately 230 x 85m) WHPZ are confined to the area within the water reserve boundary, as shown in Figure 4.

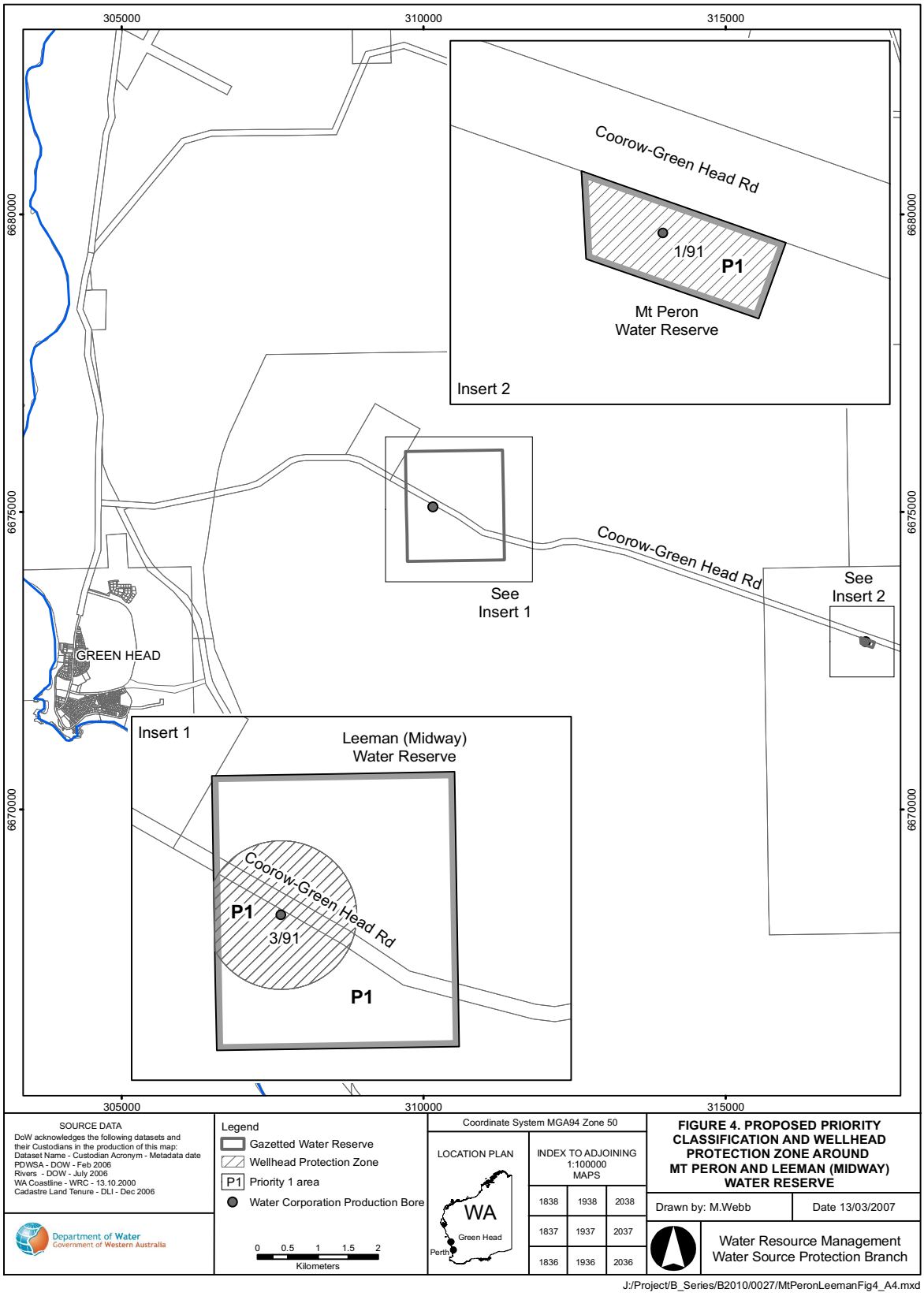


*Figure 4 Protection classifications and zones for the Mount Peron and Leeman (Midway) Water Reserves*

## 4.5 Land use planning

The *State Planning Strategy* (Western Australian Planning Commission, 1997) recognises that water quality protection mechanisms need to be provided for in statutory land use planning processes to secure the long-term protection of drinking water sources. As outlined in Statement of Planning Policy No. 2.7 – *Public Drinking Water Source Policy* (Western Australian Planning Commission, 2003) it is appropriate that the Mount Peron and Leeman (Midway) water reserves, priority areas and protection zones be recognised in the Shire of Coorow Town Planning Scheme. Any development proposal within the water reserves that are inconsistent with the Department of Water's water quality protection note – *Land Use Compatibility in public drinking water source areas* or recommendations in this plan is expected to be referred to the Department of Water for advice and recommendations. This referral and advice process will ensure only appropriate land and water based developments are approved in public drinking water source areas.

## 4.6 Best management practices

There are opportunities to significantly reduce risks to water quality by carefully considering design and management practices. The adoption of best management practices for land uses will continue to be encouraged to help protect water quality. On freehold land, the Department of Water aims to work with landowners to achieve best management practices for water quality protection through the provision of management advice.

There are guidelines available for many land uses in the form of industry codes of practice, environmental guidelines or water quality protection notes. These have been developed in consultation with stakeholders such as industry groups, producers, state and local government agencies and technical advisers. Examples include *Roads near sensitive water resources* and *Agriculture – dryland crops near sensitive water resources*, which are listed in the References section. The guidelines help managers reduce the risk of their operations causing unacceptable environmental impacts. They are recommended as best practice for water quality protection.

Education and awareness (e.g. signage and information material) is another means of achieving water quality protection, especially for those people visiting the area who are unfamiliar with the importance of the Mount Peron water reserve or Leeman (Midway) water reserve. A brochure has been produced describing the water reserves, their location and the main threats to water quality protection. This brochure will be available to the community and will inform people in simple terms about the drinking water source, its importance and the need to protect it.

## 4.7 Surveillance and by-law enforcement

The quality of public drinking water sources within country areas of the State is protected under the *Country Areas Water Supply Act 1947*. Declaration of these areas allows existing By-laws to be applied to protect water quality.

The Department of Water considers By-law enforcement, through on-ground surveillance of land use activities in PDWSAs as an important water quality protection mechanism.

Signs are erected around PDWSAs to educate the public and to advise of activities that are prohibited or regulated. This plan recommends that delegation of surveillance and By-law enforcement to the Water Corporation is continued.

## 4.8 Emergency response

Escape of contaminants during unforeseen incidents and the use of chemicals during emergency responses can result in water contamination. The Shire of Coorow Local Emergency Management Committee (LEMC) through the Mid West-Gascoyne Emergency Management District should be familiar with the location and purpose of the Mount Peron and Leeman (Midway) water reserves. A locality plan should be provided to the Fire and Rescue Services headquarters for the Hazardous Materials Emergency Advisory Team (HAZMAT). The Water Corporation should have an advisory role to any HAZMAT incident in the Mount Peron and Leeman (Midway) water reserves.

Personnel who deal with WESTPLAN – HAZMAT (Western Australian Plan for Hazardous Materials) incidents within the area should have access to a map of the Mount Peron and Leeman (Midway) water reserves. These personnel should have an adequate understanding of the potential impacts of spills on this water resource.

## 4.9 Implementation of this plan

Table 1 identifies the potential water quality risks associated with existing land uses in the Mount Peron and Leeman (Midway) water reserves and recommends protection strategies to minimise these risks.

Following publication of the final Mount Peron water reserve and Leeman (Midway) water reserve drinking water source protection plan, an Implementation Strategy will be prepared, with stakeholders, based on the recommendations in Table 1. It will describe timeframes for the recommended protection strategies and identify responsible stakeholders with an interest, or key role, in implementing the protection strategies.

# 5 Recommendations

1 Prepare an implementation strategy for this plan showing responsible stakeholders and planned timeframes for the recommended protection strategies to be achieved *(Department of Water).*

2 Implement the recommended protection strategies as detailed in Table 1: *Land use, potential water quality risks and recommended strategies* of this plan *(Applicable stakeholders)*.

3 Prepare an implementation strategy for this plan showing responsible stakeholders and planned timeframes for the recommended protection strategies to be achieved *(Department of Water).*

4 The Shire of Coorow Town Planning Scheme should incorporate this plan and reflect the identified Leeman (Midway) water reserve and Mount Peron water reserve boundaries, Priority 1 areas and protection zones in accordance with State Planning Policy No. 2.7 – *Public Drinking Water Source Policy (Shire of Coorow).*

5 All development proposals within the Mount Peron water reserve and Leeman (Midway) water reserve that are inconsistent with the Department of Water's water quality protection note – *Land use compatibility in public drinking water source areas* or recommendations in this plan should be referred to the Department of Water for advice and recommendations (*Department for Planning and Infrastructure, Shire of Coorow, Proponents of proposals*).

6 Incidents covered by WESTPLAN – HAZMAT in the Mount Peron water reserve and Leeman (Midway) water reserve should be addressed by ensuring that:

- the Shire of Coorow LEMC should be aware of the location and purpose of the Mount Peron water reserve and Leeman (Midway) water reserve
- the locality plan for the Mount Peron water reserve and Leeman (Midway) water reserve are provided to the Fire and Rescue headquarters for the HAZMAT Emergency Advisory Team
- the Water Corporation provides an advisory role during incidents in the Mount Peron water reserve and Leeman (Midway) water reserve
- personnel dealing with WESTPLAN – HAZMAT incidents in the area have ready access to a locality map of the Mount Peron water reserve and Leeman (Midway) water reserve, and information to help them recognise the potential impacts of spills on drinking water quality.

(*Department of Water, Water Corporation)*

7 The Water Corporation's existing surveillance program should be maintained to identify any incompatible land uses or potential threats within the Mount Peron water reserve and Leeman (Midway) water reserve *(Water Corporation).*

8 Signs should be erected along the boundary of the Mount Peron water reserve and Leeman (Midway) water reserve to define the location and promote awareness of the need to protect drinking water quality. Signs should include an emergency contact telephone number (*Water Corporation*).

9 A review of this plan should be undertaken after five years (*Department of Water*).

10 Bore 3-91 should remain in service until it is no longer required or a new bore can be established, possibly within the Mount Peron water reserve, If a new bore is established, the Leeman (Midway) water reserve should be deproclaimed (*Water Corporation, Department of Water*)

# Appendix A Water quality

The Water Corporation has monitored the raw (source) water quality from Mt Peron and Midway borefields in accordance with the Australian Drinking Water Guidelines (ADWG) and interpretations agreed to with the Department of Health. This water quality report is for the period January 2002 to June 2007. The raw water is regularly monitored for:

**a. Aesthetic related characteristics**– (Non-Health Related)

**b. Health related characteristics**

- Health-related chemicals
- Microbiological contaminants

Following is data representative of the quality of raw water in Mt Peron and Midway borefields. In the absence of specific guidelines for raw water quality, the results have been compared with ADWG values set for drinking water, which defines the quality requirements at the customers tap. Results that exceed ADWG have been shaded to give an indication of potential raw water quality issues associated with this source.

It is important to appreciate that the raw water data presented does not represent the quality of drinking water distributed to the public. Barriers such as storage and water treatment, to name a few, exist downstream of the raw water to ensure it meets the requirements of ADWG. For more information on the quality of drinking water supplied to Greenhead and Leeman refer to the most recent Water Corporation Drinking Water Quality Annual Report at <http://www.watercorporation.com.au/W/waterquality_annualreport.cfm?uid=2377-9937-9579-7091>.

**Aesthetic Related Characteristics**

Aesthetic water quality analyses for raw water from Mt Peron and Midway borefields are summarised in Table 1.

The values are taken from ongoing monitoring for the period January 2002 to June 2007. All values are in milligrams per litre (mg/L) unless stated otherwise. Any water quality parameters that have been detected are reported, those that have on occasion exceeded the ADWG are shaded.

The raw water from Mount Peron wellfield is of good quality complying with ADWG aesthetic guidelines with the exception of pH levels typically of higher acidity than the aesthetic guideline. However, compliance with the ADWG is based on treated water.

Although the pH of the raw water may be of concern the quality of the water delivered to consumers complies with the ADWG guideline values.

The raw water from Midway wellfield is of poor quality with high salinity and hardness levels. This source is used in emergencies only.

*Table 1 Aesthetic related detections for Mt Peron and Midway borefields*

| Parameter | Units | ADWG Aesthetic Guideline Value* | Mt Peron Bore 1/91 SP | | Midway Bore 3/91 SP | |
|---|---|---|---|---|---|---|
| | | | Range | Median | Range | Median |
| **Aluminium unfiltered** | mg/L | na | <0.008 - 0.07 | <0.008 | <0.008 | <0.008 |
| **Chloride**† | mg/L | 250 | 280 - 285 | 280 | 240 | 240 |
| **Conductivity at 25ºC** | mS/m | na | 98 - 120 | 105 | 130 - 145 | 135 |
| **Hardness as $CaCO_3$**† | mg/L | 200 | 94 - 104 | 98 | 383 | 383 |
| **Iron unfiltered** | mg/L | 0.3 | <0.003 - 3.2 | 0.006 | <0.003 - 0.045 | 0.004 |
| **Manganese unfiltered** | mg/L | 0.1 | <0.002 - 0.075 | 0.002 | <0.002 | <0.002 |
| **pH** | - | 6.5 - 8.5 | 5.58 - 6.62 | 5.65 | 6.91 - 7.04 | 6.94 |
| **Sodium**† | mg/L | 180 | 150 - 170 | 160 | 130 | 130 |
| **Sulphate**† | mg/L | 250 | 33 - 35 | 34 | 23 | 23 |
| **Total Filterable Suspended Solids**† | mg/L | 500 | 535 - 568 | 560 | 903 | 903 |
| **Turbidity** | NTU | 5 | <0.1 - 43 | <0.1 | <0.1 - 0.2 | <0.1 |

* An aesthetic guideline value is the concentration or measure of a water quality characteristic that is associated with good quality water.

† Water quality data observed from 5 or less sampling occasions

### Health Related Characteristics

### Health Parameters

Raw water from Mt Peron and Midway borefields are analysed for health related chemicals including inorganics, heavy metals, industrial hydrocarbons and pesticides. Health related water quality parameters that have been measured at detectable levels in the source between January 2002 and June 2007 are summarised in the Table 2. Any parameters that have on occasion exceeded the ADWG are shaded.

All detected health parameters at the Mount Peron and Midway wellfields are at levels which pose no health concern. Monitoring of health parameters is ongoing.

*Table 2 Health related detections¥ for Mt Peron and Midway borefields*

| Parameter | Units | ADWG Health Guideline Value* | Mt Peron Bore 1/91 SP | | Midway Bore 3/91 SP | |
|---|---|---|---|---|---|---|
| | | | Range | Median | Range | Median |
| **Barium** | mg/L | 0.7 | 0.15 - 0.16 | 0.16 | 0.04 | 0.04 |
| **Boron** | mg/L | 4 | <0.02 - 0.022 | <0.02 | 0.065 | 0.065 |
| **Nitrate as nitrogen** | mg/L | 11.29 | 0.81 - 0.82 | 0.815 | - | - |
| **Nitrite plus nitrate as N** | mg/L | 11.29 | 0.48 - 0.8 | 0.77 | 1.8 | 1.8 |

¥Water quality data observed from 5 or less sampling occasions

* 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 (NHRMC & ARMCANZ, 1996).

### Microbiological Contaminants

Microbiological testing of raw water samples from the Mt Peron borefield is currently conducted on a monthly basis. *Escherichia coli* counts are used as an indicator of the degree of recent faecal contamination of the raw water from warm-blooded animals. A detection of *Escherichia coli* in raw water abstracted from any bore may indicate possible contamination of faecal material through ingress in the bore, or recharge through to the aquifer (depending on aquifer type).

During the reviewed period of January 2002 to June 2007, positive *Escherichia coli* counts were not recorded in any of samples collected from the borefield. This low occurrence of *Escherichia coli* detections is indicative of minimal contamination of the groundwater from faecal sources.

Low-level detections of thermotolerant coliforms were recorded in 18% of raw water samples from the Midway Bore 3/91 in the period of December 2000 to December 2002 when production sampling from this bore ceased.

# Appendix B Photographs


*Photo 1 Midway Bore 3/91*

*Photo 2 Coorow-Green Head Road*

*Photo 3 Mount Peron storage tank*

*Photo 4 Land surrounding the Mount Peron Water Reserve*

# Glossary

| | |
|---|---|
| **Abstraction** | The pumping of groundwater from an aquifer. |
| **ADWG** | The Australian Drinking Water Guidelines, outlining guideline criteria for the quality of drinking water in Australia. |
| **Aesthetic guideline** | Australian Drinking Water Guidelines value which is the concentration of measure of a water quality characteristic that is associated with acceptability of water to the consumer e.g. appearance, taste and odour (NHMRC & NRMMC, 2004). |
| **Allocation** | The quantity of water permitted to be abstracted by a licence, usually specified in kilolitres per annum (kL/a). |
| **ANZECC** | Australian and New Zealand Environment Conservation Council. |
| **Aquifer** | A geological formation or group of formations able to receive, store and transmit significant quantities of water. |
| **ARMCANZ** | Agriculture and Resource Management Council of Australia and New Zealand. |
| **Bore** | A narrow, lined hole, also known as a well, drilled to monitor or draw groundwater. |
| **Bore field** | A group of bores to monitor or withdraw groundwater. |
| **CFU** | Colony forming units is a measure of pathogen contamination in water. |
| **Confined aquifer** | An aquifer that is confined between non-porous rock formations (such as shale and siltstone) and therefore contains water under pressure. |
| **Diffuse source** | Pollution originating from a widespread area e.g. urban stormwater runoff, agricultural infiltration. |
| **EC** | Electrical conductivity estimates the amount of total dissolved solids (TDS), or the total amount of dissolved ions in a solution (water) corrected to $25^{o}$ Celsius. Measurement units include milliSiemens per metre and microSiemens per centimetre. |
| **GL** | Gigalitre (1 000 000 000 litres) or 1 million kilolitres |
| **ha** | Hectare (a measure of area) |

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|---|---|
| **HAZMAT** | Hazardous Materials |
| **Health guideline** | Australian Drinking Water Guideline value which is the concentration of 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 (NHMRC & NRMMC 2004). |
| **Hydrogeology** | The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality. |
| **kL** | Kilolitre (1000 litres) or 1 cubic metre |
| **km** | Kilometre (1000 metres) |
| **$km^2$** | Square kilometre (a measure of area) = 1 million square metres |
| **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. |
| **LEMC** | Local Emergency Management Committee |
| **m** | Metres |
| **mg/L** | Milligram per litre (0.001 grams per litre) as a measurement of a total dissolved solid in a solution. |
| **ML** | Megalitre (1 000 000 litres) |
| **mm** | Millimetre |
| **MPN** | Most probable number (a measure of microbiological contamination). |
| **mSv** | Millisievert is a measure of annual radiological dose, with a natural dose equivalent to 2mSv/yr. |
| **mS/m** | MilliSiemens per metre is a measure of electrical conductivity of a solution or soil and water mix that provides a measurement of salinity. |
| **NHMRC** | National Health and Medical Research Council. |

| | |
|---|---|
| **NRMMC** | Natural Resource Management Ministerial Council. |
| **Nutrients** | Minerals dissolved in water, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorous (phosphate) which provide nutrition (food) for plant growth. Total nutrient levels include the inorganic forms of an element plus any bound in organic molecules. |
| **Pathogen** | A disease producing organism that can cause sickness and sometimes death through the consumption of water contaminated by pathogens, including bacteria (such as *Escherichia coli*), protozoa (such as *Cryptosporidium* and *Giardia*) and viruses). |
| **Perched** | An unconfined aquifer, often ephemeral or seasonal, perched on top of an impermeable horizon near the land surface and separated from deeper groundwater by an unsaturated zone. |
| **Pesticides** | Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms. |
| **Point source pollution** | Pollution originating from a specific localised source, 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 Drinking Water Source Area (PDWSA)** | Includes all underground water pollution control areas, catchment areas and water reserves constituted under the *Metropolitan Water Supply Sewerage and Drainage Act 1909* and the *Country Areas Water Supply Act 1947*. |
| **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. |
| **Scheme supply** | Water diverted from a source or sources by a water authority of private company and supplied via a distribution network to customers for urban, industrial or irrigation use. |

| | |
|---|---|
| **Stormwater** | Rainwater which has run off the ground surface, roads, paved areas etc. and is usually carried away by drains. |
| **TCU** | True colour units (a measure of degree of colour in water) |
| **TDS** | Total dissolved salts, a measurement of ions in solution, such as salts in water. |
| **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 in which the upper surface of water is lower than the top of the aquifer itself. 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. |
| **Water Reserve** | An area proclaimed under the *Country Areas Water Supply Act 1947* or the *Metropolitan Water Supply Sewerage and Drainage Act 1909* for the purposes of protecting a drinking water supply. |
| **Watertable** | The upper saturated level of the unconfined groundwater. |
| **Well field** | A group of bores to monitor or withdraw groundwater. |
| **Wellhead** | The top of a well (or bore) used to draw groundwater. A wellhead protection zone (WHPZ) is usually declared around wellheads in drinking water areas to protect the water source from contamination. |
| **WESTPLAN HAZMAT** | Western Australian Plan for Hazardous Materials. |

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