Safe Drinking Water Act 2011

Standard Drinking Water Risk Management Plan

GUIDANCE MANUAL (used to complete RMP Template)

Dual source water supplies – rainwater and bore water

Government of South Australia
SA Health

Background

The *Safe Drinking Water Act 2011* (the Act) and Safe Drinking Water Regulations 2012 (the Regulations) apply to all drinking water providers who supply water to the public. Under the Act drinking water providers must prepare and implement a drinking water risk management plan (RMP).

What is a drinking water risk management plan?

A risk management approach is recommended in the Australian Drinking Water Guidelines (ADWG) and the World Health Organisation's Guidelines for Drinking-water Quality. A drinking water RMP is a document that identifies hazards and associated risks that may affect drinking water quality. A RMP also documents preventative measures that have been identified to reduce or eliminate these risks and the day-to-day operational requirements for managing the system.

The level of detail contained in a RMP will vary according to the size, complexity and risk associated with the drinking water supply system. RMPs for small bore water based drinking water supplies do not require as much detail as those generated for complex drinking water supplies.

About this document

This guidance manual is to be used in conjunction with the Template – Standard RMP document for dual source water supplies - rainwater and bore water (**template document**). It contains all relevant information and step-by-step instructions for drinking water providers to prepare a Standard RMP. Adoption of an appropriate standard RMP fulfils the requirements of Part 3 of the Act in regard to RMPs.

Some sections of the RMP are standard for all drinking water supplies, and where applicable criteria have been pre-populated into the template document. Completion of the RMP requires the input of system specific information into the Template – Standard RMP document for dual source water supplies - rainwater and bore water **(template document)** using the following 9 steps (page number reference provided for relevant item in the **template document**):

Step 1: Provide RMP document control and review details (page 3)

Step 2: List relevant key contacts (page 3)

Step 3: Provide system description and schematic of your drinking water supply (page 4)

Step 4: Undertake risk assessment of water quality hazards (page 7)

Step 5: Review and modify the maintenance program (page 9)

Step 6: Review water quality testing program – insert relevant Table 4 and add Table 4.1 if required (page 11)

Step 7: Review and modify incident response criteria – (page 12)

Step 8: Identify personnel responsible for activities associated with RMP (page 14)

Step 9: Prepare record keeping documents using documentation templates in Appendix B

Who can adopt a standard RMP for dual source water supplies using rainwater and bore water?

This RMP is for drinking water providers who supply water with two types of source water - rainwater and bore water, including (but not limited to):

- Bed and breakfast / farm stays, caravan parks, holiday rentals, resorts, hotel / motel
- Community centres, sporting centres, convention centre
- Regulated premises such as schools, hospitals, aged care facilities

Contents

For drinking water quality assistance and enquires contact

Water Quality Unit, SA Health

- Phone: 0421 618 311 – for incident reporting
- Phone 8226 7100 – for non-incident related enquires
- Email: waterquality@sa.gov.au

Document control and review

Document control ensures that the latest version of the RMP is being used and implemented. The RMP should be reviewed on an annual basis or more frequently if required. Documentation related to, or generated, as part of the plan (such as inspection reports, incident reports, water quality test results) must be kept for at least 5 years.

Step 1: *Provide RMP document control and review details in the* ***template document.***

RMP prepared by	Who prepared the Standard RMP document?
Date prepared	Date the Standard RMP was finalised / approved by SA Health
Version number	Version number of the Standard RMP document.
Next revision date	At least 12-month review frequency

Key contacts

The Act requires registration of a drinking water provider prior to the supply of water. The registered drinking water provider is the person responsible for the operation of the drinking water system and the supply of drinking water to customers. Once the Template – Standard RMP for dual source water supplies – rainwater and bore water (**template document**) has been completed and approved by SA Health, a letter addressed to the drinking water provider will be issued outlining any conditions of registration. **SA Health must be notified of any changes to the business details within 14 days of the change being made.**

Step 2: *List relevant business details of the drinking water provider in the* ***template document****. These details are used to complete the registration process.*

Business details

Business trading name	The business / trading name of the registered drinking water provider – include on front cover of template document
Name of Owner / manager	The owner / manager (registered drinking water provider) who is responsible for meeting all requirements of the *Safe Drinking Water Act 2011* as outlined in the approval.
Contact details of the registered drinking water provider / water supply	Phone number, email address, website, location of business / drinking water supply
Address	Postal address for the registered drinking water provider (if different from above)
Operator name and contact details	The operator who undertakes the day-to-day management of the drinking water supply

Other important contacts

Name	**Name and Phone Number**
Local Council	The local council area where the business is located
Water Testing Laboratory	The SA Health approved water testing laboratory used to undertake water quality testing (see Section 4)
Water Treatment Company	Contact details of water treatment company
Tank Cleaning Company	Contact details of tank cleaning company
Water Carting Company	Contact details of SA Health registered water carting company

Section 1: Description of drinking water supply system

It is essential that a drinking water provider has a good understanding of their water supply system. Here are the key components to include when preparing a system description of your water supply.

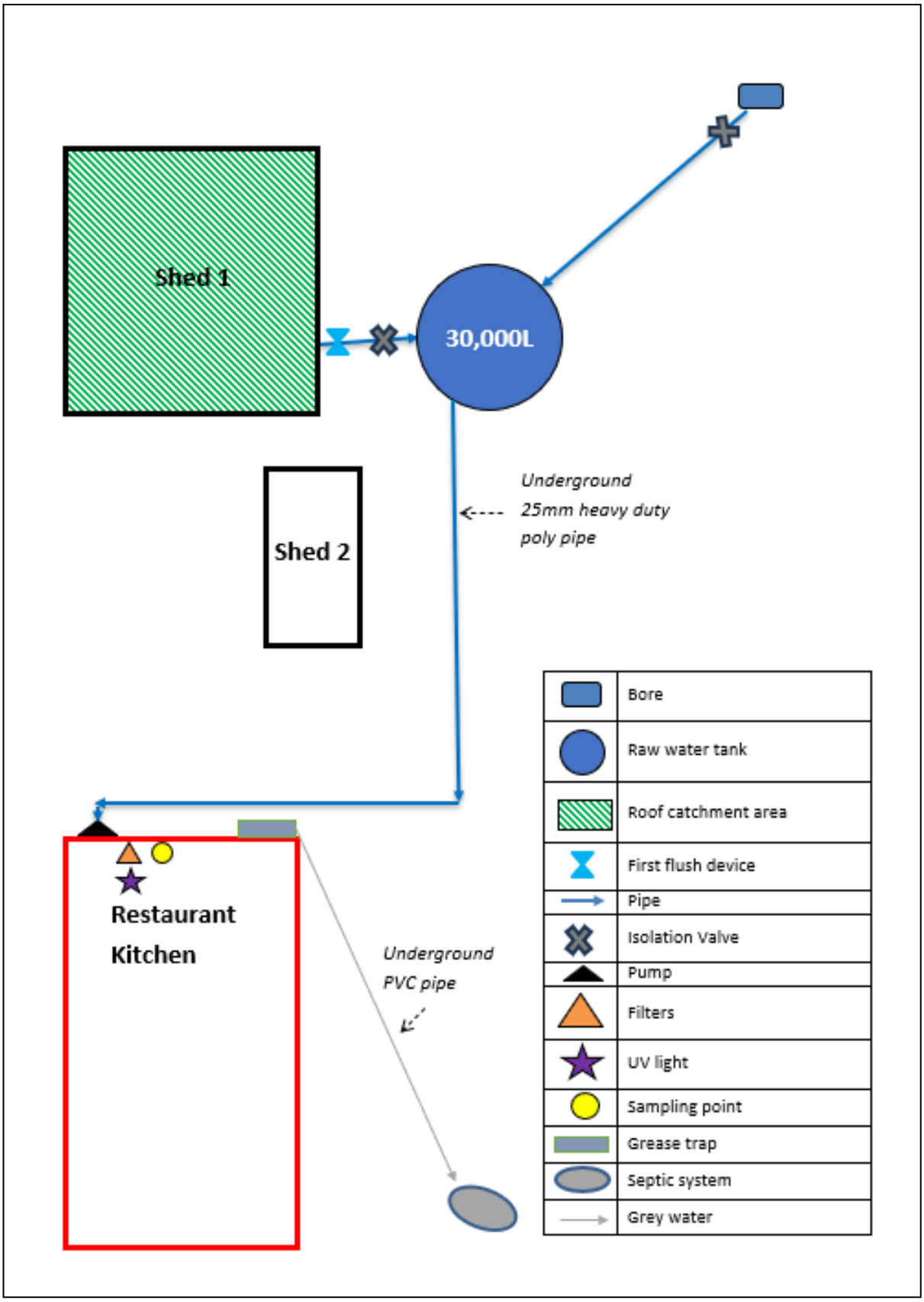
Step 3: *Prepare a system description and schematic / diagram of your drinking water supply in Table 1 in the* ***template document*** *using the key components / questions outlined below. Photographs of the water supply infrastructure are useful. Additional pages can be inserted if required.*

Table 1: Key components of the drinking water supply system

Use of drinking water supply	▪ Summarise how the drinking water is being used. (e.g., used at a restaurant in a winery or a childcare facility with food preparation) ▪ Usage of rainwater vs bore water supply (e.g., rainwater is the main source however when the tanks are low they are filled with bore water)
Rainwater supply	
Roof catchment	▪ Which buildings are capturing the water? ▪ What is the construction of the roof(s)? ▪ Is there any unpainted lead flushing on the roof? ▪ Are there any over-hanging trees? ▪ Is there a solar hot water service or evaporative air-conditioner on parts of the roof used to capture rainwater? ▪ Is there a leaf catcher or first flush device on any of the gutters?
Rainwater tank(s)	▪ Are the tanks above or below ground tanks? ▪ Size of the tank(s) ▪ Construction (e.g., metal, concrete, plastic) and age ▪ What is the condition of the tank walls and roof (e.g., are there holes, gaps to allow entry of small animals/birds)? ▪ Is there a septic tank in the vicinity of the rainwater tanks?
Bore water supply	
Surrounding catchment environment	▪ What is the land activity in the surrounding catchment environment? (e.g., horticultural, farming, domestic) ▪ Are there any sheds with chemicals nearby? Is so, what chemicals and how much? What is the distance to the chemical store? Does the shed have a concrete pad? ▪ Are there any animals grazing nearby? If so, what animals and how far are the animals kept from the bores? ▪ Is there a septic tank in the vicinity of the bores?

Bore details Your bore drilling report or WaterConnect can assist with providing some of the information	▪ What is the Water Connect Unit number for the bore? ▪ When was the bore drilled? What is the bore depth? ▪ Is the bore in a confined or unconfined aquifer? ▪ What is the bore casing constructed from? (e.g., PVC, cast iron) ▪ Is there a concrete plinth around the base of the bore? ▪ As the bores are used to back-up supply, how often are they flushed? ▪ Is there an isolation valve between the bore and rainwater source? ▪ Can water enter the bore or pool near the bore head? ▪ Any known raw water issues such as iron?
Treatment and distribution network	
Treatment and / or disinfection Refer to relevant sections	▪ Provide details of treatment (e.g., filters, UV, or chlorine disinfection) including make and model of the equipment. Equipment specification guides for these products are useful. The water treatment company that installed the unit may also provide this information. ▪ **For filters:** What size/type of filters are installed, e.g., 0.5-micron sediment filter ▪ **For UV disinfection**: What is the Ultraviolet (UV) disinfection dose rate? This can be found in the specification guide. It is dependent on the flow of water in the unit. How is operation of the UV disinfection unit monitored e.g. (indicator light/alarm with SMS notification or daily checks). Does the water flow stop when the UV disinfection is not working? ▪ **For chlorine disinfection**: What is the chlorine dose rate? What is the target chlorine residual to be measured on the chlorine analyser? Include details of the handheld instrument used to check the chlorine analyser and downstream chlorine residuals. What are the set-points on the fault alarm on the dosing equipment / analyser?
Pipework and taps	▪ Where is this water delivered? e.g., kitchen tap ▪ Approximate length of pipework and type (e.g., copper, PVC) ▪ Is pipework above or underground?
Water quality sampling locations and analysis	▪ Water quality samples should be collected at the point of use (after UV / chlorine disinfection if in place). ▪ Where are the water quality samples taken? ▪ How many samples are collected from the supply? ▪ Which laboratory is used to analyse the samples and how are results received? ▪ **For supplies with chlorine disinfection:** what are the target chlorine residuals in the network (at least 2 locations) including at the end of the network (ideally approximately 0.2 mg/L free chlorine). Who undertakes the weekly testing and where is it recorded?

An example of a schematic of a dual source water supply using rainwater and bore water:



Section 2: Water Quality Hazards

Drinking water providers should be aware of the potential hazards that represent risk to bore water quality and implement appropriate preventive measures. Many of the hazardous events outlined below can be avoided through the completion of regular maintenance as documented in Section 3.

Bores can be place in two main categories:

- Shallow unprotected bores – unconfined aquifer, depth less than 20m
- Deep protected bores – confined aquifer, depth greater than 20m

Step 4: *Undertake a risk assessment of your drinking water supply. Populate Table 2 in the* ***template document*** *with identified hazards for your drinking water supply. Below is a comprehensive list of potential hazards, select hazards that are relevant to your drinking water supply, noting that some hazards may develop over time if the system is not properly maintained.*

Table 2: Hazards, risks and preventive measures

Hazardous event	Risk	Preventive Measure
Rainwater supply		
Animal access to tank and/or faecal contamination from birds and small animals	▪ Illness due to ingestion of harmful pathogens	▪ Tree branches overhanging the roof catchment area should be pruned to reduce access to roof catchment and tank. ▪ Keep roof catchment area well maintained. ▪ Install a first flush device. ▪ Inlets, overflows, and other openings should be covered with mesh to prevent entry by small animals and birds. ▪ Maintain the tank (particularly the roof) in good condition. ▪ Install disinfection system (e.g. UV light or chlorination)
Faecal contamination due to surface water ingress into below ground tank	▪ Illness due to ingestion of harmful pathogens	▪ Ensure tank is protected from surface water or subsurface flows. ▪ Ensure tank walls are intact
Mosquitoes	▪ Nuisance and possible transmission of arbovirus (e.g., Ross River virus)	▪ Protect all inlets, overflows, and other openings with mosquito-proof mesh
Bushfire (particularly if located in Bushfire Risk area)	▪ Illness due to ingestion of chemicals and / or water supply is lost during bushfire	▪ Supply is classified as non-drinking until declared drinking by SA Health. Contact Water quality unit, SA Health for assistance and testing regime. ▪ Infrastructure repaired and supply restored

Hazardous event	Risk	Preventive Measure
Lead flashing, lead-based paint, preserved/treated timber or bitumen-based products on roof or gutter catchment	▪ Illness due to ingestion of chemicals ▪ Increase in turbidity/colour/taste of water	▪ Lead flashing or preserved/treated timber should be painted over, replaced or excluded from the catchment area. ▪ Rainwater should not be collected from bitumen-treated roofs
Anaerobic growth in accumulated sediment at the bottom of tank	▪ *Aesthetic* ▪ Odour issues: Sulphide/rotten egg/sewage odours, particularly during warmer weather	▪ Tank should be regularly inspected and cleaned to prevent accumulated sediment
Slimes and stagnant water in pipework		▪ U-bends or underground pipework that can hold stagnant water should be avoided where possible. If not, drainage points should be installed on pipework
Accumulated material on roofs and gutters (including pollen)	▪ *Aesthetic* ▪ Taste and odour issues: Musty or vegetable type taste and odours, colouration of water	▪ Overhanging branches should be pruned. ▪ Gutters should be cleaned out regularly. ▪ Leaf protection devices should be installed on gutters. ▪ Install a first flush device
Algal growth due to light penetration into tank or pipework	▪ *Aesthetic* ▪ Taste and odour issues: Musty, vegetable, or fishy type taste and odours	▪ Light access into storage tanks should be prevented (e.g. ensure tank is completely roofed) ▪ Ensure pipework is impervious to light (white or opaque pipes can allow light penetration)
Accumulated damp leaves in gutter	▪ *Aesthetic* ▪ Coloured water	▪ Gutters should be kept clean and leaf protection devices installed on gutters
Hydrocarbon contamination from wood-fire flues	▪ *Aesthetic* ▪ Tastes and odour issues	▪ Install flues in accordance with Australian Standards ▪ Operate heaters in accord with the manufacturer's instructions. ▪ Use appropriate types of wood for fuel, e.g., do not use treated pine
Aesthetic Unpleasant tastes ▪ Bitter taste (concrete tanks) ▪ Metallic taste (galvanised tanks) ▪ Plastic taste (plastic tanks)Detergent taste associated with newly painted roof	▪ *Aesthetic* ▪ New tank	▪ Use water from first fill for non-drinking purposes such as garden watering or toilet flushing. Taste will reduce with subsequent fills and age

Hazardous event	Risk	Preventative Measures
Bore water		
Shallow unprotected bore – unconfined aquifer, depth less than 20 m	▪ Increased risk of illness from ingestions of pathogens or chemicals	▪ Where possible bores should be drilled into a confined aquifer and at the greatest depth to prevent contaminants entering the supply. ▪ Install disinfection system (e.g. UV light or chlorination) ▪ Increase water quality testing of microbiological and chemical parameters (see Section 3)
Livestock entry to bore protection zone	▪ Illness from ingestion of harmful pathogens contained in livestock waste	▪ Bore should be protected from livestock access (e.g.by fencing in agricultural areas) to allow at least a 50 metre radius around the bore
Leakage from sewage collection system	▪ Illness from ingestion of harmful pathogens contained in human waste	▪ Bore should be protected from human waste by not allowing discharge from an on-site wastewater system within 50 metres of the bore (per the On-site Wastewater Systems Code) ▪ On-site wastewater systems should not be installed within 10 metres of a bore (per the On-site Wastewater Systems Code)
Toxic chemicals leaching into groundwater	▪ Health or aesthetic impact of chemicals	▪ Agricultural chemicals, diesel and petrol should not be stored or used within the minimum protection zone except in areas with physical barriers to prevent spills contaminating ground water
Groundwater may contain microbiological contaminants or health-related chemicals,	▪ Illness from ingestion of harmful pathogens or chemicals (e.g. arsenic, fluoride)	▪ Bore water should be tested for microbiological and chemical quality prior to use for drinking, food preparation, use in swimming pools or watering edible plants
UV disinfection - Surface water entering the bore can cause contamination (human or animal waste) and/or increase turbidity and colour of water which will reduce UV disinfection effectiveness	▪ Illness from ingestion of harmful pathogens contained in animal waste ▪ Aesthetic concerns with water (e.g. increased turbidity)	▪ Bores should be constructed to prevent the entry of surface water and to protect the groundwater supply against contamination ▪ Pumps and water outlets should not allow entry of surface water ▪ Bores should be surrounded with a concrete slab/plinth at least 1 metre in diameter sloping away from the borehead ▪ The space between the casing and the borehole should be sealed ▪ Install filtration system

Hazardous event	Risk	Preventative Measures
Chlorine disinfection- Too much chlorine added to water during chlorination	▪ Irritation of skin and mucous membranes ▪ Customer complaints due to taste and odour	▪ Ensure dosing equipment and chlorine analyser are checked on a weekly basis and calibrated as per manufacturers specification. ▪ Measure the chlorine residual in the network on a weekly basis and ensure target residuals from chosen locations are within specification. ▪ Ensure fault alarm system is operational.
Chlorine disinfection – Failure of disinfection system or underdosing leading to no chlorine in the distribution system	▪ Reduced protection from microbial contamination	

Treatment options for rainwater and bore water supplies

Installation of treatment processes can be considered for protecting the microbiological quality of drinking water at all times. The most common type of treatment include filtration, UV disinfection and chlorination.

Filtration

Water sourced from a well-maintained deep bores should not require filtration to improve microbiological quality. More commonly filtration is used to remove sediment or suspended particles from water to improve performance of disinfection (see below). Depending on the type of filter, contaminants such as bacteria and viruses can also be removed. Point of use filters (e.g., under-sink carbon or ceramic filtration units) are commonly installed to improve the taste and odour of water.

Where filters are in use, they must be operated, maintained, and replaced as per the manufacturer's recommendations to avoid problems associated with microbial growth. Filters that are not maintained correctly may not work effectively and may have adverse impacts on water quality.

Minimum requirements for the use of a filtration system includes:

- Maintenance program in line with manufacturers specification for cleaning and replacement of filters

Ultraviolet (UV) light disinfection

UV disinfection can be used to provide continuous assurance of water quality at point of application. UV disinfection systems require relatively low maintenance and have the advantage of not involving the addition of chemicals. UV disinfection systems can be installed in pipework delivering water from a tank to a dwelling, or selectively to taps used to supply water for drinking and food preparation.

Standard UV disinfection systems deliver a dose of 40 mJ/cm^2. Maintaining this dose is important to ensure the effective control of micro-organisms. The UV dose applied to water is determined by the flow rate of water through the UV unit. Details of the flow rate will be specified by the manufacturer and need to be followed. UV disinfection is only effective in treating water with a low turbidity therefore maintenance activities to prevent increases in turbidity (e.g. from ingress of surface water or soils) are critical. Installation of sediment and particle filters before disinfection is common practice. The need for filtration will generally be based on manufacturer specifications.

As there is no disinfection residual to measure following UV light disinfection, the system should be closely monitored to ensure that it is operating as expected at all times. A fault alarm should be installed on the unit with immediate notification to the drinking water provider preferably with an audible or remotely monitored alarm. If this is not available then the UV disinfection must be checked on a daily basis. Most UV lamps will need to have their sleeves cleaned regularly to reduce biofilm or scale. In addition, the lamps will need to be replaced between nine and twelve months. If power to the UV disinfection unit is interrupted the system should be designed to stop water flow into the drinking water system until disinfection is restored.

Minimum requirements for the use of UV disinfection include:

- UV disinfection dose of 40 mJ/cm^2 (a UV disinfection dose >30 mJ/cm^2 may be considered acceptable depending on source water quality, discuss with Water Quality Unit, SA Health)
- Clean UV disinfection lamp sleeves regularly and replace lamps as per manufacturers instruction
- A fault alarm with direct notification to drinking water provider, if not available daily checking that UV disinfection is operational with log sheet to record as evidence. A UV disinfection failure is a notifiable incident to SA Health (see Section 5)

Chlorine disinfection

Chlorine is the most commonly used drinking water disinfectant. It is a strong disinfectant and is effective at short contact time against viruses and bacteria (i.e. *E.coli*). The Australian Drinking Water Guidelines has an upper health guideline value of 5 mg/L.

Unlike UV disinfection a chlorine residual can persist in the water distribution network and will prevent growth of biofilm and provide protection against ingress of microbiological contamination through minor faults in pipework or storages.

Liquid sodium hypochlorite is generally the source of chlorine used in smaller drinking water supplies. Strict safety requirements are associated with the use of liquid chlorine. Disadvantages of sodium hypochlorite are that the concentrations degrade over time, chlorate can be formed during storage, and it is a corrosive solution. Solid calcium hypochlorite is also available and can be applied in a powder or tablet form and is generally used for emergency chlorination. Calcium hypochlorite needs to be stored in a cool dry environment and kept away from moisture and heat. Stabilised calcium hypochlorite tablets or chlorine containing cyanuric acid are not suitable for use in drinking water.

Chlorinators are typically installed prior to any tanks in the system (which are a common source of contamination). Reliable dosing and monitoring equipment is available and can be set up by a water treatment company. The chlorine dose can be set to achieve both initial disinfection and to provide chlorine residuals reaching the end of the distribution system. The dosing equipment should be monitored online and alarmed to notify the drinking water provider of an overdosing (greater than 5 mg/L) or underdosing event so that remedial action can be put in place. Regular maintenance of the dosing equipment and monitoring is required. If power to the chlorination unit is interrupted the system should be designed to stop flow of undisinfected water into the system .

Reliable field kits for measuring chlorine residuals in the distribution system are available. Regular weekly free chlorine measurements at different points in the distribution network are important to closely monitor the presence of chlorine residuals. Seasonal variations and water age can have an impact on the residual measured in the network and may require adjustment of chlorine doses at different times of the year. The aim should be to provide a free chlorine residual of 0.2 mg/L at the last point in the distribution network.

Minimum requirements for the use of chlorine include:

- The Australian Drinking Water Guideline value for chlorine is 5 mg/L (maximum)
- Use reliable dosing and monitoring equipment including an online chlorine analyser to measure the chlorine dose. Ensure this equipment has a fault alarm with direct notification to the drinking provider. A chlorination failure is a notifiable incident to SA Health (see Section 5)
- Record the free chlorine residual in the network on a weekly basis. Set the chlorine dose, and target chlorine residuals to achieve at least 0.2 mg/L free chlorine at the end of the distribution network.

Further information regarding installation and cost of UV and chlorination disinfection systems can be obtained through contacting a water treatment company (look in the Yellow Pages® under ‘Water Treatment & Equipment’).

Additional information on treatment options such as boiling, and emergency chlorination are provided in Appendix A.

Section 3: Maintenance program

Regular maintenance can prevent hazardous events in your water supply that can lead to a water quality incident. Records of completed maintenance activities must be kept with the RMP.

Step 5: *The approved maintenance program should be undertaken as documented below. Review the maintenance activities to ensure they are relevant to your drinking water supply. As a minimum these activities should be conducted at the frequency stated below.*

Table 3 has been populated in the ***template document****:*

- *If the frequency is varied to outlined below, amend the timeframe that has been specified.*
- *Add the maintenance activities (outlined below) to Table 3 in the* ***template document*** *relevant to your treatment and / or disinfection i.e., filters, UV disinfection, chlorination.*
- *Develop a log for recording completed maintenance activities. Examples of documentation are available in Appendix B.*

Table 3: Maintenance program

Area	Frequency	Activity	Corrective Actions
Rainwater			
Gutters	▪ 6 monthly	▪ Inspect for presence of accumulated debris such as leaf and other plant material	▪ Clean and repair as necessary ▪ The frequency of inspection and cleaning may need to be increased if large amounts of material are present
Roof	▪ 6 monthly	▪ Inspect for presence of accumulated debris such as leaf and other plant material	▪ Clear any accumulated matter from the roof and prune overhanging branches
Tank inlets, leaf filters, overflows. Insect proofing.	▪ 6 monthly	▪ Inspect for accumulated material or damage.	▪ Clean and repair as necessary
Tank & tank roof	▪ 6 monthly	▪ Check structural integrity of tank including roof and access cover. ▪ Internal inspection to check for evidence of access by animals and birds and presence of mosquitoes or larvae. ▪ Internal inspection to check for algal growth ▪ Internal inspection to check for accumulated sediment (to be cleaned every 2 yrs.)	▪ Repair any holes or gaps. ▪ Remove bird /animal carcass and empty and clean tank. Chlorinate if emptying/cleaning tank is not possible. ▪ If the bottom of the tank is covered with sediment the tank should be cleaned

Area	Frequency	Activity	Corrective Actions
Pipework	▪ 6 monthly	▪ Check for structural integrity	▪ Repair pipework as necessary
Gutters	▪ 6 monthly	▪ Inspect for presence of accumulated debris such as leaf and other plant material	▪ Clean and repair as necessary ▪ The frequency of inspection and cleaning may need to be increased if large amounts of material are present
Bore water			
Bore protection zone	▪ Monthly	▪ Inspect area for anything unusual, e.g., signs of livestock activity, the use or storage of chemicals or fuels, wastewater discharges	▪ Restrict animal access via mechanisms such as fences, etc. ▪ Investigate and remove potential sources of contamination, e.g., chemicals/fuel
Bore	▪ Monthly	▪ Check integrity of bore plinth and casing and any other mechanisms installed to ensure that the borehead is water-tight and protected from surface water flows	▪ Repair or replace any faulty mechanisms designed to prevent the entry of surface water ▪ Repair damaged bore casing and slab/plinth
Bore protection zone	▪ 6 monthly	▪ Check structural integrity of fencing, gates, locks, etc.	▪ Repair any faults
Pump	▪ 6 monthly	▪ Maintain/service pump on an annual basis or as per the manufacturer's recommendations	▪ Repair/replace pump as required ▪ If the pump is removed for maintenance, ensure the top of the bore is blocked to prevent entrance by small animals and other debris
Tank & tank roof	▪ 6 monthly	▪ Check structural integrity of tank including roof and access cover. ▪ Internal inspection to check for evidence of access by animals and birds and presence of mosquitoes or larvae. ▪ Internal inspection to check for algal growth ▪ Internal inspection to check for accumulated sediment (to be cleaned	▪ Repair any holes or gaps. ▪ Remove bird /animal carcass and empty and clean tank. Chlorinate if emptying/cleaning tank is not possible. ▪ If the bottom of the tank is covered with sediment the tank should be cleaned

Area	Frequency	Activity	Corrective Actions
		every 2 yrs.)	
Pipework	▪ 6 monthly	▪ Check for structural integrity	▪ Repair pipework as necessary
If filters present	▪ Manufacturer's specification	▪ Clean and check filters as per manufacturer's recommendations	▪ Clean filters as required. ▪ Replace or repair filters as required
If UV disinfection present	▪ Daily / Monthly	▪ Where a UV disinfection fault alarm is not available, daily checking is required to ensure unit is operational. ▪ Check for biofilm growth or build-up on UV disinfection lamp sleeves ▪ UV disinfection lamps have been replaced as required per manufacturer's instructions	▪ If UV disinfection is not operational, stop water immediately and notify SA Health (see Section 5) ▪ Clean sleeves and replace lamps as necessary
If chlorine disinfection present	▪ Weekly	▪ Inspect, calibrate, and maintain chlorine dosing equipment as per manufacturer's requirements. ▪ Ensure adequate supplies of chlorine. Check use-by dates.	▪ Calibrate to ensure correct dose of chlorine. Rectify any issues. Repair as necessary. ▪ Dispose of out-of-date chlorine and replace as required
	▪ 6 monthly	▪ Ensure handheld chlorine meter is maintained as per manufacturer's recommendations	▪ Calibrate handheld chlorine photometer. Record results.

Section 4: Water quality testing

Water quality testing (both laboratory and operational) is used to verify that the water is treated effectively and is safe to drink. Drinking water providers are responsible for organising the collection of samples and the associated costs for analysis. Analysis of drinking water must be undertaken by a NATA accredited of other laboratory approved by SA Health (a list is available on the SA Health website). Copies of test results must be kept with the RMP, laboratory reports are suitable.

Step 6: *A sample tap is chosen that is representative of the water received by the consumer at its point of use, such as a kitchen tap. Document the sample point location in the system description and included on your schematic.*

- *Include Table 4 (either shallow bore or deep bore) in the **template document** to reflect your drinking water supply. Arrange for samples to be analysed as per the prescribed frequency.*
- *Insert the location of the sample point in the relevant column in Table 4 within the **template document** e.g. kitchen tap*
- *The laboratory results must be reviewed (as outlined in Table 7) and SA Health contacted if required (see Section 5). Copies of the laboratory results are to be kept with the RMP.*
- *For supplies with chlorine disinfection add Table 4.1 operational chlorine residual testing program into the **template document**.*

Table 4: Water quality testing program – Shallow bore (unconfined aquifer or < 20 m depth)

Sample Point	Frequency	Monitoring	Corrective Action
Identify location of sample point (e.g., kitchen tap)	▪ 3 monthly ▪ 12 monthly	▪ *E.coli* ▪ Health related chemical parameters	If *E.coli i*s detected: ▪ UV disinfection or chlorination is not working and requires immediate investigation. ▪ Storage tanks (if present) should be disinfected with chlorine (see Appendix A) ▪ Notify as a water quality incident (see Section 5) If chemical guideline values are exceeded (see Appendix C) ▪ advice on further action and corrective responses should be sought from DHA

Table 4: Water quality testing program – Deep bore (confined aquifer or > 20 m depth)

Sample Point	Frequency	Monitoring	Corrective Action
Identify location of sample point (e.g., kitchen tap)	▪ 12 monthly ▪ 2 yearly	▪ *E.coli* ▪ Health related chemical parameters	If *E.coli i*s detected: ▪ UV disinfection or chlorination (if installed) is not working and requires immediate investigation. ▪ Storage tanks (if present) should be disinfected with chlorine (see Appendix A) ▪ Notify as a water quality incident (see Section 5) If chemical guideline values are exceeded (see Appendix C): ▪ advice on further action and corrective responses should be sought from DHA

Table 4.1: Operational chlorine residual testing program

Sample Point	Frequency	Monitoring	Corrective Action
Identify locations of sample points (*choose at least two locations*)	▪ Weekly	▪ Free chlorine residual using hand-held unit ▪ Compare results to target chlorine residuals	▪ Adjust chlorine dose to ensure adequate disinfection ▪ If chlorine residual <0.2 or ≥ 5 mg/L immediate notification to SA Health is required (See Section 5) ▪ Calibrate or repair as necessary

Section 5: Incident identification and notification protocol

An RMP prepared by a drinking water provider must include an approved incident identification and notification protocol. The protocol described in Table 5 is taken to be approved where adopted by a drinking water provider supplying bore water.

Step 7: *Tables 5 and 6 have been populated in the **template document**. Include details for UV or chlorine disinfection depending on type of disinfection in use.*

Table 5: Incident identification and notification protocol

Parameter	Criteria	Notification requirements to SA Health
E.coli	▪ Any detection of *E.coli* per 100 mL sample of water	Immediate notification to SA Health on **0421 618 311** AND incident notification form is submitted within 24 hours via email waterquality@sa.gov.au.
Health and Aesthetic chemicals	▪ Any exceedance of the ADWG values (see Appendix C for guideline values) for the following parameters: Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Chromium, Copper, Fluoride, Lead, Manganese, Mercury, Molybdenum, Nickel, Nitrate, Selenium, Silver, Sulfate and Uranium, Total dissolved Solids, Hardness ($CaCO_3$), Iron, pH, Zinc	
Contamination of rainwater supply	Suspected contamination due to: ▪ a dead animal in storage tank ▪ wastewater discharge, flooding or other surface water ingress (where tank or pipework underground)	
Undefined incident	▪ Any other incident (not defined above) or where specific concerns exist over the quality of the drinking water supply	
UV disinfection failure	▪ Any failure of the UV disinfection unit	
Chlorination	▪ Overdosing producing a chlorine residual >5 mg/L	
Chlorination failure	▪ Chlorination failure resulting in chlorine residual <0.2mg/L (measured immediately after the dosing point)	

Incident response

If any of the criteria in Table 5 are confirmed for your drinking water supply:

- Contact Water Quality Unit, SA Health immediately on **0421 618 311**
- Undertake immediate remedial actions (see Table 6). Use packaged water while corrective action is taken.
- Complete the SA Health Water Quality Incident notification form available from the SA Health website. Documenting the corrective actions taken.
- Submit the completed form within 24 hours to Water Quality Unit, SA Health via email waterquality@sa.gov.au.

Table 6: Immediate remedial actions for typical water quality incidents

WQ Incident	Corrective Actions
Detection of *E.coli*	▪ Undertake an inspection of the bore, catchment area, storage tank and distribution system to identify any potential sources of contamination. ▪ Check that the UV disinfection unit or chlorinator (if present) is working ▪ Implement any immediate remedial action as required, e.g., water pooling at base of the bore. ▪ Disinfect the storage tank with chlorine (see Appendix A for information on the procedure and information on calculating doses). ▪ Ensure chlorinated water is flushed through all pipework.
Loss or overdose of chlorine disinfection	▪ Measure the free chlorine residual at the point of use and check the chlorine analyser (immediately after dosing) ▪ If free chlorine is less than 0.2mg/L ○ Reinstate (if failure detected) or increase chlorine dosing and flush any undisinfected water from the system ▪ If free chlorine is greater than 5 mg/L ○ Reduce chlorine dose and flush the system to remove water with elevated chlorine ▪ Closely monitor equipment and calibrated (if necessary)

Section 6: Management and record keeping

To ensure your drinking water supply remains safe to drink, activities required to manage your water supply must be documented including inspections and maintenance, water quality results and incident management.

Step 8: *Identify the personnel in your business that are responsible for fulfilling the activities outlined in the RMP. Multiple tasks may be assigned to the same individual. Populate Table 7 in the* ***template document.***

Table 7: Responsibility table

RMP review	Who updates the RMP document when required?
Maintenance activities	Who undertakes maintenance activities?
Water quality sampling	Who undertakes water quality sampling?
Review of water quality test results and notification to SA Health if required	Who reviews water quality test results and notifies SA Health if required?
Corrective action in response to water quality incident	Who undertakes any corrective actions in response to a water quality incident?
Record keeping location	Document where your RMP, maintenance records, water quality testing data and incident notification forms are kept

Record Keeping

Step 9: *Establish a record keeping system that is easily accessible, such as a folder of printed documents or electronic files, to allow for quick reference during a water quality incident and for review during an inspection. The record keeping system should include your approved RMP and records of maintenance activities, water quality results, incident notification forms and details of corrective actions. Record keeping templates are provided in Appendix B.*

Additional information is available from:

- SA Health Website – Providing safe drinking water including specific information on bore water
- Bore construction information is available in the document 'Minimum construction requirements for water bores in Australia'

Appendix A: Additional Treatment options

Boiling

Where contamination of drinking water is suspected or where additional precautions are considered necessary boiling of undisinfected bore water will ensure microbial safety. For example, people with lower immune responses, such as the very young or very old, cancer patients, people with diabetes, organ transplants or those who are HIV positive should consider boiling bore water prior to consumption. Boiling should also be considered if gastric upsets e.g., vomiting and diarrhoea occur. Boiling also provides a disinfection option for water provided to the public, including use in food preparation, as an assurance of safety.

Bringing water to a boil will achieve disinfection. Boiling does not have to be maintained for any length of time – kettles with automatic shutoffs are suitable for this purpose. Boiling the water will kill any harmful bacteria, viruses or protozoa including *Giardia* and *Cryptosporidium*. Boiled water can be cooled and stored in a clean container until use. The taste of boiled water can be improved by pouring it back and forth from one clean container to another or letting it stand for a few hours to increase the dissolved oxygen concentration.

Care should be taken when boiling water, particularly large quantities, to avoid the risk of scalding.

Emergency chlorination

Regular manual chlorination of drinking water held in tanks is generally only recommended as a remedial action. The effectiveness of chlorine is short-lived, and it will only act on the water in the tank at the time of dosing. Fresh flows of water into the tank after chlorination will probably not be disinfected.

To achieve effective disinfection, it is necessary to add sufficient chlorine to provide a free chlorine residual of at least 0.5mg/L after a contact time of 30 minutes. This can be measured using a suitable chlorine test kit, e.g., a swimming pool kit. As a general guide, to achieve a chlorine dose of approximately 5mg/L you will need to add:

- 40ml of liquid sodium hypochlorite (12.5% available chlorine) per 1000L of water
- 7g of granular calcium hypochlorite (70% available chlorine) per 1000L of water

Further guidance on determining the size of bore water tanks for chlorination and for specific amounts of chlorine for various volumes of water is below.

Calcium hypochlorite should be dissolved in water, in a clean plastic bucket, in the open air, before adding it to the tank. Always add the disinfectant to the water rather than vice versa. When adding the chlorine to the tank, spread it as widely across the surface as possible to promote mixing and let it stand for at least one hour before use. Pipework should be flushed with the chlorinated water.

Sodium and calcium hypochlorite and chlorine test kits can be purchased from large supermarkets, hardware stores or swimming pool stockists. The two forms of chlorination should **never be mixed** as this can cause explosions**.** The chlorine will not make the water unsafe to drink but you may notice a distinct taste and odour that should disappear in 10 to 14 days. Boiling the water will remove most of the taste and odour associated with chlorine.

Calculations to determine the volume of water in a tank

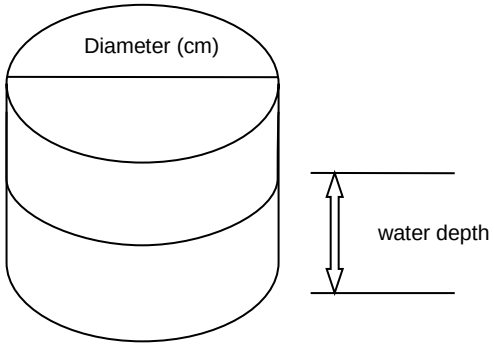
To calculate the volume of a rectangular tank, use the formula:

- Volume (in litres) = depth (cm) x width (cm) x length (cm) ÷ 1000

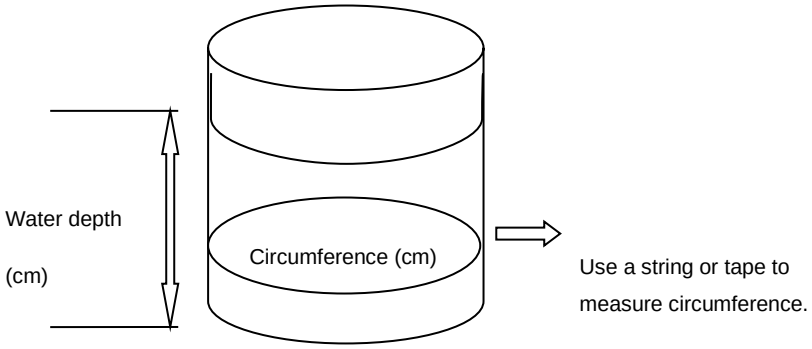
To calculate the volume of a cylindrical tank either use the formula:

- Volume (in litres) = π x diameter^2 (cm^2) x depth (cm) ÷ 4000 (where π = 22 ÷ 7)

OR use one of the following methods, **remember to calculate the volume of water in the tank and not the volume of the tank:**



FORMULA 1: Volume (in litres) = 0.8 x water depth (cm) x diameter^2 (cm^2) ÷ 1000



FORMULA 2: Volume (in litres) = 0.08 x water depth (cm) x circumference^2 (cm^2) ÷ 1000

Chlorine doses

To achieve 5 mg/L of free chlorine, use the following measurements (mL or g) of hypochlorite (liquid or granular) assigned for the tank volume (calculated above).

Remember to calculate the volume of water in the tank not the volume of the tank

Chlorine Concentration	**5 mg/L**	
Tank Volume (L)	**12.5% liquid Sodium Hypochlorite**	**70% granular Calcium Hypochlorite**
	mL	**g**
1000	40	7
2000	80	14
3000	120	21
4000	160	28
5000	200	35
6000	240	42
7000	280	49
8000	320	56
9000	360	63
10000	400	70
11000	440	77
12000	480	84
13000	520	91
14000	560	98
15000	600	105
16000	640	112
17000	680	119
18000	720	126
19000	760	133
20000	800	140

Appendix B: Record Keeping for template documents

These are suggested template documents to be used as part of your record keeping for maintenance activities (see Section 3). If maintenance activities are recorded via a different method/records system, please ensure all activities relevant to your supply listed below are captured

Maintenance Activities template document

*Modify as required to align with Table 3 in the **template document**. If the frequency varies for the task consider using multiple tables.*

Safe Drinking Water Act 2011 **- Maintenance program (Monthly)**

Observations and actions (if taken) during scheduled inspections.

Area	**Inspection**	**Date:**	**Date:**	**Date:**	**Date:**
		Name:	**Name:**	**Name:**	**Name:**
Bore Protection Zone	Inspect area for anything unusual, e.g. signs of livestock activity, the use or storage of chemicals or fuels, wastewater discharges				
Bore	Check integrity of bore plinth and casing and any other mechanisms installed to ensure that the borehead is water-tight and protected from surface water flows				
UV disinfection	Check for biofilm growth or build-up on UV disinfection lamp sleeves				
	Check operation of fault alarm				
	Check and record date until lamp replacement (as per manufacturer's instructions)				

Safe Drinking Water Act 2011 **- Maintenance program (6-Monthly)**

Observation and actions (if taken) during scheduled inspections

Area	**Inspection**	**Date:**	**Date:**	**Date:**	**Date:**
		Name:	**Name:**	**Name:**	**Name:**
Bore Protection Zone	Check structural integrity of fencing, gates, locks, etc.				
Pump	Maintain/service pump as per the manufacturer's recommendations				
Gutters	Inspect for presence of accumulated debris such as leaf and other plant material				
Roof	Inspect for presence of accumulated debris such as leaf and other plant material				
Tank inlets & overflows, Insect proofing, Leaf filters	Inspect for accumulated material or damage				
Tank and tank roof	Check structural integrity of tank including roof and access cover.				
	Internal inspection to check for evidence of access by animals and birds and presence of mosquitoes or larvae.				
	Internal inspection to check for algal growth				

Area	Inspection	Date:	Date:	Date:	Date:
		Name:	Name:	Name:	Name:
	Internal inspection to check for accumulated sediment				
Pipework	Check for structural integrity				
Filters	Check filters as per manufacturer's recommendations				
Chlorine	Ensure handheld chlorine meter is maintained as per manufacturer's recommendations				

Safe Drinking Water Act 2011 **- Maintenance program (2 yearly)**

Observations and actions (if taken) during scheduled inspections.

Area	Inspection	Date:	Date:	Date:	Date:
		Name:	Name:	Name:	Name:
Tank	Clean tank to remove any accumulated sediment				

Safe Drinking Water Act 2011 **- UV disinfection unit daily visual check**

UV disinfection details:_____

Week Beginning (Date)	**Sun**	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**

Safe Drinking Water Act 2011 **- Weekly chlorine residual measurements**

Operating targets

Sample Point Location	**Free chlorine residual (mg/)**
Location 1(i.e. Tank)	*1.5 ±0.5 mg/L*
Location 2 (i.e. Kitchen tap)	*1.0 ±0.5 mg/L*

Date:	**Free chlorine for Sample locations**		**Calibration of handheld unit complete?**	**Sodium hypochlorite in date?**	**Checked by:**
	Location 1 ***(mg/L)***	***Location 2*** ***(mg/L)***	**(Yes / no)**	**(Yes / no)**	

Appendix C: Health and Aesthetic Chemical Parameters

Health-related chemical parameters in drinking water should be less than the Australian Drinking Water Guideline 2011, Version 3.8 (ADWG) values in the table below.

Chemical	ADWG Health value (mg/L)	ADWG Aesthetic value (mg/L)
Antimony	0.003	-
Arsenic	0.01	-
Barium	2	-
Beryllium	0.06	-
Boron	4	-
Cadmium	0.002	-
Chromium	0.05	-
Copper	2	1
Fluoride	1.5	-
Hardness (as $CaCO^3$)	-	200
Iron	-	0.3
Lead	0.01	-
Manganese	0.5	0.1
Mercury	0.001	-
Molybdenum	0.05	-
Nickel	0.02	-
Nitrate	50	-
pH	-	pH 6.5 – 8.5
Selenium	0.01	-
Silver	0.1	-
Sulfate	-	250
Total Dissolved Solids	-	600
Uranium	0.02	-
Zinc	-	3

For the latest version of the ADWG go to:

http://www.nhmrc.gov.au/guidelines/publications/eh52

For more information

Water Quality Unit
Health Protection and Regulation
Public Health Division
PO Box 6
Rundle Mall SA 5000
Telephone: 08 8226 7100
www.sahealth.sa.gov.au

Government of South Australia
SA Health