Queensland Health

Managing private drinking water supplies in commercial and community premises

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Introduction

These guidelines are for operators and managers of commercial and community premises that rely on private drinking water supplies. Drinking water, sometimes referred to as potable water, is water that is safe for human consumption. Drinking water can safely be used for drinking, cooking, food preparation and food processing, bathing, showering, handwashing and tooth-brushing.

Sources of water used for private drinking water supplies include the following:

- Rainwater – water collected from a roof when it rains and stored in a tank for future use.
- Groundwater – water drawn from bores, wells or springs which may or may not be stored in a tank prior to use.
- Surface water – water drawn from rivers, creeks and dams which may or may not be stored in a tank prior to use.
- Carted water – water from a mains or town water supply, transferred by tanker and stored in a tank prior to use.

Poorly managed private drinking water supplies can become contaminated with disease-causing microorganisms or harmful chemicals that may lead to outbreaks of disease, serious illness and, in rare circumstances, death. The advice contained in these guidelines is designed to help operators and managers of commercial and community premises that rely on a private drinking water source to better manage their water supply. The template in Appendix 1 can be used to compile a simple drinking water supply management plan.

Commercial and community premises with private drinking water supplies that may find this guide useful include:

- Food premises such as cafes, restaurants and mobile caterers
- Accommodation premises such as hotels, motels, guest houses, bed and breakfast, farm stay and backpacker accommodation
- Caravan parks and camping grounds, including school and church camps
- Childcare centres
- Private residential aged care facilities
- Health clinics
- Schools
- Recreation and sporting facilities
- Community halls and show grounds
- Petrol stations and roadhouses
- Mining camps and other worksites.

It should be remembered that every water supply system is different so the examples in this guide may not cover all hazards, risks and management actions that need to be considered. For more information on matters covered by this guideline, contact your local council or Queensland Health.

Non-potable water supplies

Water is considered non-potable when it is unsafe to use for purposes such as drinking, cooking, food preparation, bathing, showering, handwashing and tooth-brushing. Non-potable water may be used for other purposes including toilet flushing, clothes washing, garden watering, irrigation, dust suppression and outdoor cleaning of cars, boats and houses.

This guideline does not provide advice for the management and use of non-potable water supplies. For more information on public health risks associated with non-potable water, contact your local council or Queensland Health.

Regulatory framework

In Queensland, there is no specific legislation relating to the management of private drinking water supplies in commercial and community premises. However, powers exist to address public health risks associated with private drinking water supplies and requirements exist for operators of certain types of premises.

Addressing public health risks associated with private drinking water supplies

The *Public Health Act 2005* permits a local government to serve a public health order to manage a public health risk associated with any form of private drinking water supply.

Food businesses and processors of primary produce

The *Food Act 2006* requires all licensed food businesses to comply with Food Safety Standard 3.2.3 of the Australia New Zealand Food Standards Code. This standard requires food businesses to use potable water (drinking water) for all activities that use water, including washing of food or ingredients, cooking, adding water to food and drinks, making ice, cleaning and for personal hygiene.

Where a food business is forced to rely on a private drinking water supply for potable water, the operator should be able to demonstrate that the quality of the water, and its intended use, will not affect food safety.

Similarly, the Food Production (Safety) Regulation 2014 requires accredited processors of primary produce to use potable water. If a private drinking water supply is used, the producer must be able to demonstrate that use of the water will not make the produce unacceptable.

The role of local laws

In Queensland, some local governments will impose licence conditions on certain classes of premises (e.g. caravan parks or campsites) under the provisions of a local law. Licence conditions may include requirements for operators reliant on a private drinking water supply to install water treatment technology, undertake routine sampling and to complete and adhere to a drinking water supply management plan.

Workplaces

Operators and managers of workplaces must comply with the risk management requirements of the *Work Health and Safety Act 2011*. Under this Act, if a workplace operator or manager identifies a private drinking water supply as a risk to workers or other persons, they should put measures in place to eliminate or reduce the risk where it is reasonably practicable to do so.

Mine sites

In addition to the requirements for workplaces, relevant mine sites must also comply with the requirements of the Coal Mining Safety and Health Regulation 2017 and the Mining and Quarrying Safety and Health Regulation 2017. These regulations require mine sites to have sufficient potable water to cater for the needs of the largest number of workers who may be employed at the mine in a single shift and to have supplies of cool drinking water for workers to maintain their fitness and health.

Water quality and water-borne illness

To be safe for human consumption, drinking water must not contain:

- Disease-causing microorganisms (bacteria, viruses or parasites) or
- Chemicals at harmful levels.

The physical quality (appearance) of the water should be acceptable. It should have no suspended material such as clay or silt, and it should be clear, colourless and well-aerated, with no unpleasant taste or odour.

Private drinking water supplies can become contaminated by a variety of things, including:

- **Human faeces** which can leak from septic systems or wastewater drainage
- **Animal faeces** such as bird or possum droppings on a roof-water collection system, or from farm run-off into rivers and creeks
- **Pesticides** in water run-off from farms or blown onto roof-water collection systems
- **Arsenic and other heavy metals** in soil from old industrial and mining sites or in some bore water supplies
- **Dust** containing chemicals blown on to your roof-water collection system
- **Lead** from old paint or flashing on roofs that can flake and end up in tanks
- **Algae**, including toxic blue-green algae (also known as cyanobacteria), which are not destroyed by boiling or disinfection
- **Nitrates** in some bore water supplies which, at elevated levels, are particularly dangerous to babies
- **Smoke, ash and debris** from bushfires can contaminate your water source
- ***Legionella*** is an opportunistic pathogen that is present in the environment and may multiply in storage tanks and pipework
- ***Naegleria fowleri*** is another opportunistic pathogen that can occur naturally in untreated warm (25°C to 40°C) water.

Water contamination affects people in different ways. What may cause a minor stomach upset in one person may cause serious illness in another. In some cases, visitors can become sick after consuming water from a particular source, while people who consume it regularly will remain healthy.

Water contaminated with human or animal faeces may contain microorganisms such as *Giardia*, *Cryptosporidium*, *Salmonella*, *Shigella*, *Campylobacter* and *Escherichia coli* (*E. coli*). Consumption of water containing these microorganisms often results in gastrointestinal illness. Symptoms of ill health generally occur quickly, within hours or days.

Health effects from consumption of water contaminated with heavy metals or other chemicals can be wide ranging. They may take much longer to become apparent, and generally only affect health when consumed over extended periods (i.e. months or years rather than hours or days).

Opportunistic pathogens generally present a lower risk of infection, but health effects can be significant (e.g. the respiratory condition legionellosis can be contracted from inhalation of water droplets contaminated with *Legionella*) or fatal (e.g. primary amoebic meningoencephalitis which can occur when *Naegleria fowleri* amoebae travel up the nose to the brain).

The people most at risk of becoming ill from unsafe water are those with weak immune systems such as the elderly, the very young and those with medical conditions that lead to compromised immunity. People with skin wounds or burns who play or wash in untreated or poorly managed water supplies could also be at risk of infection.

Managing your private drinking water supply

Keeping your private drinking water supply safe involves:

- Choosing the water source of the highest quality and lowest risk
- Understanding and managing the hazards associated with the water supply
- Where necessary, treating the water to eliminate or reduce contaminants
- Monitoring the quality of water and performance of treatment systems
- Planning on how to respond to problems that may arise in your water supply system.

It is recommended that a drinking water supply management plan is developed to record the approach to managing a private drinking water supply.

A simple drinking water supply management plan can be drawn up using the template in Appendix 1.

Adopting a multiple barrier approach

Using multiple barriers (or control measures) against contaminants is recommended because, if one barrier fails, the remaining barriers will reduce the likelihood of contaminants passing through the system and causing harm to consumers.

Barriers include:

- Selecting the highest quality water source available
- Protecting the catchment for your supply (e.g. for rainwater tanks, keeping roofs and gutters clean; for groundwater, protecting the bore from surface water and sewage seepage)
- Adequate treatment (e.g. filtration, disinfection)
- Measures to prevent recontamination after treatment.

Choosing the water source of the highest quality and lowest risk

Some commercial and community premises that rely on private drinking water supplies will have access to more than one source of water. In these circumstances, a risk management approach should be adopted to select the safest source of water for drinking, food preparation and personal hygiene purposes.

Generally, the safest form of private drinking water supply will be treated town water, transported by a council-registered water carter and stored in a well-maintained tank. However, it is acknowledged that due to high costs, most people that rely on private drinking water supplies will only use treated, carted water when alternative sources are unavailable or unsafe.

Water testing for microbial and chemical contaminants can help determine which water source is safest. Generally, rainwater or deep groundwater (sourced via a bore accessing an aquifer which is tens to hundreds of metres below the surface) will be of better quality than shallow groundwater or surface water sources, which are more prone to contamination from sewage seepage, animal faeces and agricultural run-off. Surface water should only be used when there are no other alternative water sources available.

If you use more than one source of water on your premises (e.g. rainwater for drinking and groundwater for showering or toilet flushing), there is a risk that a cross-connection between the two pipe systems could occur. To minimise the risk of cross-connections, it is recommended that pipes and fixtures are appropriately marked, and detailed drawing(s) of the plumbing systems are maintained. Where there is more than one pipe-system used, make sure anyone undertaking plumbing activities at your property is made aware before they commence work.

Understanding and managing hazards associated with private water supplies

A good understanding of the drinking water supply system is required to identify all the potential hazards and sources of contamination. Factors to be considered when identifying hazards include:

- Possible sources of contamination
- Quality of the source water including during rare but anticipated hazardous events (e.g. storms and floods)
- Condition of water storage components and risk of contamination (e.g. age of tank, risk of pipework cross connection)
- Treatment failures (e.g. UV lamp failure).

The identified hazards need to be managed to minimise any risk to the drinking water supply. This can be done via measures such as good design and routine maintenance of the drinking water supply system and, where necessary, appropriate treatment of the water. Figures 1 - 4 on the following pages, and Appendix 2 provide advice on identifying common sources of contamination and ways to reduce risk for rain, ground, surface and carted water supply systems.

Rainwater

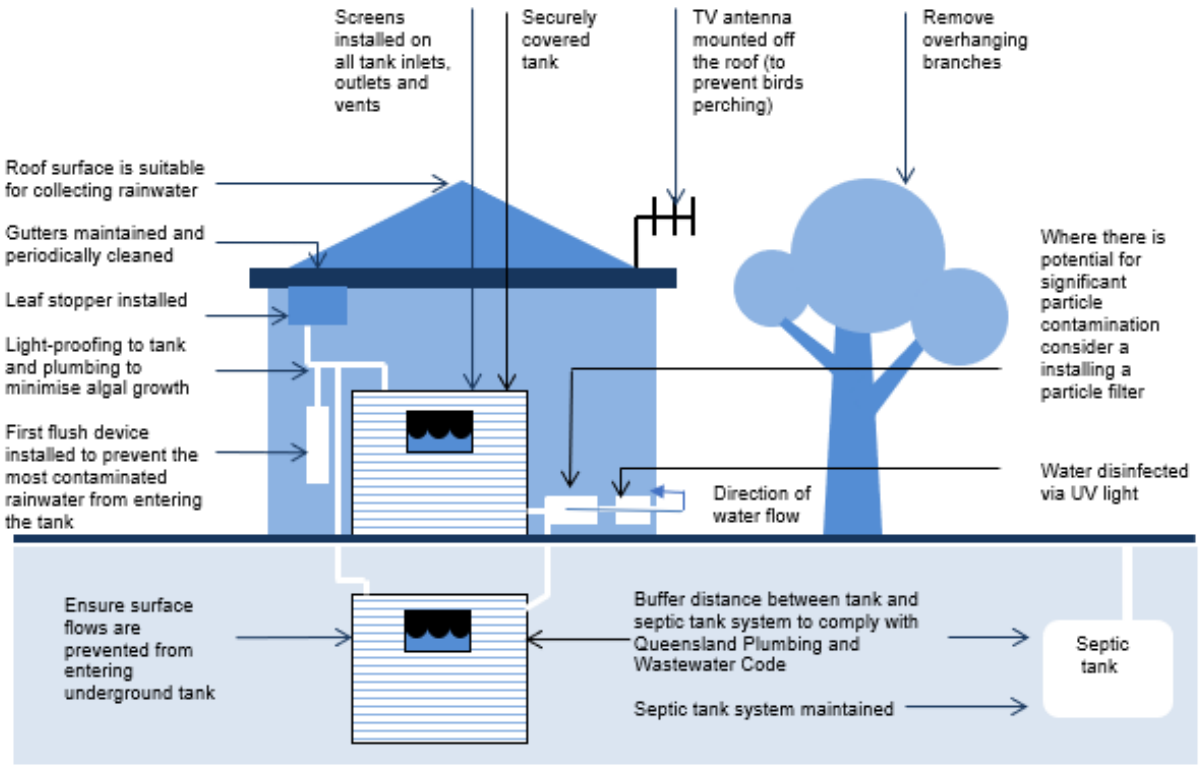
Rainwater contamination hazards include:

- roof materials, such as roofs coated in bitumen products or lead-based paints
- animal/bird faeces
- leaves and debris
- ash and chemicals from wood heaters (e.g. where chimneys and flues are not installed properly or due to the burning of inappropriate fuel) or nearby bushfires
- pesticides and fertilisers from aerial spraying
- metals leaching from fixtures (e.g. taps) due to rainwater being both slightly acidic and soft (i.e. having a low mineral content).

Where rainwater storage tanks are located below the ground, additional contamination hazards include:

- seepage from sewerage pipes, septic tanks and on-site sewage treatment plants
- industrial and agricultural run-off (e.g. pesticides, fertilisers and animal faeces)
- seepage from rubbish disposal
- stormwater
- chemical spills.

Figure 1: Contamination hazards and ways to minimise risks to rainwater supply systems

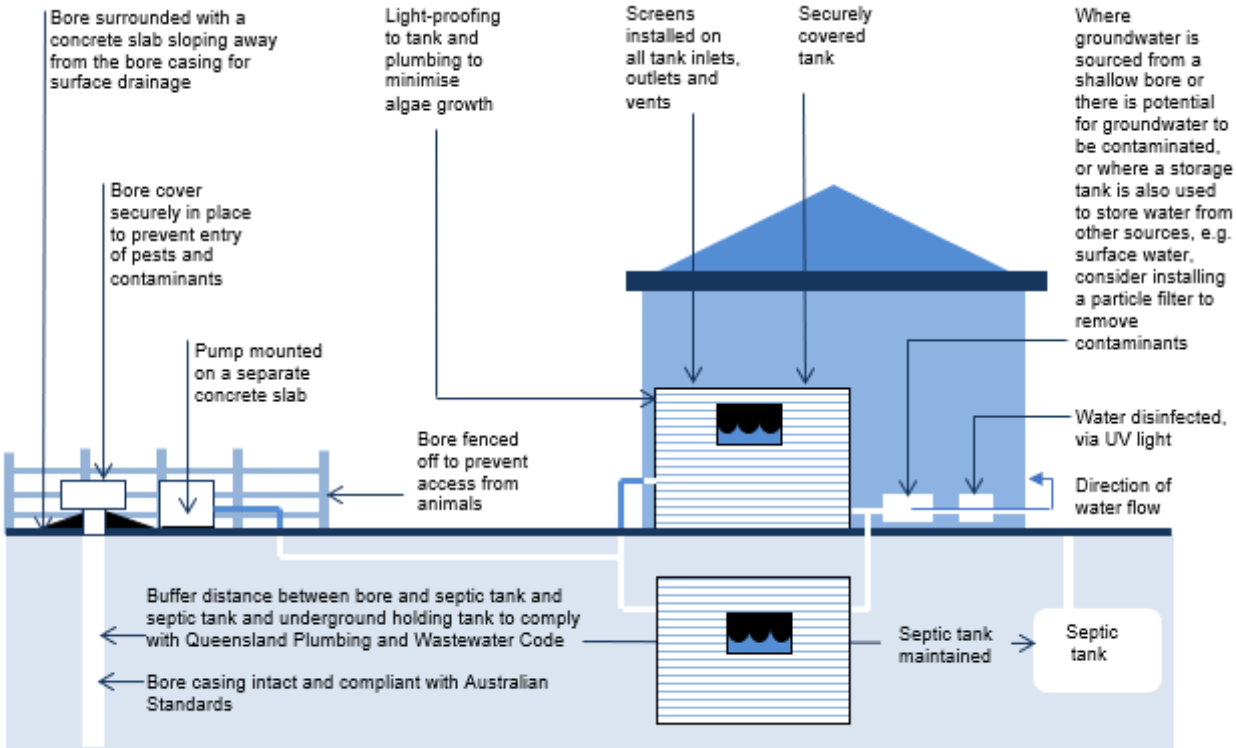


Groundwater

Groundwater contamination hazards include:

- seepage from sewerage pipes, septic tanks and on-site sewage treatment plants
- animal faeces
- industrial and agricultural run-off (e.g. pesticides and fertilisers)
- seepage from rubbish disposal
- stormwater
- chemical spills
- naturally occurring chemicals (e.g. arsenic).

Figure 2: Contamination hazards and ways to minimise risks to groundwater supply systems



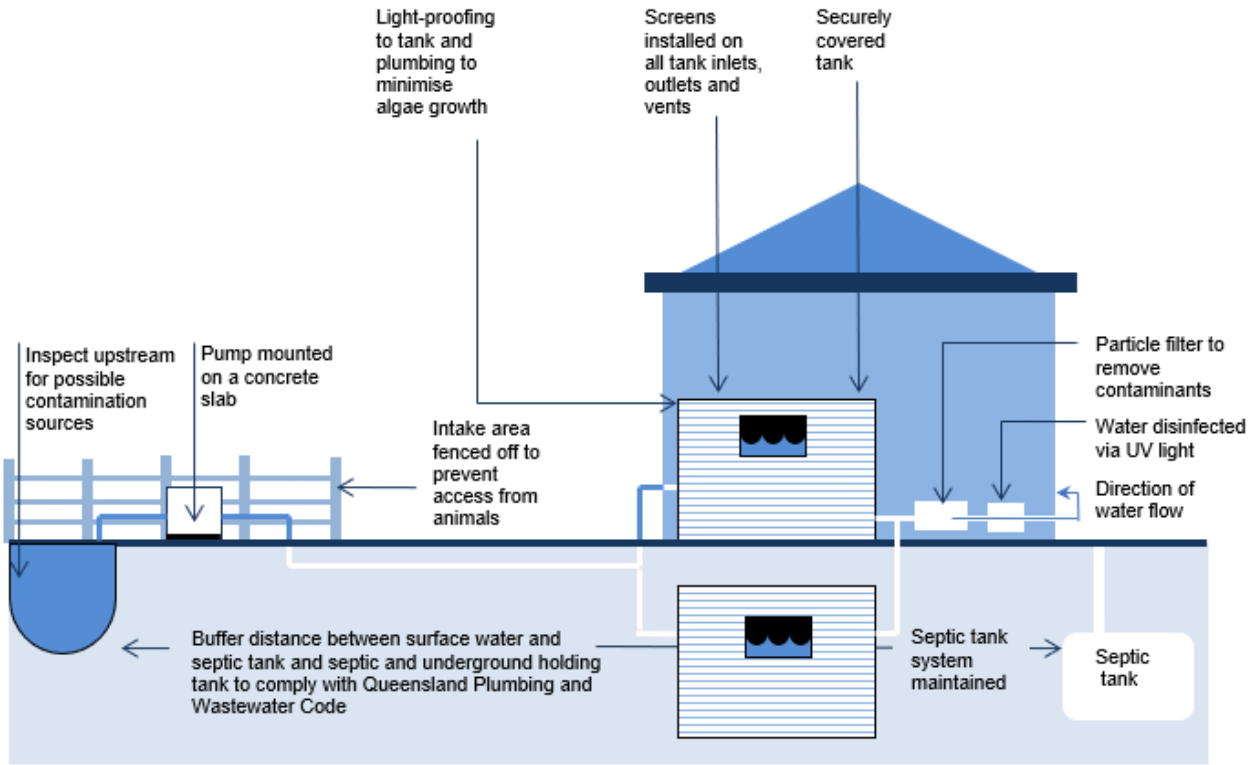
Surface water

Surface water contamination hazards include:

- sewage effluent from septic tanks
- animal faeces
- industrial and agricultural run-off (e.g. pesticides and fertilisers)
- seepage from rubbish disposal
- stormwater
- chemical spills.

Wherever possible, drinking water supply systems using raw surface water should have a full water treatment system installed that complies with the relevant plumbing codes and standards. In addition to filtration and disinfection, this may need to include water treatment steps not shown in the diagram below such as coagulation and flocculation or the use of a settling tank (especially during periods where rainfall gives rise to increased suspended solids in the water source). The treatment system should be able to cope with varying raw water qualities because surface water is subject to substantial changes in quality over time. Short periods of lowered quality in the water source can be readily managed by shutting off the offtake during these periods.

Figure 3: Contamination hazards and ways to minimise risks to surface water supply systems



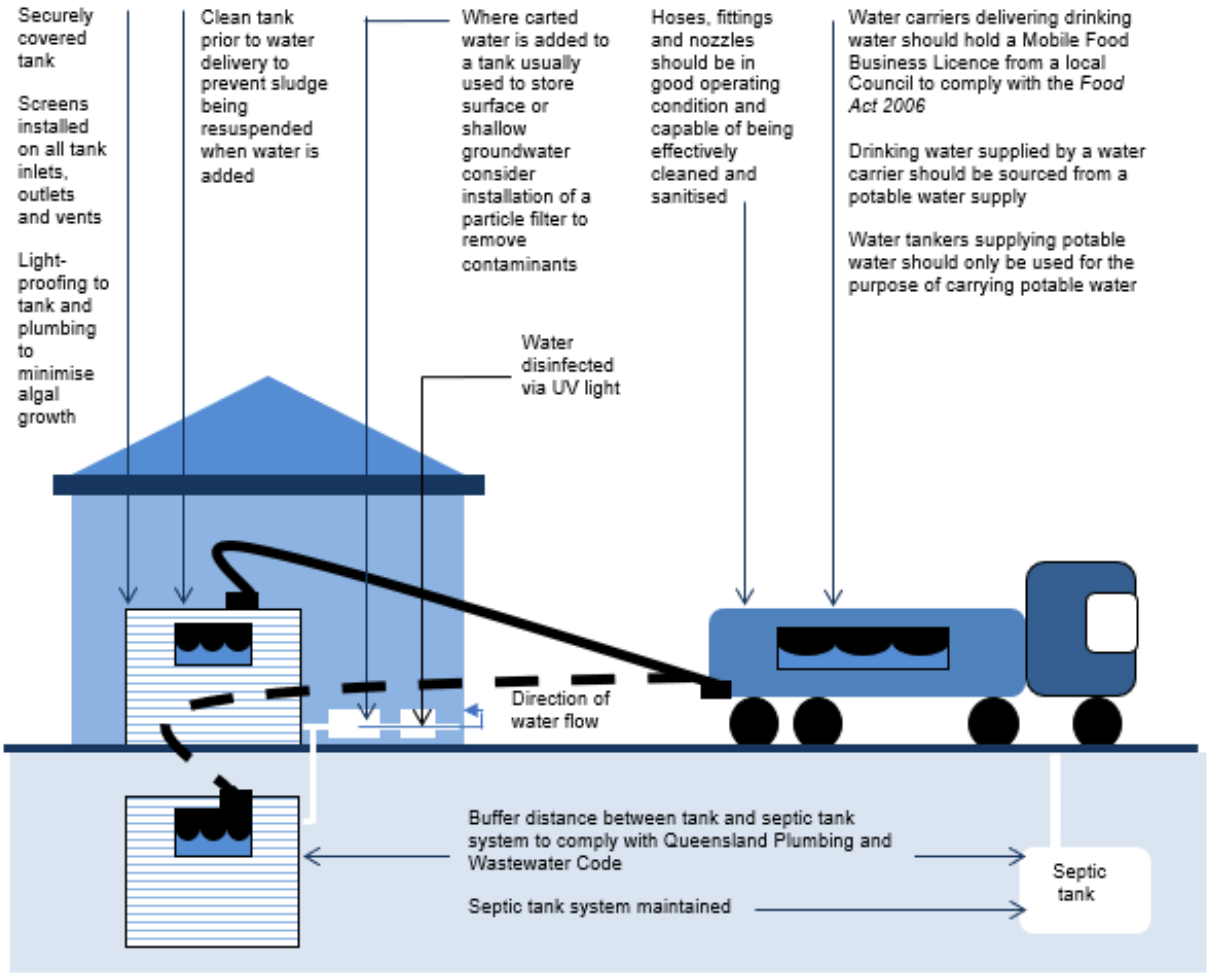
Carted water

Carted water contamination hazards include:

- contamination from water carriers' tanks if they have been used for liquids other than drinking water
- dirty hoses, fittings and nozzles used to transfer water from water carriers' tanks to water storage tanks
- sludge from the bottom of the storage tank, resuspended when water is delivered.

Where carted water is added to a tank usually used to store rain, surface or ground water, the hazards associated with these water sources should also be considered.

Figure 4: Contamination hazards and ways to minimise risks to carted water supply systems



Keeping mosquitoes and other animals out of your tank

It is important to maintain any drinking water storage tank so that mosquitoes and other animals cannot easily gain access. Mosquitoes can breed in tanks if entry points are not appropriately protected and animals such as possums, rats, mice and frogs may also be attracted to tanks and may become trapped inside, contaminating the water.

In Queensland, the Public Health Regulation 2018 requires all new tanks to be fitted with mosquito-proof screens and/or flap valves on every opening, including overflows. Screens must be made of brass, copper, aluminium or stainless steel gauze, have a mesh size of 1mm or less, be installed in a way that does not cause or accelerate corrosion, and stop mosquitoes passing through the openings. Flap valves must be able to stop mosquitoes passing through openings when they are closed. Penalties apply for tanks that don't meet these requirements.

Treatment options

If there is uncertainty as to whether a source of drinking water can consistently remain free of contamination, consideration should be given to installing some simple treatment steps. Treating drinking water is particularly important if there is potential for vulnerable people such as children, the elderly or those with compromised immunity, to consume the water.

A range of treatment options are available for private drinking water supplies. The most common include filtration, ultraviolet light disinfection and chlorine disinfection. More details on these options are provided in the sections below.

In most cases, a combination of filtration and ultraviolet light disinfection will be the best treatment option for a private drinking water supply. However, chlorine dosing may be preferable to address poor water sampling results (e.g. an *E. coli* detection) or a contamination event. Chlorine dosing may also be required for private drinking water supplies with larger drinking water reticulation networks, such as at holiday resorts or larger schools. These types of premises may benefit from the maintenance of a residual level of chlorine in order to maintain the quality of the drinking water. This is because stale water sitting in water pipes can provide ideal conditions to grow hazardous bacteria such as *Legionella*.

When deciding what treatment option is best for your private drinking water supply, it is always best to get professional advice. Consult a plumber, tank supplier, your local environmental health officer or search online for a local water treatment company or expert.

Filtration

Filtration is generally recommended for all surface water and shallow ground water supplies. It should also be considered for other water sources that are known or suspected to contain contaminants.

When selecting a filter, you should consider whether the filter will be used on its own or in conjunction with ultraviolet light disinfection or chlorine disinfection. When filtration is used on its own, the filter may be located either at the point of entry to the premises or at the point of use. Point of entry filters ensure water supplied to the whole premises is subject to filtration whereas point of use filters, such as one that is connected to a kitchen tap, only filter the water used by that outlet.

When filtration is used on its own (not in conjunction with disinfection), you should choose a filter that is capable of removing bacteria (e.g. *Campylobacter, Salmonella, Shigella,* and *E. coli*). Filters that can remove bacteria will also be effective in removing protozoa (i.e. intestinal parasites such as *Cryptosporidium* and *Giardia*).

For water sources that contain sediment or lots of suspended particles, a second filter may need to be installed prior to the filter used to remove bacteria, so that the filter used to remove bacteria doesn't become clogged.

Where filtration is being used in conjunction with disinfection (ultraviolet light or chlorine disinfection), the filter(s) should be installed prior to the disinfection step. Arranging the treatment steps in this order will increase the efficacy of the disinfection process. The only instance where the treatment steps may not be ordered in this way may be where point of use filters are installed at outlets.

For supplies that have elevated levels of chemicals (e.g. metals or salts), objectionable tastes, odour and colour, a more advanced filtration system will be required, and for supplies that may be impacted by human waste, a filter capable of removing viruses (e.g. Hepatitis A, Norovirus, Rotavirus) is also recommended.

In all instances, care must be taken to ensure that the filter cartridges are replaced or cleaned according to the manufacturer's instructions such that they continue to operate properly.

Several factors determine a filter's ability to remove specific types of contaminants, including the material the filter is made from, the filter grade (i.e. how fine the filter is) and the flow rate of water through the filter. Common types of filter include:

- **Polypropylene and ceramic cartridge type filters:** These filters contain tightly packed fibres that form a fine mesh screen that physically traps and removes particles from water. They are effective in removing sediment and are moderately effective in removing protozoa and bacteria. They will not remove viruses or chemicals.
- **Microfiltration:** A microfiltration filter typically has pore sizes between 0.1 and 1 micron (a micron is one millionth of a metre) and can effectively remove sediment. They are also highly effective at removing protozoa and moderately effective at removing bacteria. They will not remove viruses or chemicals.
- **Ultrafiltration:** An ultrafiltration filter typically has a pore size of approximately 0.01 micron and can effectively remove sediment, protozoa and bacteria, and is moderately effective at removing viruses. Ultrafiltration has a low effectiveness in removing chemicals.
- **Nanofiltration** membranes overlap with both ultrafiltration and reverse osmosis filters having a nominal pore size of around 0.001 microns.
- **Reverse osmosis filters:** These filters are very sophisticated and have a filter pore size of approximately 0.0001 microns. They are highly effective at removing protozoa, bacteria and viruses. They can remove common chemical contaminants including sodium, chloride, copper, chromium and lead, and may reduce arsenic, fluoride, radium, sulfate, calcium, magnesium, potassium, nitrate and phosphorous. However, these filters produce a constant waste stream. This means they usually need to be connected to a drain and they may be unsuitable where the water supply is limited. Reverse osmosis filters must always be installed prior to any chlorination step as chlorine will destroy the filter membrane. Installations generally require a power supply and a pre-filtration stage of 5 micron rating.

When selecting a filtration system, the following should be considered:

- Determine the volume of water to be treated and ensure the equipment has the capacity (litres/hour) to treat all the water needed.
- Be aware that the smaller the pore size of the filter (expressed in microns), the finer the filtration, and the greater the reduction of flow rate and available pressure through the filter.

  It is often cost effective to have two filters, one after the other, where the first would typically have a large pore size (20 or 30 microns) and would be capable of removing larger contaminants that would quickly block the second filter (with a pore size of 1 micron or less).
- Look for a filtration system that
  - carries the WaterMark or Plumbing Safety Type Test Mark.
  - complies with at least one of the following performance standards: NSF/ANSI Standard 53: Drinking Water Treatment Units – Health Effects or AS/NZS 4348 – Water supply – Domestic type water treatment appliances – Performance requirements.
  - complies with AS/NZS 3497 – Drinking water treatment units – Plumbing requirements.

Ultraviolet light disinfection

Ultraviolet (UV) light is a common and effective form of disinfection. It relies on the use of UV lamps which emit light at wavelengths that kill or inactivate most disease-causing microorganisms.

However, care must be taken to select a system that meets the correct treatment classification. UV light disinfection systems will not remove sediment or chemicals.

When selecting a UV disinfection system, the following should be considered:

- UV disinfection systems need to be designed and installed by a water treatment specialist.
- Determine the volume of water to be treated and ensure the equipment has the capacity (litres/hour) to treat all the water needed.
- UV light disinfection is most effective when preceded by filtration because UV light cannot penetrate dirty or 'cloudy' water. Consider installing a two-stage filtration process before the UV unit. A 20 or 30 micron filter installed between the pump and UV unit will remove any dirt and debris which may stop the UV unit working properly.
- For best results, the UV unit should be located at the point just before water is used i.e. after any tank storage and after filtration. This is because UV light disinfection does not provide any ongoing residual disinfection. Minimising the length of pipe between UV disinfection and the point of use outlet (e.g. tap) will reduce the opportunity for microbial regrowth in the water.
- Consider purchasing a UV unit that has a built-in sensor to monitor the UV light intensity, connected to an alarm system that will trigger an alert in case of low UV levels.
- Consider purchasing a system that can shut off the water supply in case of a low UV alarm or loss of power.

- If the UV light disinfection system is to be used in combination with chlorination, it should precede chlorination as UV light can break down chlorine making it ineffective.
- Ensure the existing power supply has capacity to suit the system.
- Look for a system that:
  - carries the WaterMark or Plumbing Safety Type Test Mark
  - complies with at least one of the following performance standards: NSF/ANSI Standard 55: Ultraviolet Microbiological Water Treatment Systems or AS/NZS 4348 – Water supply – Domestic type water treatment appliances – Performance requirements.
  - complies with AS/NZS 3497 – Drinking water treatment units – Plumbing requirements
- Note that if you are considering a smaller unit aimed at the domestic market, it is important to check it meets the treatment classification you require. AS/NZS 3497 requires domestic UV light disinfection systems to be classified into one or more of the following classifications: Class IIa capable of removing or inactivating bacteria; Class IIb capable of removing or inactivating viruses; or Class IIc capable of removing or inactivating protozoa (e.g. *Cryptosporidium* and *Giardia*).
- UV disinfection units have to be checked and maintained regularly, following the manufacturer's instructions, to ensure the lamps are working and they remain effective. UV lamps have a limited life and most need replacing every 12 months.

Chlorine disinfection

Chlorine treatment is a low-cost method of disinfection that is highly effective at inactivating bacteria and viruses. To be most effective, it should be preceded by filtration to remove sediment and larger particles from the water supply. Chlorine disinfection will not inactivate protozoa (e.g. *Cryptosporidium* and *Giardia*), remove sediment or chemical contaminants.

Water can be chlorinated either through an automatic dosing system or manually by adding to a storage tank.

Chlorine is a hazardous chemical that can cause harm to people, property and the environment. Whether chlorine is used as a regular source of disinfection, or to shock dose a water storage tank following a contamination event, it should only be used in accordance with instructions on labels and after arrangements have been made for safe handling and storage.

Advice on how to manually dose a tank with chlorine is provided in Appendix 3. Adequate disinfection usually results in a chlorine concentration between 0.2 and 0.5 mg/L at the point where the water is used (e.g. at the kitchen sink).

Where the installation of an automatic chlorine dosing system is necessary, the following should be considered:

- Determine the volume of water to be treated and ensure the equipment has the capacity (litres/hour) to treat all the water needed.

- Consider installing a pre-filter before chlorination. Water for chlorine disinfection should be free of dirt and debris and contaminants such as iron and manganese which may absorb or deplete chlorine levels.
- Check that the chlorination system comes with a test kit that can be used to monitor the level of residual chlorine. If it doesn't, you will need to purchase a separate test kit.

pH correction

Some sources of water, like rainwater, can be both slightly acidic and quite soft (i.e. low in dissolved minerals). Water with these properties can lead to the leaching of metals, such as lead and copper, from certain plumbing fixtures (e.g. valves and taps), particularly when the water is in contact with fixtures for an extended period of time. pH correction is the term used to describe the adjustment of pH, and sometimes the hardness, of water. Operators of supplies utilising sources of water that are both slightly acidic and soft should consider including a pH correction step to reduce the likelihood of metals leaching into the water supply.

When selecting a pH correction system, such as a calcite (calcium carbonate) filter, the following should be considered:

- Ensure any compounds used by the system (e.g. calcite) are suitable for use in drinking water.
- Look for a system that:
  - carries the WaterMark or Plumbing Safety Type Test Mark
  - complies with AS/NZS 3497 – Drinking water treatment units – Plumbing requirements

Note that chlorine often raises the pH so pH correction may not be required if chlorine is used for disinfection. Likewise, newly installed concrete tanks can increase the pH of the water meaning a pH correction system may not be needed initially.

Supplies that are used intermittently, such as those that supply school camps, should be flushed before the commencement of each occupation to reduce the likelihood of exposing visitors or guests to elevated levels of metals.

Monitoring and record-keeping

Monitoring is an essential part of the multiple barrier approach to good drinking water management. The results of monitoring indicate whether barriers to contamination are working properly.

Monitoring includes:

- Operational monitoring - monitoring activities that can be undertaken onsite by the person responsible for the water supply
- Verification monitoring - taking samples of the water and submitting it to an external laboratory for analysis
- Record-keeping.

For most commercial and community premises that rely on private drinking water supplies, operational monitoring and record-keeping should be the focus of monitoring activities. Verification monitoring, which may be expensive and may present logistical difficulties, is required less frequently.

More details on operational and verification monitoring are provided below. A monitoring and maintenance checklist is provided in Appendix 4.

Operational monitoring

Operational monitoring can be split into two main activities. Firstly, inspection of the drinking water supply system to identify any maintenance work that is required. This should be done on a regular basis and also after an event such as a storm, flood or bushfire to identify any damage to the water supply system. Secondly, checks should be undertaken to ensure that water treatment systems are working correctly. More advice on operational monitoring for filtration, UV and chlorine disinfection systems is provided below.

Filtration

Filtration systems should be maintained in accordance with the manufacturer's operating and maintenance advice. Filter cartridges should be checked regularly to ensure they remain free from build-up. Water quality after the filter should also be checked regularly. If flow decreases or the water becomes dirty or cloudy, the filter cartridge should be checked to determine if it needs to be cleaned or replaced. Some filters include a light or display that indicates the need for filter cartridge replacement.

Ultraviolet light disinfection

Ultraviolet light disinfection systems need regular and careful maintenance to ensure they remain effective. The unit should be checked to ensure:

- A reliable power supply is provided to the lamp
- The lamp is intact and operating

- The outside of the lamp is free from biofilm or scum
- The lamp is replaced annually or as per the manufacturer's advice.

Chlorine disinfection

Drinking water supplies that are subject to chlorine disinfection need careful onsite monitoring. The chlorine concentration should be tested weekly at the point where the water is used (e.g. at the kitchen sink). This can be done using a simple swimming pool chlorine test kit. The chlorine concentration should ideally be at least 0.2 mg/L at points where the water is used and should not exceed 5 mg/L, noting that water containing chlorine at concentrations greater than 0.6 mg/L can give rise to a chlorine taste/odour that may be unpleasant to some people).

Additional tests to check chlorine concentration should also be undertaken when the drinking water supply has not been used for an extended period, (e.g. more than one week). In this situation, the pipes should be flushed for a few minutes i.e. until fresh water flows through from the tank., before testing the chlorine concentration.

Verification monitoring

Whether a drinking water supply is treated or not, it is recommended that the quality of the water is tested routinely to ensure it is safe and that any treatment systems installed are working well. The water quality should comply with the Australian Drinking Water Guidelines. Guideline values for key microbiological, chemical and aesthetic (e.g. taste and odour) characteristics outlined in the Australian Drinking Water Guidelines are provided in Appendix 5.

Tests of the microbial quality of the water should look for the microorganism *Escherichia coli* (*E. coli*). If *E. coli* is detected, this indicates faecal contamination and the possible presence of disease-causing microorganisms. The Australian Drinking Water Guidelines state that *E. coli* should not be detected in 100mL of water tested. Testing for other microbial disease-causing microorganisms (e.g. *Cryptosporidium*) is not required unless the drinking water supply is suspected of causing illness.

The types of chemical and physical parameters that should be tested for will vary depending on the water source and location. Shallow ground water and surface water supplies are most at risk from chemical contaminants but that is not to say that other sources of water should not be tested. If possible, managers of private drinking water supplies should seek advice from someone who is knowledgeable about drinking water contaminants in their local area. For example, if the drinking water is sourced from a surface water supply downstream of a former mine site, then it would be wise to get a water sample analysed for heavy metals. Alternatively, if you are concerned about contamination of your rainwater supply from aerial application of pesticides nearby, then getting your water analysed for pesticides may be advisable. Once you have some results, the Australian Drinking Water Guidelines provide health and aesthetic guideline values for a wide range of chemical and physical parameters.

Testing for algae in surface water supplies only needs to be undertaken if you suspect it is present.

Water samples should be tested at a laboratory accredited by the National Association of Testing Authorities (NATA) to ensure the results are reliable. Water testing services for commercial and community premises that rely on private drinking water supplies are sometimes offered by local councils. Alternatively, undertake an internet search for an analytical laboratory servicing your local area.

If you require assistance interpreting laboratory reports you should seek assistance from the laboratory that has conducted the analysis, or your local government environmental health department.

Frequency of verification monitoring

The frequency of verification monitoring of private drinking water supplies should be based on risk.

For private drinking water supplies that are subject to effective treatment, microbial sampling should only be necessary once or twice a year to confirm that the water is safe, and that the treatment system is operating correctly. For private drinking water supplies in community and commercial premises that are not subject to treatment, more frequent testing – monthly if possible – is recommended.

The frequency of testing for chemical and physical parameters should be guided by the results of initial testing after considering the advice of a water treatment professional or environmental health officer. If no results of concern are identified, then ground and surface water supplies should be retested annually. Rainwater supplies will require less frequent testing compared with surface waters or surface water impacted groundwater.

In addition to routine verification monitoring, the water quality should be tested:

- After installing a new treatment system
- After altering a treatment system
- After a significant event that may have affected the water quality, such as heavy rains or a bushfire.

Guidance on taking a water sample is included in Appendix 6.

Record-keeping

Records should be kept of maintenance, monitoring and treatment activities such as:

- Results of system inspections
- Treatment performance (record indicators such as chlorine concentrations, if chlorine is used, and UV intensity)
- Details (date and type) of maintenance carried out on the water system, including calibration of any instruments or monitoring equipment
- Results of any microbial or chemical testing
- Details of any contamination incidents and the actions taken
- Details of carted water deliveries
- Details of any warning signs posted.

Records are recommended to be kept with drinking water supply management plan documentation so that they are easy to find. Where premises are subject to inspection from local or state government departments, inspectors may ask to view these records.

Responding to problems in your drinking water supply system

If monitoring of a drinking water supply system shows that something is wrong, the cause will need to be investigated and, where necessary, corrective actions undertaken. The following unusual events can contaminate water supplies that are normally safe to drink:

- Sewage or chemical spills within the catchment for the water supply
- Dead animals in a storage tank or water catchment area
- Bushfires
- Drought
- Flood or cyclone
- Equipment or treatment failures
- Pipe breakages
- Algal blooms in the water storage.

If it is suspected that a private drinking water supply has been contaminated, it is important to immediately notify everyone with access to the water. An effective way to do this is to install signs at water outlets. If the water cannot be treated to a standard safe for drinking, an alternative water supply should be provided, or where the contaminant is microbial, and it is appropriate, all consumers may be advised to boil the water, until the regular water supply is proven to be safe.

Where the drinking water supply serves a food business, the operators will also need to consider whether the contaminated water will have had any effect on food already produced and if they are able to continue to operate while the issue is being resolved.

If there are any cases of illness thought to be due to consumption of contaminated drinking water, medical assistance should be sought, and the relevant local government environmental health department should be notified.

To determine the best approach for resolving the issue, it may be necessary to consult with your local environmental health officer and/or a water treatment specialist for advice. Corrective actions may include things like:

- Undertaking maintenance to components of the drinking water supply system (e.g. repairing tanks, cleaning gutters, replacing bore covers)
- Undertaking maintenance to components of the water treatment system (e.g. replacing filter cartridges or UV lamps)
- Installing new or different treatment systems
- Emergency disinfection

It is important that a record is kept of corrective actions to demonstrate that the appropriate response has been made to any identified issue.

Public warnings

Operators of commercial and community facilities should ensure all consumers are informed about drinking water quality. Signs are useful for this purpose.

Signs for general use

If a private drinking water supply is not treated by a reliable process (e.g. filtration and UV or filtration and chlorine dosing), suitably maintained, or regularly tested, all potential consumers should be warned.

The warning can be in the form of a sign at each water outlet and/or via an entry in an in-house directory or an accommodation in-room notification card. An example is provided below:

WARNING
The water here is not monitored or treated. Water quality may not meet health guidelines

Signs for water not supplied for drinking

If the water supply is not intended to be used for drinking, then consumers should be warned. The warning should be displayed at each water tap and in bathing areas. Examples are provided below:

WARNING
Water not suitable for drinking

Signs to advise of contamination or adverse testing results

Where water is known to have microbial contamination, an alternative water supply (e.g. commercially bottled water) should be provided, or water should be boiled before use. Examples are provided below:

WARNING
Do not drink

WARNING
Use bottled water for drinking, preparing food and cleaning teeth

WARNING
Boil water before drinking, preparing food and cleaning teeth

If a drinking water supply is contaminated by chemicals or blue-green algae, consumers should be warned that the water is not suitable for drinking or bathing. Boiling the water will not remove chemicals or blue-green algae. Examples are provided below:

WARNING
Water not suitable for drinking or bathing

Appendix 1: Drinking water supply management plan

The following information should be included in your drinking water supply management plan:

Organisational details

Property name	
Property address	
Owner/occupier	
Contact details	
After-hours contact	

Responsibility for system monitoring and maintenance

Main person responsible	
Roles and responsibilities	
Contact details (including after-hours)	

Description of the system

Water source and uses	

Insert → diagram

Insert a diagram showing location of:

- Drinking water supply system – water source, pumps, storage, treatment, pipelines etc.
- Wastewater system – sewerage pipes, septic tanks, disposal trenches/dispersal areas, composting toilets etc.
- Any other water supplies (including pipework) e.g. irrigation water, non-drinking supplies

Possible contaminants and controls

Insert → a list of possible contamination sources and the control measures in place to minimise risk

Use Appendix 2 and Figures 1-4 to identify possible sources of contamination and control measures to complete a list for your drinking water supply system, by adding new rows for each contamination source.

Potential source of contamination	Control measure

Monitoring and record-keeping

Insert → monitoring and maintenance checklist

Use the monitoring and maintenance checklist in Appendix 4 to complete a list of inspection and maintenance activities relevant to your drinking water supply system. For each activity identify:

- Person responsible
- Frequency of monitoring
- Procedure used (if applicable)

Activity	Person responsible	Frequency	Procedure

Insert → record keeping

Draw up a simple record-keeping log to record your inspection and maintenance activities. You should keep records for activities such as:

- System inspection notes
- All results of microbial and chemical testing
- Chlorine concentration checks (where applicable)
- Any maintenance to the water system (filter change, addition of chlorine, tank cleaning)
- Incidents and corrective actions taken (e.g. finding a dead animal in the tank, storms or bushfires that may have affected water quality)
- Deliveries of carted water (including date and name of supplier)
- The posting of warning signs

Date	Person responsible	Type of monitoring or maintenance	Result	Corrective actions (if applicable)

Incident response procedure

Insert → incident responses for system failures

Insert a brief description of the steps to take in the event of a system failure. You may want to consider the following situations:

- Microbial contamination event or suspected event (e.g. gastro outbreak)
- Chemical contamination event
- Loss of supply

Insert → emergency contacts

Insert a list of emergency contacts. People to consider including:

- Plumber
- Water treatment specialist
- Repairs contractor
- Tank cleaner
- Local government environmental health officer

Emergency contact	Contact details

Appendix 2: Common sources of contamination and control measures

Water supply	Source of contaminants	Control measure
Rainwater and water storage tanks (Note that water storage tanks may be used for rainwater, groundwater, surface water and carted water)	Roof and gutters (e.g. build-up of leaves, dirt, animal droppings, airborne contaminants from intensive farming, mining and industrial sites)	• First flush device • Regular cleaning of roof and gutters, (remembering to block any flow to water supply system during cleaning) • Periodic tank inspection and cleaning • Removal of overhanging branches • Antennas mounted off roof to prevent birds perching • Water treatment (filtration/disinfection)
	Roof material (e.g. lead-based paint, lead flashing, bitumen-containing products, treated timber, peeling paint)	• Do not collect water from roofs coated or painted with substances that may leach hazardous chemicals • Remove and replace lead flashing with non-leaded alternative
	Animals (including insects, frogs, birds or mammals) in the system	• Screen all inlets and outlets to the tank • Regular inspections of tank, roof and gutters
	Build-up of sludge in tank, dirt in inlet strainers, insect screens and first flush devices	• Regular inspection, cleaning and maintenance program
	Leaching of tank materials (as shown by changes in pH of water in concrete tanks, presence of metals from metallic tanks)	• Materials in contact with water to comply with relevant Australian Standards (see below) • Chemical adjustment of pH in new concrete tanks may be necessary
Rainwater and water storage tanks (Note that water storage tanks may be used for rainwater, groundwater, surface water and carted water)	Seepage and surface water run-off (in-ground tanks)	• Ensure surface flows are prevented from entering access points in underground tanks • Keep required buffer (or "setback") distance between sewerage pipes, septic tanks and water storage tanks in accordance with Queensland Plumbing and Wastewater Code • Water treatment (filtration/disinfection) if needed • Periodic tank inspection to check integrity
	Pump and plumbing materials	• All materials in contact with water to comply with AS/NZS 4020:2018 and hold WaterMark certification • Periodic flushing where water supply or plumbing fixture is used intermittently.

Water supply	Source of contaminants	Control measure
Groundwater (bore, well, spring)	Surface water seepage	• Raise bore heads above ground level to prevent water pooling around bore head • Install sloped concrete skirt around bore head • Ensure bore covers and bore casing are intact • Regular inspections
	Sub-surface contamination (e.g. from industry, farming, landfill, sewage)	• Extract groundwater from places where leaching of surface contaminants is unlikely • Considering the flow of groundwater, extract water 'upstream' or 'up gradient' of potential contamination sources • Test the water for chemicals and treat if necessary • Protect groundwater source from onsite or offsite wastewater disposal system contamination, including tree root damage to pipes • Water treatment (filtration/disinfection) if needed
	Backflow water (e.g. from animal water troughs)	• Backflow prevention device
	Leaching from bore casings, pumps, pipes or plumbing materials	• All materials in contact with water to comply with AS/NZS 4020:2018 and hold WaterMark certification • Periodic flushing where water supply or plumbing fixture is used intermittently.
Surface water (dams, creeks, rivers)	Surrounding land uses (e.g. intensive farming, urban areas, industrial sites and sewage discharges)	• Where possible, protect surface water source against livestock, septic tanks/sewage overflows and chemical spills • Monitor upstream developments and land use for potential impacts • Fit pump drawing water with an inlet screen • Where possible, do not pump water when surface water level is low to avoid the possibility of pumping increased sediment • Water treatment
	Animal and human activities	• Fence water storage and offtake area • Don't permit swimming or public access in offtake area • Monitor upstream activities for contamination sources • Water treatment

Water supply	Source of contaminants	Control measure
	Pump and plumbing materials	• All materials in contact with water to comply with AS/NZS 4020:2018 and hold WaterMark certification • Periodic flushing where water supply or plumbing fixture is used intermittently.
Carted water	Water source	• Carted water should be sourced from a mains or town water supply
	Water carrier	• Carrier should hold a Mobile Food Business Licence from local government under the *Food Act 2006* • Containers supplying drinking water should only be used for the purpose of carrying drinking water • Hoses should be in good condition and should be capable of being effectively cleaned and sanitised between uses
	Re-suspension of tank sludge when water is added	• Clean tank prior to water delivery
	Pump and plumbing materials	• All materials in contact with water to comply with AS/NZS 4020:2018 and hold WaterMark certification • Periodic flushing where water supply or plumbing fixture is used intermittently.

Appendix 3: Manual chlorine dosing

There are various types of chlorine that can be used to manually disinfect a tank. Options include:

- liquid household bleach
- sodium hypochlorite
- calcium hypochlorite.

Liquid household bleach can be purchased at a supermarket or hardware store. Check that the product has at least 4 per cent available chlorine and has no additives such as fragrances or detergents. Sodium hypochlorite and calcium hypochlorite can be purchased from large supermarkets, hardware stores or swimming pool suppliers.

Stabilised chlorine (which is used for swimming pools and contains cyanuric acid) is not suitable for enclosed tanks and should not be used.

Raising the concentration of chlorine to 5mg/L is usually sufficient to disinfect water held in a tank. As chlorine is available in a number of different forms, the percentage of available chlorine must be known before it is added to the water.

Calculating how much chlorine to add

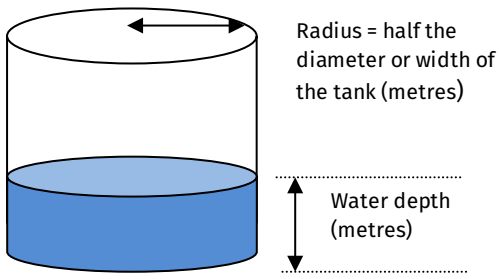
To determine how much chlorine to add, first calculate the volume of water in the tank. This can be done using the following formulae:

Rectangular/square tanks:

Volume (litres) = depth of water in tank (metres) x tank width (metres) x tank length (metres) x 1,000

Cylindrical tanks:

Volume (litres) = depth of water in tank (metres) x tank radius (metres) x tank radius (metres) x 3142



Once the volume of water in the tank has been calculated, use the table below to estimate the amount of chlorine that should be added to provide an initial chlorine concentration of 5mg/L.

Table 1: Chlorine addition to water storage tanks

Volume of water in tank (Litres)	Amount of chlorine to add to achieve 5mg/L in tank		
	4% liquid bleach (mL)	12.5% liquid sodium hypochlorite (mL)	65% granular or powdered calcium hypochlorite (g)
1,000	125	40	8
2,000	250	80	15
5,000	625	200	38
6,000	750	240	46
7,500	938	300	58
10,000	1,250	400	77
16,000	2,000	640	123
20,000	2,500	800	154
30,000	3,750	1,200	231

Chlorine is hazardous. When adding chlorine to the tank, first mix the chlorine solution with cold water in a plastic bucket in the open air, then add the mixture to the tank and let it stand for at least one hour (ideally 24 hours) before use.

Always add chlorine to water, never water to chlorine, avoid inhalation of fumes and use appropriate protective equipment including gloves and goggles. Always follow the manufacturer's handling and storage instructions.

After adding the chlorine to the tank, it will dissipate (disappear) from the water quite rapidly. The concentration of chlorine remaining in the water after 30 minutes should be at least 0.5mg/L, but no more than 5mg/L. This can be measured using a swimming pool chlorine test kit to confirm the concentration of chlorine is appropriate.

If the water quality in the tank is poor, the amount of chlorine added to the tank may need to be increased to above 5mg/L in order to achieve 0.5mg/L after 30 minutes.

For routine (i.e. non-emergency) treatment of good-quality water, an initial dose of less than 5mg/L may be sufficient to achieve 0.5mg/L after 30 minutes. If chlorine is routinely used, the chlorine concentration should be tested weekly to determine if re-dosing is required. The concentration of chlorine should ideally be between 0.2 and 0.5mg/L at the point where the water is used (e.g. at the kitchen sink).

Appendix 4: Monitoring and maintenance checklist

The checklist below can be used to inform operational and verification monitoring activities. Extra items may need to be added.

Item	Recommended frequency
Water source - Rainwater	
Clean gutters	3 Monthly and after storms
Clear first flush device of debris	3 Monthly and after storms
Check and trim branches overhanging the rainwater collection system (usually the roof)	Annually
Inspect and repair downpipes	Annually
Check condition of roof	Annually
Water source - Groundwater	
Check control measures to protect against surface flow contamination	Monthly
Check infrastructure (bore casing, pump, piping) is fully operational and well maintained	Monthly
Water source - Surface water	
Assess upstream catchment for new developments and other possible sources of contamination	Monthly
Check maintenance and operation of the pump and piping	Monthly
Check inlet screen on pump for debris	Monthly

Item	Recommended frequency
Tank	
Check inlet and outlet screens are intact	3 Monthly
Check access covers	3 Monthly
Clear strainer of debris	3 Monthly
Check structural condition	Annually
Check sludge level and internal cleanliness	Every 2 years
Distribution system	
Check plumbing/pipework is fully operational and well maintained	Annually
Check any backflow prevention devices	Annually, or as per manufacturer's advice
If more than one water source is used, check for cross connections between pipes for drinking water and non-drinking water	After any significant plumbing work
Flush drinking water outlets if the premises have not been occupied/used for more than two days, and all outlets if more than seven days	Refer to Appendix 2 for contamination issues for which flushing is an appropriate control
Treatment - Filtration	
Clean/change filters	As per manufacturer's advice
Treatment - UV disinfection	
Check UV light is operational	Weekly
Clean biofilm (surface scum) on UV light	3 Monthly
Replace UV lamp	Annually or as per manufacturer's advice
Treatment - Chlorine disinfection	
If chlorine injection system is used, check it is fully operational	Weekly

Item	Recommended frequency
Check chlorine concentration at point of use is between 0.2 and 0.5mg/L	Weekly or after heavy rain
Check pH level of water in tank is between 6.5 and 8.5 and adjust as necessary	Monthly
Water quality testing	
E. coli test for microbial contamination	Monthly where possible; when new treatments are installed or altered; after a potential contamination event
Chemical testing – (see pages 25 and 26 of these guidelines for advice on what to test for).	Initial test then annually where possible for ground and surface water system; when new treatments are installed or altered; after a potential contamination event
Blue-green algae test (surface water)	If growth is suspected

Appendix 5: Drinking water guideline values

The following microbial, chemical and aesthetic guideline values have been adopted from the Australian Drinking Water Guidelines. They represent the most likely contaminants in private drinking water supplies.

The Australian Drinking Water Guidelines can be accessed online at:

www.nhmrc.gov.au/guidelines-publications/eh52

Microbial

Health-based characteristic	Guideline value
E. coli	Not detected in 100mL

Chemical

Health-based characteristic	Guideline value
Arsenic	0.01mg/L
Long term consumption of water with a concentration of arsenic greater than 0.3mg/L has been shown to increase the likelihood of skin cancers and other diseases. Arsenic is found in soil and rocks. It is also released by the burning of fossil fuels, and in the drainage of old gold mines and some types of sheep dips. It occurs naturally in some groundwater supplies.	
Cadmium	0.002mg/L
Cadmium is a toxic metal that, in cases of long exposure, can cause kidney problems. Cadmium may enter water supplies from impurities in the zinc of galvanised metal, from solders, and from some fertilisers.	
Chromium (hexavalent)	0.05mg/L
Hexavalent chromium is a toxic heavy metal which can cause cancers. Chromium is found in small amounts in most rocks and soils. It is also used in a number of industrial processes.	

Health-based characteristic	Guideline value
Copper	2mg/L
Copper is a common metal that can cause ill effects (nausea, abdominal pain and vomiting) in some people. Copper is found in many rocks and soils. It is also frequently used in plumbing and some industrial processes. It should be noted that 2mg/L is a health-based guideline; concentrations above 1mg/L may cause blue or green stains on porcelain baths or basins.	
Fluoride	1.5mg/L
Fluoride is important for preventing tooth decay, but it can be harmful at high concentrations. It is found naturally in rocks and most waters and is sometimes present in industrial pollution. The highest concentrations in Queensland are likely to be found in groundwater sourced from the Great Artesian Basin.	
Lead	0.01mg/L
Lead is a toxic heavy metal. Lead may enter the water supply from natural sources or from plumbing or roofing components that contain lead. It can also be present in some industrial emissions.	
Manganese	0.5mg/L
Manganese may enter water supplies from natural sources or from contaminated sites. Although the health-based guideline for manganese is 0.5mg/L, an undesirable taste in the water and staining of laundry and plumbing fittings may occur at concentrations above 0.1mg/L.	
Mercury	0.001mg/L
Mercury is a highly toxic heavy metal that may contaminate water supplies via industrial emissions or a variety of natural sources.	
Nickel	0.02mg/L
Long term exposure to nickel can cause kidney problems. Nickel may enter water supplies from industrial processes, burning fossil fuels or in small concentrations from nickel-plated tap and plumbing fittings.	
Nitrate **Nitrite**	50mg/L 3mg/L
Excessive nitrate or nitrite in water can lead to occurrences of 'blue baby syndrome' in infants fed with formula made up using contaminated water. The decomposition of organic wastes such as manure can introduce nitrate to water supplies. Nitrite is only likely to be present in water that has not been aerated.	

Aesthetic

Aesthetic characteristic	Guideline value
Sulfate	250 mg/L
Although harmful at higher concentrations, the guideline value for sulfate ions is set to avoid an undesirable taste in water. Under some conditions it can also contribute to corrosion of plumbing fittings. Sulfate at levels greater than 500mg/L can have adverse health effects.	
pH	6.5 – 8.5
A pH of 7 is neutral, greater than 7 is alkaline, and less than 7 is acidic. Drinking water with increased acidity (pH less than 6.5) can corrode plumbing fittings and pipes. Apart from the damage caused, this can release harmful metals such as lead and copper into the water. Drinking water with increased alkalinity (pH greater than 8.5) can lead to scale build-up in plumbing fittings and pipes. A pH of greater than 8 will decrease the efficiency of chlorine disinfection while a pH of greater than 11 may cause corrosion.	
Total dissolved solids (TDS)	600 mg/L
Dissolved material, usually salts, in the drinking water supply can affect the water's taste. It can also lead to the development of scale on the inside of plumbing fittings and pipes, and lead to excessive corrosion.	
Total hardness	200 mg/L
Hardness is the measure of calcium and magnesium in the water and comes from the dissolving of these materials from soil and rocks. Hard water can contribute to the formation of scale in hot water pipes and fittings and makes lathering soap difficult.	
Turbidity	5 NTU
Turbidity is a measure of cloudiness of water. It indicates the amount of suspended material present. This can affect the taste of water and can make the water look dirty. It can also reduce the effectiveness of chlorination and UV disinfection. Unusual increases in turbidity can indicate a disturbance in the drinking water supply system. Less than 1 NTU is the target for effective disinfection. Less than 0.2 NTU is the target for effective filtration of *Cryptosporidium* and *Giardia*.	

Appendix 6: Water sample collection

Before collecting any samples, ask the laboratory that will perform the analysis:

- If there are any specific requirements or protocols for sample collection.
- About the type and size of sample bottle that should be used and if it will be supplied by the laboratory.
- How much water should be collected for each test?
- How the sample should be stored and how quickly it should be delivered to the laboratory?

To ensure they remain sterile, sample bottles provided by a laboratory should be kept unopened until they are required for filling.

Bottles used for *E. coli* samples must be sterile and should contain a small amount of sodium thiosulphate if the water has been treated with chlorine.

Collecting samples for *E. coli* testing

Method (unless otherwise instructed by the laboratory)

1. Label the container with:
   - What the sample is (i.e. water)
   - Where it was collected (address)
   - Location of collection (i.e. tap or storage location)
   - Who collected the sample?
   - Date and time of sample collection.
2. Wash hands thoroughly before sampling or wear sterile gloves.
3. Do not allow the screw cap or mouth of the sample container to touch anything that may contaminate the sample.
4. 4. **If filling from a tap:** Remove any external fittings (e.g. aerators) and swab the inside and outside of the tap outlet with an alcohol wipe. Let the water run for 20 seconds and then open the sample bottle. Hold the sample container in one hand and the screw cap in the other hand, making sure that fingers do not come into contact with the underside of the lid. Fill the bottle, leaving a head space of about 2cm from the cap to the water level in the bottle. Immediately replace the screw cap.

   If sampling directly from the storage tank: Open the sample container at the moment of filling. Hold the sample container in one hand at an angle of 45 degrees, and the screw cap in the other hand, making sure that fingers do not come into contact with the underside of the lid. Plunge the container in vertically to a depth of approximately 20cm, allow it to fill without rinsing, and immediately replace the screw cap.

   A minimum of 200mL is usually enough water for *E. coli* analysis unless otherwise advised by the laboratory.
5. Maintain samples at a temperature of 2-10°C (normal fridge, or esky with freezer bricks but do not allow samples to freeze). Transport samples to the laboratory, preferably within six hours of sampling (no more than 24 hours).

Additional information and resources

The *Australian Drinking Water Guidelines 2011* (National Health and Medical Research Council)

The Australian Drinking Water Guidelines 2011 have been used as the basis for developing this guideline. They provide an authoritative reference on safe, good quality drinking water. The Guidelines include health and aesthetic guideline values for many microbial, chemical and physical water quality parameters.

The Australian Drinking Water Guidelines can be downloaded from www.nhmrc.gov.au/guidelines-publications/eh52.

Australian Standards and Australian Technical Standards

Standards relating to private drinking water supplies are shown below.

Water storage tanks

- Above ground polyethylene tanks should comply with AS/NZS 4766 – Polyethylene storage tanks for water and chemicals
- Rainwater tanks made from other materials may be certified under ATS 5200.026 Technical Specification for plumbing and drainage products - Cold water storage tanks (and hold WaterMark certification). ATS 5200.026 is not applicable for some tanks, such as concrete tanks, underground tanks and flexible water storage tanks. In this case, these tanks should be structurally sound and watertight.

Plumbing and distribution systems

- Pipework and plumbing fittings that carry drinking water should comply with AS/NZS 4020 – The testing of products for use in contact with drinking water, or AS 2070 - Plastic materials for food contact use, and hold WaterMark certification.
- All plumbing must comply with the requirements of the *Plumbing and Drainage Act 2018.*

Treatment systems

- AS/NZS 4348 – Water supply – domestic type water treatment appliances – performance requirements
- AS/NZS 3497 – Drinking water treatment units – plumbing requirements
- ATS 5200.103 Technical specification for plumbing and drainage products – Part 103: water treatment systems

The Australian Standards and Australian Technical Specifications can be purchased from www.standards.org.au or www.techstreet.com/publishers/as.

***Guidance on the use of rainwater tanks* (enHealth)**

The enHealth *Guidance on the use of rainwater tanks* is a national document that covers the safe use of rainwater. It provides detail on sources of contamination and control measures. It also covers aesthetic issues such as colour, taste and odour, and includes a table of common causes of aesthetic problems that can be used for trouble-shooting rainwater supplies.

Guidance on the use of rainwater tanks can be downloaded from https://www.health.gov.au/resources/publications/enhealth-guidance-guidance-on-the-use-of-rainwater-tanks

Naegleria fowleri information

Naegleria fowleri is a single-celled amoeba that occurs naturally in untreated warm (25°C to 40°C) water. It can grow in warm dams, poorly managed swimming pools and in untreated water carried by long distance above ground pipelines and hoses.

Water drawn from deep artesian bores in rural Queensland is particularly at risk from *Naegleria fowleri*. This type of groundwater often exits the ground at elevated temperatures and is typically cooled in open dams before being transported via above ground pipelines to homesteads and tank storage.

Naegleria fowleri can cause primary amoebic meningoencephalitis (PAM). PAM is a rare but severe illness. Infection occurs when water containing the amoeba goes up the nose. Once in the nose, Naegleria makes its way to the brain where it causes destruction of the brain tissue and lining which is usually fatal.

Additional information on *Naegleria fowleri* is available from:
https://www.waterra.com.au/publications/factsheets/
http://conditions.health.qld.gov.au/HealthCondition/condition/14/165/101/Naegleria-fowleri-Qs-As

Glossary

Aesthetic	Aesthetic parameters of water are those associated with how the water looks, tastes and smells.
Blue-green algae	Blue-green algae (cyanobacteria) are not true algae but are a type of bacteria. They are present in almost all aquatic ecosystems, including creeks, rivers, lakes and wetlands. Some types of blue-green algae produce toxins under certain conditions that pose a risk to human health when they are consumed or come into contact with skin.
Carted water	Water that is supplied in a tanker or other bulk container.
Coagulation	Coagulation is a water treatment process that uses chemicals (coagulants) to make very fine particles to clump together to form larger particles which can be more easily removed.
Disinfection	The treatment of water to kill microorganisms. Disinfection does not remove chemicals.
Filtration	Filtration is a treatment process that removes contaminants from water via size exclusion by passing it through a filter. The types of contaminants removed depend on factors such as the material the filter is made from, the filter grade (how fine it is) and the flow rate of water through the filter.
First flush device	Device which collects the first runoff from a roof during a rain event (usually the most contaminated water containing material which has settled on the roof and the gutters since the last rain event) and prevents it from entering the storage tank.
Flocculation	Flocculation is a water treatment process in which small particles are encouraged to join together to form larger particles (which can settle more easily) through gentle stirring.
Groundwater	Water from beneath the earth's surface, which supplies bores, wells and springs.
Hazard	A source of danger or potential harm.
Microorganism	An organism that can only be seen through a microscope. Microorganisms include bacteria, viruses and protozoa, some of which can cause disease.
NTU	Nephelometric Turbidity Units – a commonly used measure of the turbidity of water.
UV intensity	UV intensity measures the amount of UV energy penetrating through the water.
UV dose	UV dose is the amount of UV energy penetrating the water, multiplied by the amount of time the water is exposed to this energy. The UV dose determines the log reduction of a pathogen.

Acknowledgements

Queensland Health would like to thank the NSW Health and the Victorian Department of Health and Human Services for permitting the use of material from the following publications:

NSW Health:

NSW Private Water Supply Guidelines, February 2015

Groundwater Treatment Fact Sheet (undated)

Rainwater Treatment Fact Sheet (undated)

Surface Water Treatment Fact Sheet (undated)

Victorian Department of Health:

Guidelines for private drinking water supplies at commercial and community facilities, December 2011

A guide to completing a water supply management plan for schools using private drinking water supplies, January 2017