Department of Water
Government of Western Australia

*Looking after all our water needs*

# Gibson Water Reserve drinking water source protection plan

## Gibson town water supply

Water resource protection series

REPORT NO. 85
May 2008

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For more information about this report, contact the Department of Water officers listed above, Water Source Protection branch or send your query to <drinkingwater@water.wa.gov.au>.

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# Preface

The Department of Water has prepared this draft drinking water source protection plan to report on the activities and risks to water quality within the Gibson Water Reserve 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 and the hazards and hazardous events that can compromise drinking-water quality, and developing and implementing preventative 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 boundaries of the drinking water source for the town of Gibson. 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.

The plan is expected to guide state and local government land use planning decisions. Accordingly, it should be recognised in the Shire of Esperance's 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 Gibson Water Reserve.

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

Gibson is a small town and agricultural service centre in the Great Southern region of Western Australia, located 24 kilometres north of Esperance. Gibson obtains its drinking water from a Water Corporation wellfield that draws groundwater from a relatively shallow and unconfined aquifer. This means that best practice management measures are needed to protect this drinking water source from contamination.

Gibson Water Reserve was proclaimed in 1990 under the *Country Areas Water Supply Act 1947.* Reviewing the appropriateness of the existing Gibson Water Reserve is a key part of developing this plan. The area of land actually required to protect the water source has been reconsidered. An amended water reserve is proposed, with land to the east and some of the land to the north and south of the existing reserve excluded. The proposed new water reserve is approximately half the size of the existing reserve.

Most of the proposed new water reserve comprises rural (pastoral and grazing) land. It is proposed that this portion of the reserve should have Priority 2 classification. Within the Gibson townsite, however, there are a number of approved and proposed land uses and activities as per the Shire of Esperance's *Draft town planning scheme 23* (section 4.3 and Figure 4b).

In general, the land uses and activities currently occurring are compatible with the proposed water reserve and maintaining the supply of good quality drinking water to Gibson. The fuel storage facilities, however, at the Gibson Soak Hotel and Store are a potential risk and require careful ongoing management. Current practices to manage this risk include a comprehensive method to account for all fuel supplied and stored. In addition, a Water Corporation monitoring bore is located between the production bores and fuel facilities.

This groundwater resource can be protected through the identification of appropriate priority areas and protection zones to guide land use planning and development. This approach recognises previous land use planning decisions and the rights of landowners to continue activities on their land that are consistent with its approved zoning.

# 1 Drinking water source overview

Gibson is located in the Great Southern region of Western Australia within the Shire of Esperance, 24 kilometres (km) north of Esperance and 747 km south-east of Perth. With a population of approximately 150, the town provides a small service centre for local primary industry.

## 1.1 Existing water supply system

Approximately 50 services are supplied with drinking water in Gibson, with a total consumption of around 15 000 kilolitres per year (kL/year). This level of supply has remained relatively constant since 2002.

Groundwater is extracted from the Water Corporation wellfield approximately 1 km south of the Gibson town centre (Figure 2). The wellfield comprises two production bores, Gibson bore 1/03 and Gibson bore 1/06, which tap into a shallow unconfined aquifer and are located about 7 m apart. They supply water to the distribution network as required, pumping to a 200 kL elevated tank, in order to maintain pressure in the network.

## 1.2 Water treatment

Raw water from the Gibson wellfield is chlorinated before being supplied to the town. This provides a disinfection barrier against possible microbiological contamination.

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 2004a) and reflects a risk-based, catchment to consumer, multiple barrier approach for the provision of safe drinking water to consumers. This approach is also endorsed by the Department of Health and the Water Corporation.

## 1.3 Catchment details

### 1.3.1 Physiography

The area is characterised by an almost flat sandplain containing a number of wetlands. The plain is on relatively high ground, and slopes gently from a low hill (165 m AHD) located about 5 km east of Gibson to wide valleys (Kern 1992).

### 1.3.2 Climate

Gibson has a temperate climate, experiencing cool, wet winters and warm dry summers. There is no direct rainfall data for Gibson. However, Esperance Airport, approximately 4 km to the south, has an average rainfall of 555 millimetres per year.

### 1.3.3 Hydrogeology

The region is underlain by weathered granitic rocks of the Albany–Fraser Orogen. The weathered granitic bedrock is overlain by sedimentary rocks of the Plantagenet Group. These sediments are covered by sand and clay deposits originating from the sandplain (Kern 1992).

The Plantaganet Group comprises a lower sandstone unit, the Werrillup Formation (up to 15 m thick) and an upper siltstone unit, the Pallinup Siltstone (10 to 20 m thick). The numerous wetlands in the area are the surface expression of perched shallow groundwater (Kern 1992).

Drinking water abstracted at Gibson is mainly from the Werrillup Formation. The principal recharge area for the wellfield (A.T. Laws 2007, pers. comm., 31 January) is comprised of higher ground to the east of the proposed water reserve (Figure 4).

## 1.4 Future water supply requirements

It is estimated that up to 60 000 kL a year could be sustainably abstracted from the current Gibson wellfield (Water Corporation 1998). As this represents around four times the demand for water than has been consumed in recent years (section 1.1), it is considered that this drinking water source can meet demand well into the future.

## 1.5 Protection and allocation

### 1.5.1 Existing water source protection

Gibson Water Reserve was proclaimed in 1990 under the *Country Areas Water Supply Act 1947* (CAWS Act), for the purpose of protecting the public drinking water source. This is shown in Figure 2.

Particular attention needs to be given to protecting this groundwater source because it is relatively shallow and unconfined nature. Protection measures that are already in place include fencing, signage and surveillance patrols of the production bores and their immediate surroundings.

### 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 1914* (RIWI Act). 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 Gibson Water Reserve is part of the Gibson groundwater area which was proclaimed under the RIWI Act in 1997. The Water Corporation can abstract up to 25 000 kL/year from the Gibson wellfield, as per their current licence for this purpose issued under the RIWI Act.

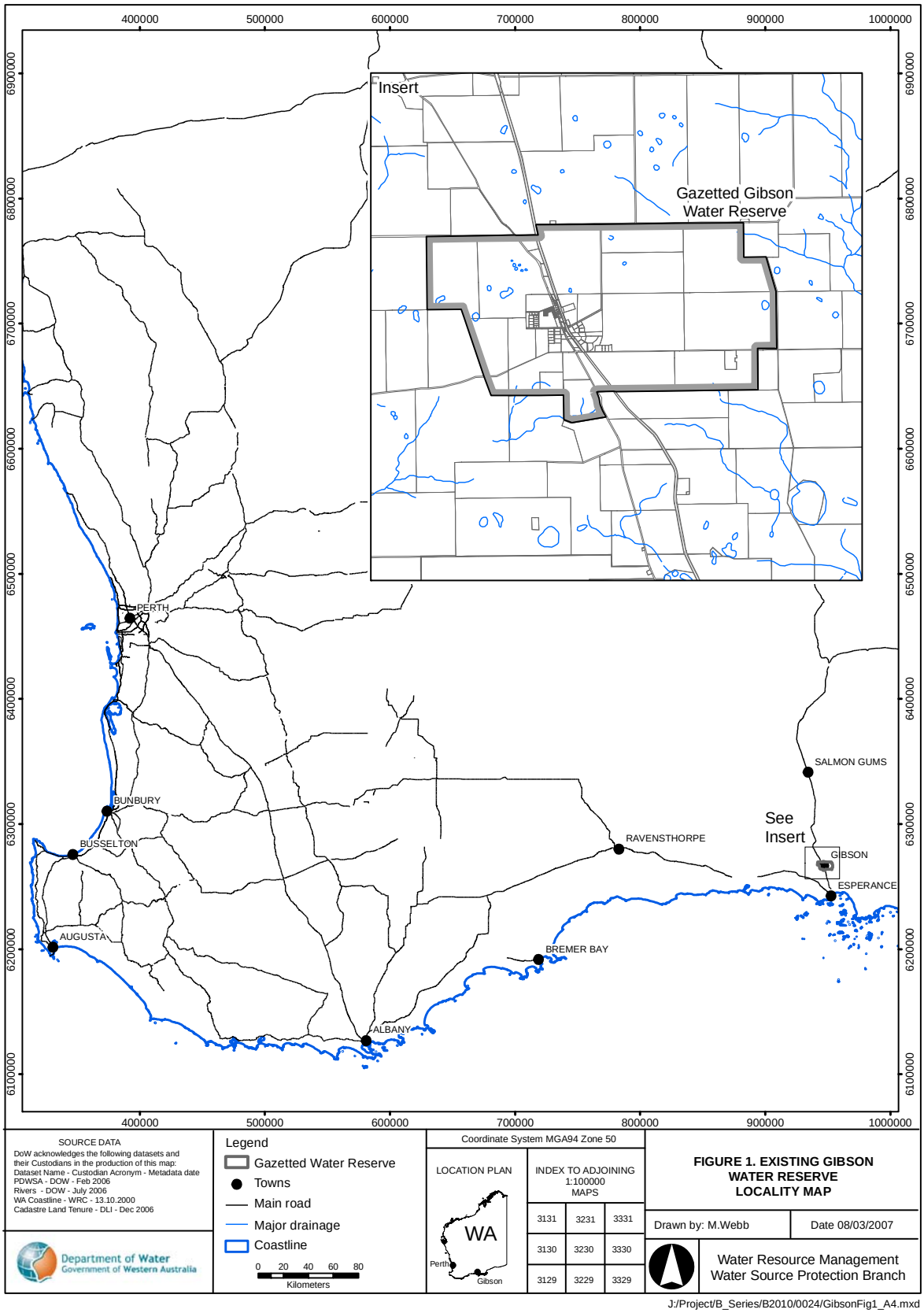


*Figure 1 Gibson Water Reserve locality map*

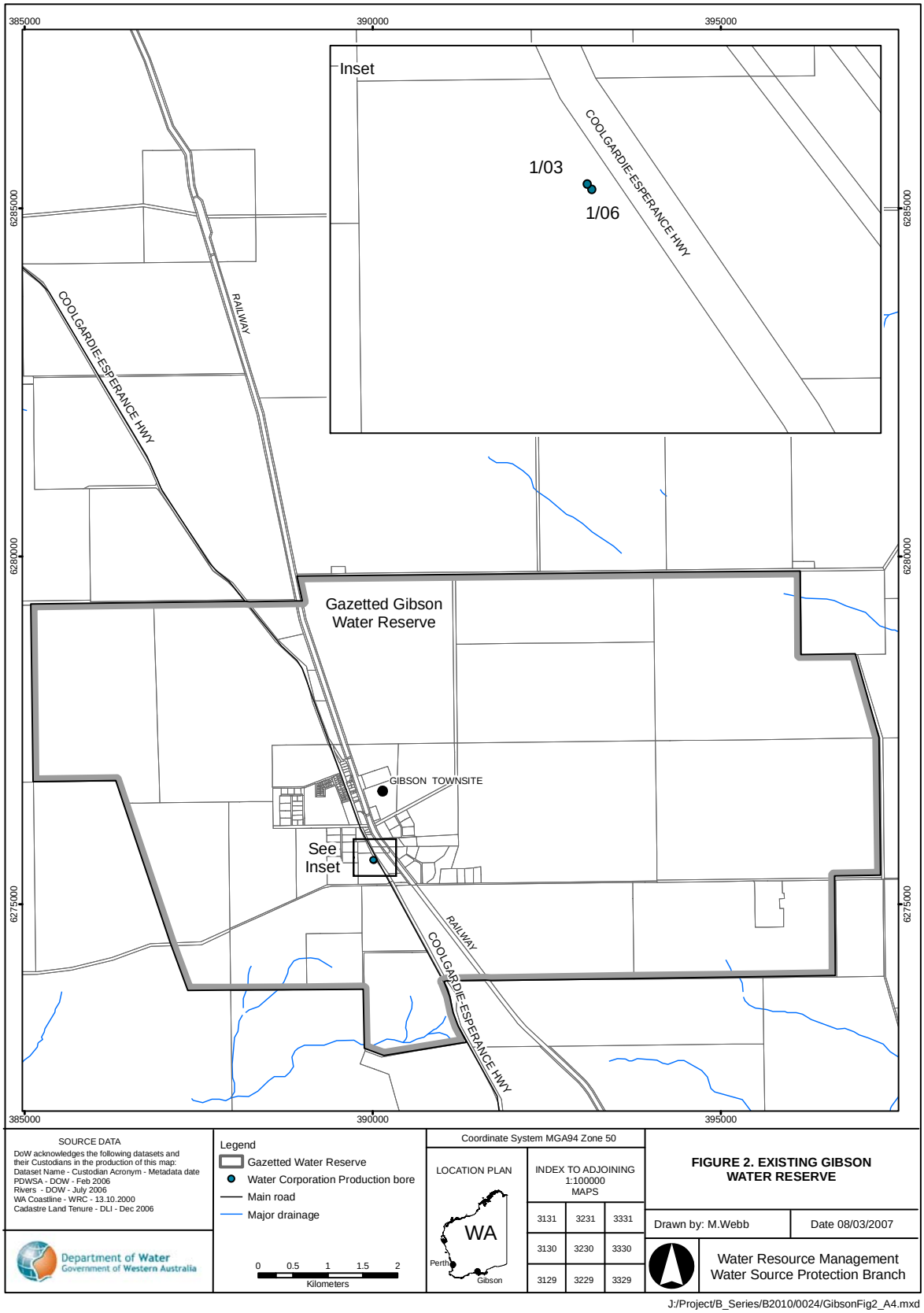


*Figure 2 Existing Gibson Water Reserve*

# 2 Water quality monitoring and contamination issues

A water quality summary for the Gibson Water Reserve from January 2002 to March 2007 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> Water> Water quality> Downloads.

Potential contamination risks related to the Gibson Water Reserve are described below and in Table 1 which also recommends protection strategies for managing these risks. The strategies balance the need to protect water quality for the community in the long term, with the rights of landholders to continue permitted land uses.

The Water Corporation regularly monitors the raw water quality from the Gibson Water Reserve for microbiological contamination, health related and aesthetic (non-health related) characteristics in accordance with the Australian Drinking Water Guidelines (ADWG). The results of this monitoring are then reviewed by an inter-agency committee, chaired by the Department of Health, called the Advisory Committee for the Purity of Water.

The highest potential risk to the Gibson water supply is the possibility of hydrocarbon contamination from fuel leaks and spills at the service station, which is part of the Gibson Soak Hotel and Store. The service station, including bulk fuel storage tanks, is located approximately 200 m from the drinking water wellfield. A Water Corporation monitoring bore is located immediately down-gradient of the fuel tanks. In addition, the service station operators monitor the volumes of fuel supplied and stored, so as to detect possible fuel leakages at an early stage.

Given the level of risk to the water supply from hydrocarbon contamination, a review of the current monitoring regime is recommended. Based on the findings of the review any necessary adjustments should be made to the monitoring regime.

There is a lower degree of risk associated with possible leachate export from the town's landfill facility, as well as the use of fertilisers, pesticides and herbicides from broadacre agriculture within the water reserve. There is also some risk of salinity increasing within the water reserve due to past land clearing. See section 4.5 and Table 1 for relevant protection strategies and best management practices.

## 2.1 Microbiological contaminants

Pathogens are types of micro-organisms that are capable of causing diseases. These include bacteria, protozoa and viruses. In water supplies, pathogens that can cause illness are mostly found in the faeces of humans and domestic animals.

There are a number of pathogens that are commonly known to contaminate water supplies worldwide. These include bacteria (for example, *Salmonella*, *Escherichia coli* and *Cholera*), protozoa (for example, *Cryptosporidium*, *Giardia*) and viruses.

*Escherichia coli* counts are a way of measuring these pathogens and are an indicator of faecal contamination.

Pathogen contamination of a drinking water source is influenced by the existence of pathogen carriers (that is, humans and domestic animals such as dogs or cattle), their transfer to and movement in the water source and the ability of the pathogen to survive in the water. 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).

The effect on people consuming drinking water that is contaminated with pathogens varies considerably, ranging from mild illness (such as stomach upset or diarrhoea) to death. In Walkerton, Canada in 2000, seven people died due to contamination by a pathogenic strain of *Escherichia coli* and *Campylobacter* in the town water source and supply (NHMRC & NRMMC 2004b). Preventing the introduction of pathogens into the water source is the most effective barrier in avoiding this public health risk.

## 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).

Nutrients (such as nitrogen) can enter drinking water supplies from leaching of fertilisers and septic tanks, and from animal faeces (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 three months old being most susceptible (NHMRC & NRMMC 2004a).

Hydrocarbons (fuels, oils and solvents) are potentially toxic to humans. If they are combined with chlorine during water treatment processes, harmful by-products may be formed.

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 use or over use and leakage from storage areas. In such cases, prompt action is required to notify relevant authorities and clean up the spill.

On average, untreated raw water from Gibson bore 1/06 contains levels of iodide above the applicable ADWG Health Guideline Value (Appendix A). As per standard practice, reports have been made to the Department of Health on the occasions when the ADWG value for iodide has been exceeded in the raw water. Chlorination during the water treatment process results in iodide being oxidised into iodine. This means that the drinking water actually supplied to consumers contains low levels of iodide, well below the relevant ADWG value.

As a result the Department of Health is satisfied that the issue is being addressed at this stage. The Water Corporation will continue monitoring iodide levels (and reporting to the Department of Health for guidance) on a monthly basis, for raw water from the wellfield and treated water within the reticulated supply system.

Please refer to Appendix A for information on the health related characteristics of the water within the Gibson wellfields.

## 2.3 Aesthetic characteristics

Impurities in drinking water such as appearance, taste, smell and feel can affect the aesthetic qualities of water. 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).

Some properties such as acidity and alkalinity (pH) can contribute to the corrosion and encrustation of pipes. Iron and dissolved organic matter can also affect the colour and appearance of water, and salinity can affect the taste. The ADWG set limits on water quality characteristics to meet aesthetic requirements of consumers.

On occasions the raw water from the Gibson wellfield has turbidity, sodium levels, iron levels and TFSS (a measure of salinity) above the ADWG value. The raw water also has pH slightly lower (alkaline) than the ADWG value.

Please refer to Appendix A for more information on the aesthetic characteristics of the water within the Gibson wellfields.

## 2.4 Installation of groundwater bores

Under the provisions of sections 26D and 5C of the RIWI Act, a licence is required to construct a bore or to extract water (unless exempt under the RIWI Exemption and Repeal (section 26C) Order 2001) within a proclaimed groundwater area. The Gibson Water Reserve is located within the Gibson groundwater area.

Any bores drilled near a public drinking water supply bore have 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 otherwise uncontaminated 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 will be assessed through the Department of Water's water licensing process where applicable 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).

Information on the production bores in the Gibson Water Reserve wellfield is provided in section 1.1.

# 3 Land use assessment

## 3.1 Land uses and activities

Current and proposed land uses and activities within Gibson Water Reserve are outlined below. This information is expanded on in Table 1, which also provides suggested protection strategies for risks to water quality.

### 3.1.1 Urban residential, service industry and amenities

The town of Gibson contains approximately 45 dwellings. The Gibson Soak Hotel and Store is comprised of a hotel/motel, a general store and a service station. An oval is located approximately 800 m from the Gibson wellfield.

### 3.1.2 Agricultural

The predominant land use in and around Gibson Water Reserve is cropping and grazing. While there are some relatively large areas of remnant native vegetation present, for the most part the original native vegetation has been cleared from land in the water reserve.

### 3.1.3 Special rural

A special rural subdivision was recently approved at lots 9000 and 9500 Gibson–Dalyup Road, Gibson. This land is to the north-west of the wellfield, comprising blocks of 2 to 3.5 ha in size.

The subdivision is compatible with this plan, based on Department of Water advice provided as part of the Western Australian Planning Commission approval process. This includes specific conditions of approval regarding the subdivision being treated in a manner consistent with a Priority 2 water source protection area (section 4.3).

Subdivision approval stipulates that prospective purchasers of these special rural blocks must be advised that they will need to make their own arrangements for drinking water, as no reticulated supply can be provided to these blocks by the Water Corporation. There are also conditions in place on these lots that will assist with water source protection, regarding wastewater disposal systems and the keeping of horses.

### 3.1.4 Transport infrastructure

Both the Coolgardie–Esperance Highway and Railway pass through the water reserve. The railway is used for the bulk transport of cattle, chemicals (including sulfuric acid), iron ore, nickel, lead carbonate and potentially rare earths. There is no stop point at Gibson.

The highway tends to have low to medium levels of traffic flow.

### 3.1.5 Other land uses – light industrial and waste disposal

An area to the east of Gibson is zoned for general and light industry. This area is currently under-utilised for these purposes.

A small landfill area, which in the past has serviced the local community, is located approximately 600 m upstream of the Gibson wellfield. The Shire of Esperance has recently committed to investigate this landfill site's historical operation, and include it in their *Post closure management plan* for closed small rural landfills.

## 3.2 Compatibility of land uses and activities with water source protection

Generally, land uses and activities within the Gibson Water Reserve are consistent with the key objective of this plan (section 4.1, to protect the quality of groundwater at Gibson. There are, however, some issues that need to be addressed to ensure that this objective will be met in the future.

Given the proximity of the existing wellfield to the service station's bulk fuel storage tanks, appropriate actions in the case of hydrocarbon contamination is a key consideration of this plan. The department has determined, on the basis of the area's hydrogeology, that there may be suitable sites for an alternative wellfield that are well removed from the service station and within the proposed new water reserve (Table 1).

Gibson is unsewered and this means that properties throughout the water reserve use conventional septic and leach drain systems (Table 1). Given the small numbers of dwellings and commercial premises in the town centre and the distance between dwellings in the special rural subdivision and the wellfield, the risk to water quality from septic systems is considered low. Where possible and practicable, however, the adoption and use of appropriate alternative wastewater systems should be considered to reduce nutrient leaching and pathogen risks.

Should any new operations commence in the area of the Gibson townsite zoned for general/light industry, measures will need to be adopted to safeguard groundwater against possible fuel and chemical leaks and spills. The issue of potential leaching from the town's landfill of hydrocarbons, other chemicals or pathogens into groundwater is being addressed by the Shire of Esperance (section 3.1.5).

Other recommended protection strategies for the Gibson Water Reserve are provided in Table 1.

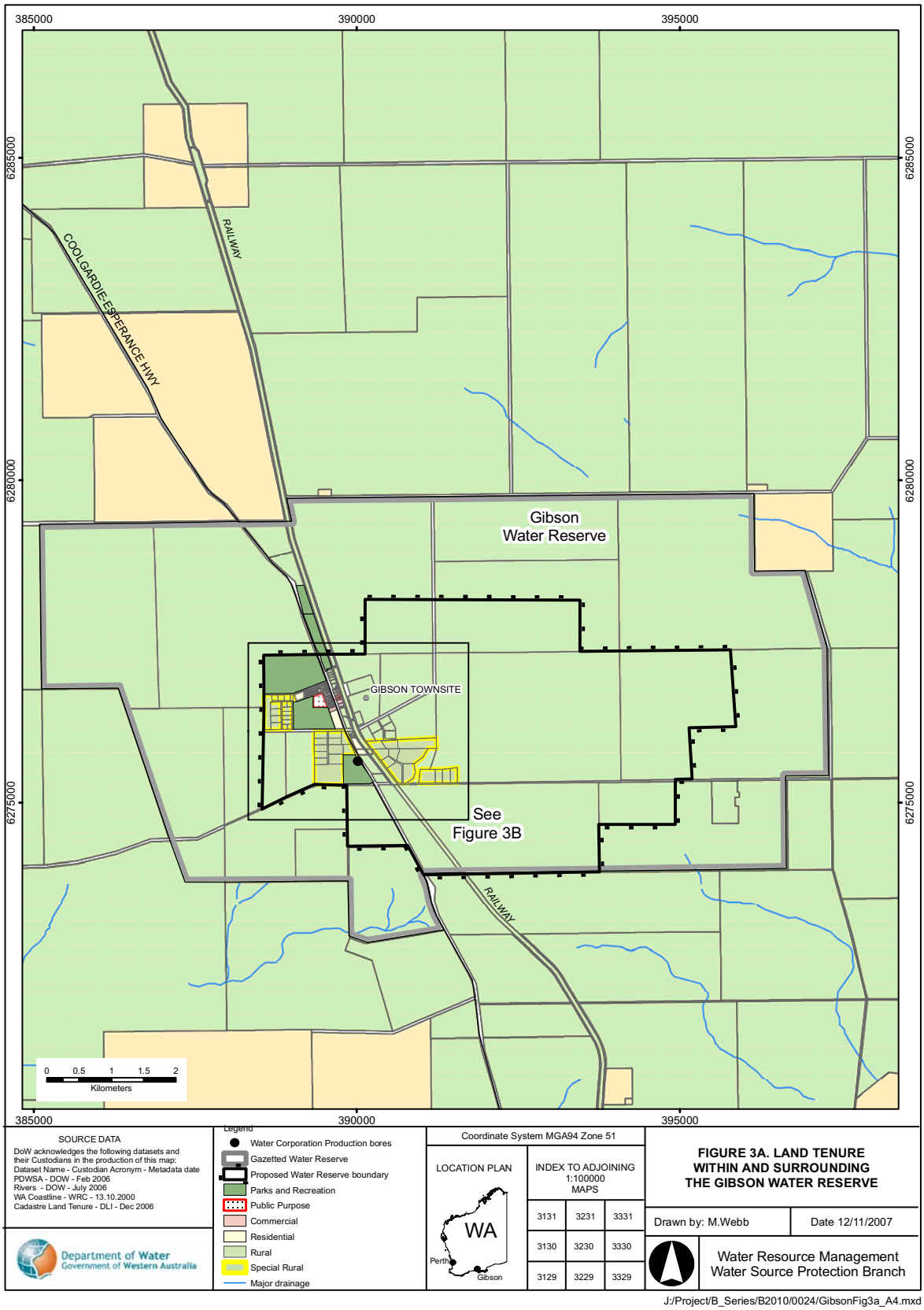


*Figure 3A Land tenure within and surrounding the Gibson Water Reserve*

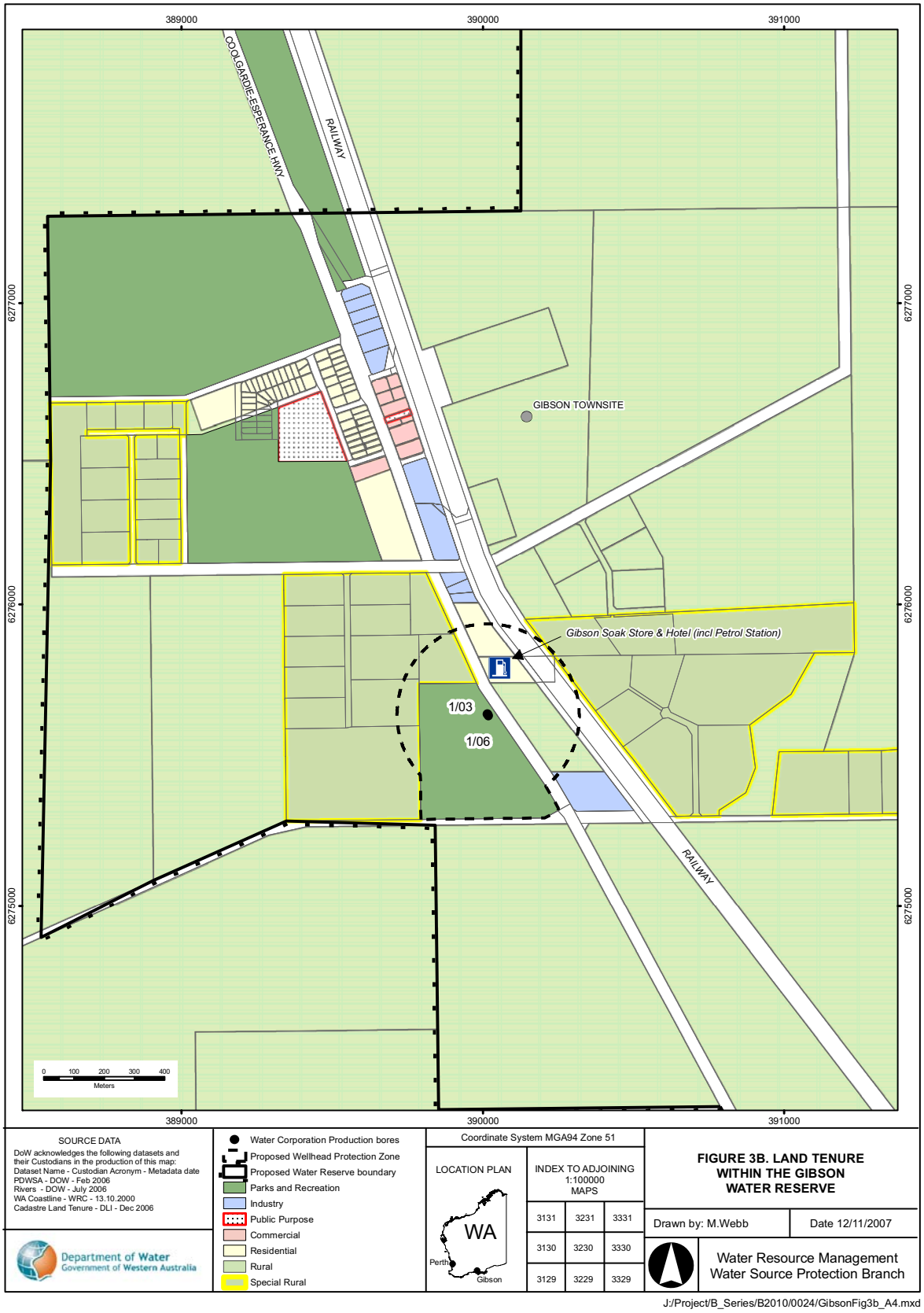


*Figure 3B Land tenure for the townsite and surrounds of the Gibson Water Reserve*

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

| Land use / activity | Potential water quality risks | | Consideration for management | Current preventative measures | Recommended protection strategies |
|---|---|---|---|---|---|
| | **Management priority** | **Hazard** | | | |
| Petrol station: (part of Gibson Soak Store and Hotel) | High | **Hydrocarbons** from bulk fuel storage tank; equipment failure; surface fuel spills. | The petrol station and its bulk fuel storage tanks are located about 200 m from the wellfield. | • Monitoring<br>- Water Corporation monitoring bore installed between petrol station and production bores<br>- service station operators monitor volumes of fuel supplied and stored to detect possible fuel leakages at early stage. | Ensure appropriate sampling of monitoring bore – including substances sampled for and frequency of sampling.<br><br>Consider upgrade of service station equipment/infrastructure.<br><br>Investigate alternative production bore locations (contingency measure should hydrocarbon contamination be detected). |

| Land use / activity | Potential water quality risks | | Consideration for management | Current preventative measures | Recommended protection strategies |
|---|---|---|---|---|---|
| | **Management priority** | **Hazard** | | | |
| Broadacre agriculture<br>(cropping and grazing) | Medium<br>Medium<br>Medium<br>Medium | **Nutrients** fertiliser use on crops<br>**Residual chemicals** from possible pesticide and herbicide use<br>**Hydrocarbons** from bulk fuel storage; tank and equipment failure; and surface fuel spills.<br>**Salinity** from land clearing (which mainly occurred well in the past). | Most of Gibson Water Reserve (existing and proposed reserves) is used for broadacre agriculture.<br>Minimal areas of original native vegetation remain.<br>Nutrients from fertilisers and residual chemicals from pesticides are variable, depending on application rates.<br>Many properties have bulk above-ground fuel storages, which typically are not bunded.<br>Tank and equipment failure and surface fuel spills must be managed.<br>The link between past land clearing practices and salinity is now understood. | • Water quality monitoring at wellfield | Encourage best practice management in the use of fertilisers, pesticides and herbicides and fuel management storage.<br>Refer to management advice:<br>Department of Water Water Quality Protection Notes including *Agriculture – dryland crops near sensitive water resources*<br>*Tanks for elevated chemical storage*<br>Water and Rivers Statewide Policy No.2 – *Pesticide Use in Public Drinking Water Source*<br>Department of Health *Use of Herbicides in Water Catchment Areas*, Circular No. PSC 88. |

| Land use / activity | Potential water quality risks | | Consideration for management | Current preventative measures | Recommended protection strategies |
|---|---|---|---|---|---|
| | **Management priority** | **Hazard** | | | |
| Special rural subdivision | Low<br><br>Low<br><br>Low<br><br>Low | **Pathogens** from septic tanks, leach drains and animal excreta.<br><br>**Nutrients** from septic tanks, leach drains; animal excreta; fertiliser use on lawns and gardens.<br><br>**Residual chemicals** from possible pesticide and herbicide use.<br><br>**Hydrocarbons** from fuel spills during private vehicle use and maintenance. | Western Australian Planning Commission conditions of subdivision approval and advice, as follows:<br>• Purchasers of lots must make their own arrangements for drinking water supply as they will not be connected to the Gibson town drinking water supply.<br>• Wastewater disposal systems must be at least 100 m from public water bores and natural watercourses and at least 2 m above the highest known groundwater level.<br>• Horse facilities are a conditional land use, subject to compliance with *Environmental Guidelines for Horse Facilities and Activities* (WRC, DEP & DoH 2002). | • Septic tanks, leach drains and other wastewater systems must comply with *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974* (Western Australia)<br>• Water quality monitoring at wellfield | Support the conditions of subdivision approval.<br>Encourage the use of appropriate alternative wastewater systems to reduce nutrients and pathogen risks of septic systems.<br>Ensure regular maintenance and assessment of septic systems.<br>Encourage best practice management in the use of fertilisers, pesticides and herbicides.<br>Refer to management advice listed above. |

| Land use / activity | Potential water quality risks | | Consideration for management | Current preventative measures | Recommended protection strategies |
|---|---|---|---|---|---|
| | **Management priority** | **Hazard** | | | |
| Roads and railways | Medium<br><br>Medium | **Hydrocarbons** from bulk fuel storage; tank and equipment failure; fuel and oil spills from vehicles and trains.<br>**Chemicals** from bulk fuel storage; equipment failure; spills from vehicles and trains. | The Coolgardie–Esperance Highway passes through Gibson, about 50 m from the wellhead at its closest point. Traffic levels are mostly low to medium.<br>The Coolgardie–Esperance Railway is about 250 m from the Gibson wellfield. Iron ore, nickel, lead carbonate and possibly rare earths are regularly transported along the line. Less frequently, large quantities of agricultural produce, fuel and chemicals are transported. Historically, accidents and spills are very rare. There is no stop point at Gibson. | • Water quality monitoring<br>• HAZMAT emergency response | • Develop a chemical spill response protocol.<br>• Ensure that WESTPLAN–HAZMAT procedures are in place. |
| Landfill | Medium to High | **Chemicals** (including nutrients and hydrocarbons) from leachate produced by materials deposited at landfill site. | This facility is about 600 m from the wellfield in the recharge area of the existing bores. It may be a point source for contaminants to groundwater and soil. | • Water quality monitoring<br>• Surveillance by Shire of Esperance staff | The Shire of Esperance has committed to investigate this landfill site's historical operation, and include it in the shire's Post Closure Management Plan for closed small rural landfills. This should include consideration of capping the landfill to prevent the ingress of water. |

# 4 Catchment protection strategy

## 4.1 Protection objectives

The key objective of this plan is to protect the groundwater resource in order to maintain a safe drinking water supply to consumers in Gibson. In achieving this objective, the department will recognise the rights of landowners for land uses and activities currently permitted in the proposed water reserve.

Management strategies are recommended to avoid, minimise or manage risks. This particularly applies to contamination risks from existing land uses, because of the vulnerability of the shallow unconfined groundwater source to potential contamination.

## 4.2 Proclaimed area

Figures 3A and 3B show the existing proclaimed Gibson Water Reserve and the proposed amended water reserve. This proposed change reflects the department's current hydrogeological assessment of the area.

## 4.3 Priority areas and protection zones

Land within public drinking water source areas is assigned a Priority 1, Priority 2 and/or Priority 3 (P1, P2 and P3) classification. This means of defining areas to protect water quality takes into account land use information, including zoning and ownership, the importance of the water source, and its vulnerability to existing land uses.

Most of the new water reserve comprises rural (pastoral and grazing) land for which a Priority 2 classification is proposed. Priority 2 protection is based on the objective of minimising risks to the water source. This provides a consistent level of protection throughout the area, and is in line with the land uses and activities within this part of the proposed water reserve.

The Gibson townsite however, contains a variety of existing and proposed land uses. Accordingly, for the townsite portion of the proposed water reserve various priority classifications are proposed, based on existing or proposed land uses of zonings shown in the Shire of Esperance's *Draft town planning scheme 23* (Figures 4A and 4B.)

Priority 1 classification, based on the objective of risk avoidance, is proposed for the areas within the townsite that have Parks and Recreation zoning. Priority 2 classification is proposed for existing and proposed Rural and Special Rural zoning areas within the reserve.

Priority 3 classification is proposed for other existing or proposed zonings within the townsite, including residential, industry and commercial areas. The aim of Priority 3 classification is to manage potential risks to the water source.

Figures 4A and 4B represent the proposed priority areas and protection zones within the Gibson Water Reserve.

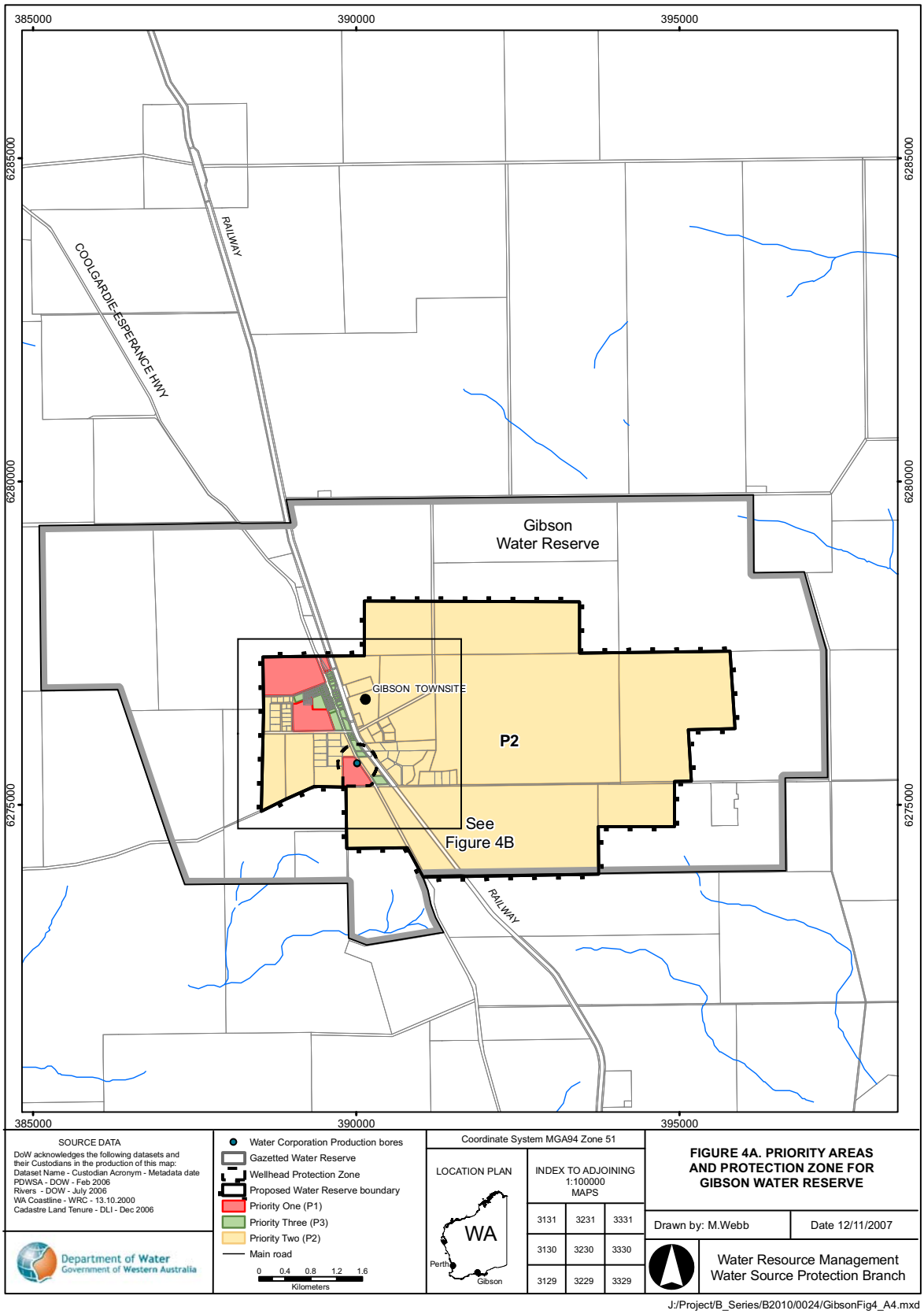


*Figure 4A Proposed priority classifications and protection zone for Gibson Water Reserve*

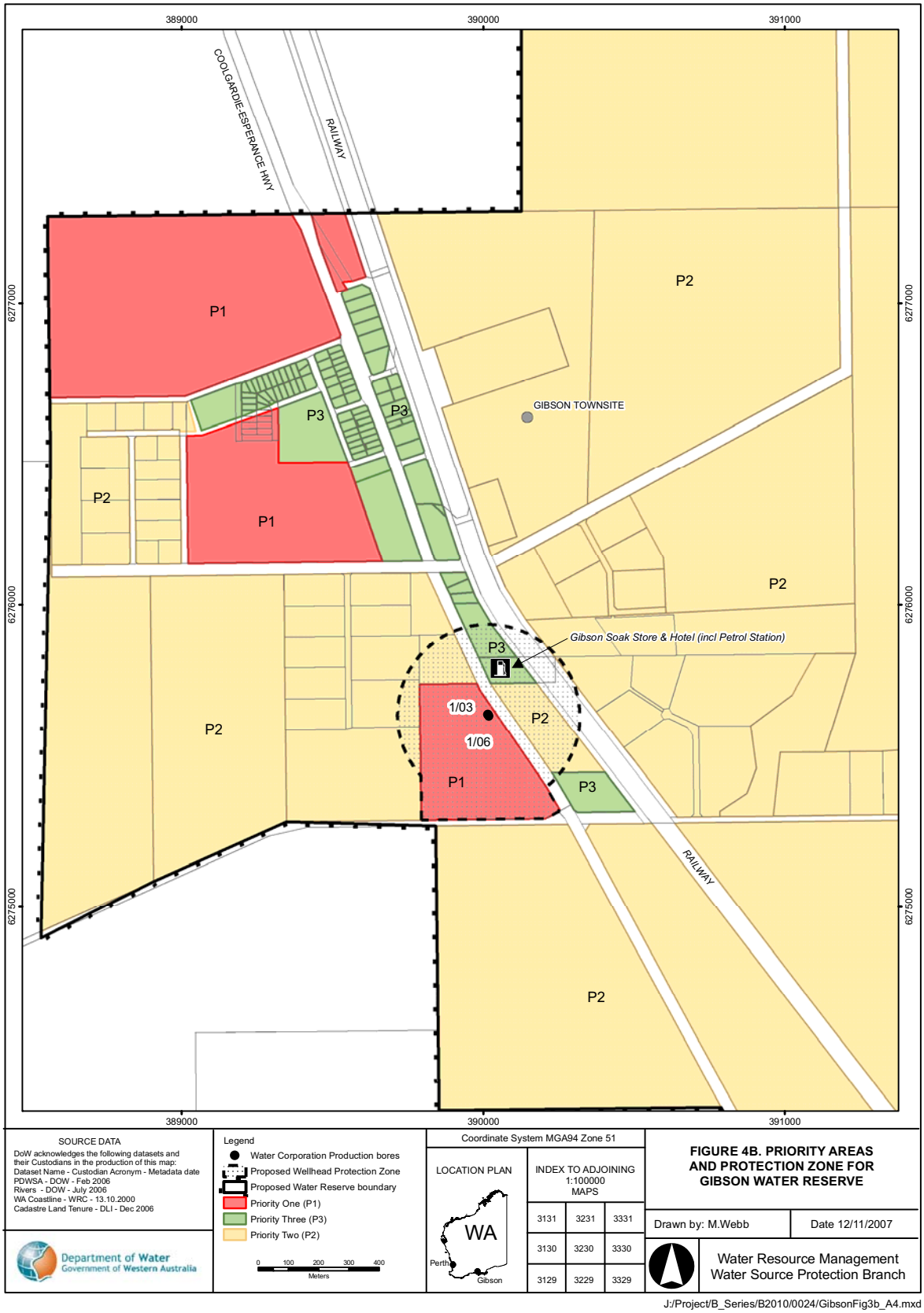


*Figure 4b Proposed priority classifications and protection zone for the townsite and surrounds within Gibson Water Reserve*

## 4.4 Land use planning

It is recognised under the *State planning strategy* (Western Australian Planning Commission 1997) that the establishment of appropriate protection mechanisms in statutory land use planning processes is necessary 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 important that the Gibson Water Reserve wellhead protection zones and priority areas are recognised in the Shire of Esperance's town planning scheme and local planning strategy.

Any development proposals within the Gibson 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.

## 4.5 Best management practices

There are opportunities to 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 and water quality protection notes. These have been developed in consultation with stakeholders such as industry groups, primary producers, state government agencies and technical advisers. Examples include water quality protection notes on:

- *Agriculture - dryland crops near sensitive water resources*
- *Contaminant spills - emergency response*
- *Light industry near sensitive waters*
- *Tanks for elevated chemical storage*
- *Tanks for underground chemical storage*
- *Temporary skid mounted fuel transfer and storage in public drinking water source areas*
- *Protecting public drinking water source areas*
- *Rural restaurants, cafes and taverns near sensitive water resources*

These guidelines assist business and land managers to reduce the risk that their operations may cause unacceptable environmental impacts. The guidelines are recommended as best practice for water quality protection.

Education and awareness (for example, signage and information material) is another mechanism for water quality protection, especially for people visiting the area who are unfamiliar with the Gibson Water Reserve's location and purpose. A brochure will be produced, describing the water reserve, its 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.

## 4.6 Surveillance and by-law enforcement

The *Country Areas Water Supply Act 1947* provides by-laws to protect drinking water quality in proclaimed water sources. The Department of Water considers by-law enforcement, through on-ground surveillance of land use activities, as an important water quality protection mechanism. Signs are erected around proclaimed water sources to educate the public and to advise of activities that are prohibited or regulated.

The department already delegates by-law enforcement, associated surveillance and appropriate signage for the Gibson Water Reserve to the Water Corporation. This plan recommends the continuation of these arrangements.

## 4.7 Emergency response

Escape of contaminants during unforeseen incidents and the use of chemicals during emergency responses can result in water contamination. The Shire of Esperance Local Emergency Management Advisory Committee (LEMAC), as part of the Goldfields–Esperance Emergency Management District, needs to be familiar with the location and purpose of the Gibson Water Reserve. A locality plan should be provided to the Fire and Rescue Services headquarters for the Hazardous Materials Emergency Advisory Team (HAZMAT). It is important for the Water Corporation to have an advisory role to any HAZMAT incident in the Gibson Water Reserve.

Personnel who deal with WESTPLAN–HAZMAT (Western Australian plan for hazardous materials) incidents within the area need access to a map of the Gibson Water Reserve. It is also expected that these personnel will have an adequate understanding of the potential impacts of spills on this water resource.

## 4.8 Implementation of this plan

Table 1 identifies the potential water quality risks associated with existing land uses in the Gibson Water Reserve and recommends protection strategies to minimise these risks.

Following publication of the *Gibson Water Reserve drinking water source protection plan*, an implementation strategy will be developed that is based on the recommendations in Table 1. It will describe timeframes for the recommended protection strategies and identify responsible stakeholders and sources of funding. This is reflected in section 5 Recommendations of this plan.

# 5 Recommendations

1 Amend the boundary of the existing Gibson Water Reserve under the *Country Areas Water Supply Act* 1947 consistent with the proposed new water reserve, reduced in area, as shown in Figures 4A and 4B. Also, assign the priority areas and protection zone within the new water reserve (*Department of Water*).

2 The Shire of Esperance's town planning scheme and other relevant local/district land use planning strategies should incorporate this plan and reflect the new boundary identified for the Gibson Water Reserve, its priority areas and protection zone in accordance with Statement of planning policy no. 2.7 – *Public drinking water source policy* (*Shire of Esperance*).

3 Implement the recommended protection strategies as detailed in Table 1 of this plan (*Water Corporation; Shire of Esperance; landowners, business operators, residents and development proponents*).

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

5 All development proposals within the Gibson 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 with recommendations in this plan should be referred to the Department of Water for advice and recommendations (*Western Australian Planning Commission; Department for Planning and Infrastructure; Shire of Esperance; development proposal proponents*).

6 Contamination incidents covered by WESTPLAN–HAZMAT in the Gibson Water Reserve should be addressed through the following:

- the Shire of Esperance Local Emergency Management Advisory Committee (LEMAC) should be made aware of the location and purpose of the Water Reserve
- the locality plan for the Water Reserve is to be provided to the fire and rescue headquarters for the HAZMAT Emergency Advisory Team
- the Water Corporation is to provide an advisory role during incidents in the Gibson Water Reserve
- personnel dealing with WESTPLAN–HAZMAT incidents in the area should have ready access to a locality map of the water reserve, and information to help them recognise the potential impacts of these incidents (including fuel and chemical spills) on drinking water quality (Department of Water; Water Corporation).

7 Signs should be erected to define the location and promote awareness of the need to protect drinking water quality in the new Gibson Water Reserve. These

signs are to include an emergency contact telephone number (*Water Corporation*).

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

9 A review should be undertaken of the adequacy of existing monitoring regimes to detect hydrocarbon spills and leaks from the service station at the Gibson Soak Store and Hotel (*Water Corporation*).

10 A strategy should be developed that effectively manages the risk to water quality from fuel spills and leaks, particularly from underground storage tanks. Upgrading of equipment/infrastructure at the service station needs to be a key consideration, such as construction of a hard stand area around the fuel pumps (*Proprietors Gibson Soak Store and Hotel; South East Petroleum*).

11 As a contingency measure, Water Corporation should consider the feasibility of alternative wellfield sites located a considerable distance from/up-gradient of the service station (*Water Corporation*).

# Appendices

## Appendix A – Water quality

The Water Corporation has monitored the raw source water quality from Gibson borefield in accordance with the *Australian drinking water guidelines* (ADWG) and interpretations agreed to with the Department of Health. The raw water is regularly monitored for:

- aesthetic related characteristics (non-health related)
- health related characteristics including:
    - health related chemicals
    - microbiological contaminants.

The following data is representative of the quality of raw water from the Gibson borefield. In the absence of specific guidelines for raw water quality, the results have been compared with ADWG values set for drinking water, which define the quality requirements at the customer's 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 this raw water data does not represent the quality of drinking water distributed to the public. Barriers such as storage and water treatment exist downstream of the raw water to ensure it meets the requirements of ADWG.

The values are taken from ongoing monitoring for the period of January 2002 to March 2007. All values are in milligrams per litre (mg/L) unless stated otherwise.

Any water quality parameters that have been detected are reported to the Department of Health; those that have on occasion exceeded the ADWG are shaded in the following tables.

For more information on the quality of drinking water supplied to Gibson, refer to the most recent Water Corporation drinking water quality annual report at <www.watercorporation.com.au/W/waterquality_annualreport.cfm?uid=2377-9937-9579-7091>.

### Aesthetic related characteristics

Aesthetic water quality analyses for raw water from Gibson borefield are summarised in Table A1.

*Table A1 Aesthetic related detections for Gibson borefield*

| Parameter | Units | ADWG Aesthetic guideline value* | Gibson Bore 01/06 SP | | Gibson Bore 1/03 SP | |
|---|---|---|---|---|---|---|
| | | | Range | Median | Range | Median |
| **Aluminium unfiltered** | mg/L | NA | 0.036–0.15 | 0.0525 | 0.018–0.37 | 0.07 |
| **Chloride**† | mg/L | 250 | 245 | 245 | 150–210 | 180 |
| **Colour – True** | TCU | 15 | <1–2 | <1 | <1–6 | <1 |
| **Conductivity at 25 ºC** | mS/m | NA | 95–105 | 98 | 65 –115 | 91 |
| **Hardness as $CaCO_3$**† | mg/L | 200 | 33 | 33 | 14.5–30 | 25.5 |
| **Iron unfiltered** | mg/L | 0.3 | 0.024–0.17 | 0.0625 | 0.026–2.8 | 0.075 |
| **Manganese unfiltered** | mg/L | 0.1 | 0.002–0.014 | 0.007 | <0.002–0.01 | 0.002 |
| **pH** | no units | 6.5–8.5 | 5.97–6.32 | 6.14 | 5.96–6.35 | 6.18 |
| **Sodium**† | mg/L | 180 | 180 | 180 | 125–185 | 160 |
| **Sulphate**† | mg/L | 250 | 57 | 57 | 45–61 | 58.5 |
| **Total filterable solids by summation (TFSS)**† | mg/L | 500 | 610 | 610 | 423–585 | 524 |
| **Turbidity** | NTU | 5 | 0.2–1.2 | 0.75 | 0.2–18 | 0.4 |

* 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 on four or less sampling occasions, at each sample point.

## Health related characteristics

### *Health parameters*

Raw water from Gibson borefield is analysed for health related chemicals including inorganics, heavy metals, industrial hydrocarbons and pesticides. Table A2 is a summary of health related water quality parameters that have been measured at detectable levels in the source.

*Table A2 Health related detections for Gibson borefield*

| Parameter | Units | ADWG Health Guideline Value* | Gibson Bore 01/06 SP | | Gibson Bore 1/03 SP | |
|---|---|---|---|---|---|---|
| | | | Range | Median | Range | Median |
| **Arsenic** | mg/L | 0.007 | <0.002–0.004 | <0.003 | <0.002–0.003 | <0.0025 |
| **Barium**† | mg/L | 0.7 | – | – | 0.008 | 0.008 |
| **Boron**† | mg/L | 4 | – | – | 0.5 | 0.5 |
| **Fluoride**† | mg/L | 1.5 | 0.45 | 0.45 | 0.35 | 0.35 |
| **Iodide** | mg/L | 0.1 | <0.02–0.22 | 0.185 | <0.02–0.14 | <0.1 |
| **Molybdenum**† | mg/L | 0.05 | – | – | 0.0025 | 0.0025 |
| **Nitrate as nitrogen** | mg/L | 11.29 | 0.013–0.027 | 0.02 | 1.1–2.9 | 1.8 |
| **Nitrite as nitrogen** | mg/L | 0.91 | <0.002–0.004 | <0.002 | <0.002–0.009 | 0.006 |
| **Nitrite plus nitrate as N** | mg/L | 11.29 | 0.009 | 0.009 | 0.075–1.8 | 1.5 |
| **Sulphate**† | mg/L | 500 | 57 | 57 | 45–61 | 58.5 |
| **Tributyltin oxide**† | ug/L | 1 | <0.002 | <0.002 | <0.002–0.002 | <0.002 |

* 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).

† Water quality data observed on four or less sampling occasions, at each sample point.

## Microbiological contaminants

Microbiological testing of raw water samples from Gibson borefield is currently conducted on a weekly 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 count less than 20 most probable number (MPN) per 100 mL is typically associated with low levels of faecal contamination and is used as a microbiological contamination benchmark of the raw water (World Health Organisation 1996). Counts of less than 20 MPN are seen as an indication of raw water that has not been recently contaminated with faecal material.

During the reviewed period of January 2002 to March 2007, there have been no positive *Escherichia coli* counts recorded in the raw water.

# Appendix B – Photographs

*Photo 1 Compound for the Gibson drinking water supply wellfield*

*Photo 2 Agricultural land, fringed by remnant native vegetation, typical of Gibson Water Reserve*


*Photo 3 Gibson Soak Hotel and Store*

# Glossary

**Abstraction** The pumping of groundwater from an aquifer.

**ADWG** *Australian drinking water guidelines* outline guideline criteria for the quality of drinking water in Australia.

**Aesthetic guideline** *Australian drinking water guidelines* value which is the concentration or measure of a water quality characteristic that is associated with acceptability of water to the consumer, for example, appearance, taste and odour (NHMRC & NRMMC 2004a).

**AHD** Australian Height Datum is the height of land in metres above mean sea level. For example, this is +0.026 m at Fremantle.

**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.

**Catchment** The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.

**CAWS Act** *Country Areas Water Supply Act 1947.*

**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, for example, urban stormwater runoff, agricultural infiltration.

**Effluent** The liquid, solid or gaseous wastes discharged by a process,

| | |
|---|---|
| | treated or untreated. |
| **GL** | Gigalitre (1 000 000 000 litres or 1 million kilolitres). |
| **HAZMAT** | Hazardous materials |
| **Health guideline** | An *Australian drinking water guidelines* value which 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 (NHMRC & NRMMC 2004a). |
| **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). |
| **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. |
| **LEMAC** | Local Emergency Management Advisory 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). |
| **MPN** | Most probable number (a measure of microbiological contamination). |
| **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. |
| **NTU** | Nephelometric turbidity units are a measure of turbidity in water. |
| **Nutrient load** | The amount of nutrient reaching the waterway over a given |

| | |
|---|---|
| | timeframe (usually per year) from its catchment area. |
| **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. |
| **PDWSA** | Public drinking water source area. 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*. |
| **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, rodenticides and so on, used to kill organisms. |
| **Point source pollution** | Pollution originating from a specific localised source, for example, sewage or effluent discharge, industrial waste discharge. |
| **Pollution** | Water pollution occurs when waste products or other substances (for example, effluent, litter, refuse, sewage or contaminated runoff) change the physical, chemical, biological or thermal properties of the water, adversely affecting water quality, living species and beneficial uses. |
| **Recharge** | Water infiltrating to replenish an aquifer. |
| **Recharge area** | An area through which water from a groundwater catchment percolates to replenish (recharge) an aquifer. An unconfined aquifer is recharged by rainfall throughout its distribution. Confined aquifers are recharged in specific areas where water leaks from overlying aquifers, or where the aquifer rises to meet the surface. |
| **RIWI Act** | *Rights in Water and Irrigation 1914.* |
| **TCU** | True colour units (a measure of degree of colour in water). |

| | |
|---|---|
| **TFSS** | Total filterable solids by summation (often used as one form of measurement for salinity levels). |
| **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. |
| **Wellfield** | A group of bores to monitor or withdraw groundwater. |
| **Wellhead** | The top of a well (or bore) used to draw groundwater. |
| **WHPZ** | Wellhead protection zone. The zone 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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