PRIVATE WATER SUPPLY GUIDELINES

NSW HEALTH

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Organisation
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Australian Bed and Breakfast Council and Farm and Country Tourism
Local Government and Shires Associations of NSW
Service Station Association
Australian Institute of Environmental Health, NSW Division
Association of Independent Schools of NSW Limited

Foreword

Throughout NSW there are many facilities, such as caravan parks, school camps, and tourist attractions that rely on small private water supplies. The sources of these supplies can include groundwater, surface water and rainwater.

Serious outbreaks of gastroenteritis have occurred as a result of people drinking contaminated water from private water supplies. However, the risk of illness can be greatly reduced by obtaining water from a good quality source and regularly maintaining and monitoring the water supply system.

The NSW Government has endorsed the *Australian Drinking Water Guidelines* 2004 published by the National Health and Medical Research Council and the Natural Resource Management Ministerial Council. The *Australian Drinking Water Guidelines* 2004 differ from the previous 1996 Guidelines by adopting a risk management approach for water supplies. Chapter 4 of the *Australian Drinking Water Guidelines* provides advice on application of the Guidelines to small water supplies.

The Private Water Supply Guidelines (the Guidelines) aim to assist operators to comply with the requirements of the *Australian Drinking Water Guidelines* 2004.

The Guidelines provide detail on managing private water supplies using the risk management approach by providing information on:

- Responsibilities and Requirements
- Water Quality,
- Understanding and Protecting Your Water,
- Water Treatment,
- Monitoring and Checking, and
- Public Warnings.

The contact details of support agencies, references and supporting information are provided to assist operators in managing their water supplies.

Contents

PRIVATE WATER SUPPLY GUIDELINES

Water is essential to life. We use it for drinking, cooking, bathing and washing. Unfortunately, water can also carry disease-causing organisms and toxic materials. Because water is so important, it is critical that the water we use is protected from these contaminants. These Guidelines are designed to assist private water supply operators in providing water that is safe to use.

In Summary

- Operators should have a water supply management plan to ensure that safe water is provided (see Section 4.a, page 5 and Section 10.a, page 20).
- NSW Health recommends that operators regularly test the quality of their drinking water (see Section 6.a, page 13), check results against *Australian Drinking Water Guideline* values (see Section 10.c, page 22) and (if necessary) take action immediately to ensure the safety of the water.
- If test results show that *E. coli* bacteria are present in the water, consumers should be warned with a sign displayed at each tap used for drinking (see Section 7, page 15).
- If the water is contaminated with microorganisms the water should be boiled before use or an alternative water supply, such as bottled water, should be provided.
- If chemical or blue-green algae contamination is present, then consumers should be warned with a sign displayed at each water tap used for drinking (see Section 7, page 16).
- If a private water supply is not monitored or treated then consumers should be warned that the water might not meet health guidelines (see Section 7.b, page 17).
- If chlorinating the water, it should be tested at least weekly for free chlorine to ensure that the treatment is working properly. Chlorine levels in the water can be tested on site and should be at least 0.5 milligrams per litre (see Section 5.a.ii, page 13).
- Operators should regularly check their water supply system to ensure its safety (see Section 6.c, page 14). Records of these checks and test results should be kept for at least two years.
- Contact your local Council or Public Health Unit for advice (see Section 9, page 19 for contact information).

1. Who Should Use These Guidelines?

These Guidelines are for any business or facility that supplies people with drinking water from an independent water supply. This includes water pumped from rivers and creeks, bores and dams, as well as water from rainwater tanks. It does not include supplies provided by water utilities (i.e. town water) or individual household supplies.

Facilities with a private water supply can include:

- caravan parks, camping grounds and manufactured home estates;
- guest houses, bed and breakfast accommodation, motels, backpacker accommodation, farmstay accommodation;
- petrol stations and roadhouses;
- community halls;
- conference centres;
- recreational and sporting facilities;
- schools;
- food manufacturing premises;
- cafes, restaurants and hotels;
- marinas;
- mines and worksites.

a. Australian Drinking Water Guidelines

The *Australian Drinking Water Guidelines,* published in 2004 by the National Health and Medical Research Council and the Natural Resource Management Ministerial Council, contain detailed advice and requirements for all drinking water supplies.

The Private Water Supply Guidelines aim to summarise and provide advice on applying the *Australian Drinking Water Guidelines* to private water supplies.

The *Australian Drinking Water Guidelines* can be accessed at http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm or by calling

1300 064672 (local call).

2. Responsibilities and Requirements

Operators of businesses or facilities that provide drinking water have a responsibility to ensure that the water is safe to use. If the safety of the water supply cannot be guaranteed, then consumers should be warned.

a. Legislative responsibilities

Operators using a private water supply to provide drinking water or prepare food for others have a responsibility to make sure that the water will not harm the health of those people. The relevant legislation includes:

- *NSW Public Health Act* 1991;
- *NSW Local Government Act* 1993;
- *NSW Food Act 2003*; and
- *NSW Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation* 2005.

b. Other requirements

If you are responsible for a business or facility that supplies people with drinking water from a private supply, the local Council or Public Health Unit may require you to:

- undergo inspection for compliance with the *Australian Drinking Water Guidelines*;
- provide a copy of your water supply management plan (see Section 4.a, page 5);
- provide access to records (see Section 6.c, page 14);
- provide access to laboratory reports on the quality of drinking water supplied.

Local Councils or Public Health Units may also maintain a register of private water supply operators.

For new development applications, provision of a safe water supply can be a condition of local Council development consent. This can mean that applicants need to:

- demonstrate that the drinking water supplied to the site will consistently meet the *Australian Drinking Water Guidelines* requirements, and/or
- develop a water supply management plan according to their local Council directions.

Before installing a new private water supply it is recommended that you consult your local Council to gain approval if required. Although in many cases, private water supply systems such as rainwater tanks may be exempt development under the relevant local environmental plan (LEP), approval may be required where the proposed system is of a significant size or is to be sited in a sensitive location such as a heritage conservation area.

A licence is required from the Department of Water and Energy under water management legislation to install and extract water from a bore and may be required for the pumping of water from a river or creek. For further information contact the Department of Water and Energy (see Section 9, page 19 for contact details).

3. Water Quality

a. Safe and acceptable drinking water

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

- disease-causing microorganisms (bacteria, viruses or parasites); or
- chemicals at potentially harmful levels.

The physical quality (appearance) of the water should be good: that is, 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.

b. Water quality problems

Water supplies can be polluted by sewage, seepage from septic tanks, animal and bird faeces, intensive farming practices (fertiliser, manure and pesticides), blue-green algae and industrial wastes. These pollutants can introduce disease-causing microorganisms or harmful chemicals into the water. The contaminated water can cause illness in people who drink the water, eat food that has been prepared with it, or use it for bathing.

Water supplies can be polluted with leaves and other organic materials, which contain nutrients that encourage microorganisms to grow more vigorously. These materials may not be harmful themselves eg fallen leaves, but the micro-organisms growing on them might make the water taste and smell bad, or cause illness.

Some salts that occur naturally in water, including sulfates and nitrates, can be harmful if they are present in large quantities. Other dissolved salts can make the water hard, and this results in scale build-up and corrosion in pipes, which can release harmful metals such as lead and copper into the water.

The quality of a water supply may also vary throughout the year. Heavy rain may wash pollution into a water source. During the warmer months the growth of blue-green algae can make drinking water from surface water sources unsuitable for humans and stock. This water is also dangerous for bathing as it can cause rashes.

If you are operating a private water supply you need to manage the quality of the water that you provide.

i. Health effects

Water contamination affects people in different ways. What causes a minor stomach upset in some people can cause serious illness in others. In some cases visitors can become sick after consuming water while people who use it regularly will remain healthy.

The people most at risk of health effects from unsafe water are those with weakened immune systems such as the elderly; the very young; transplant recipients; dialysis patients and cancer patients; and some people with HIV and AIDS. People who have recently suffered burns may need to be careful about the quality of water in which they bathe.

Water can be contaminated with a wide range of disease-causing microorganisms such as *Giardia, Cryptosporidium*, *Salmonella, Shigella, Campylobacter*, some strains of *Escherichia coli* (*E. coli*), cyanobacteria (blue-green algae), Rotavirus, Norovirus, and Hepatitis A virus, as well as many others. Most of these can cause diarrhoea, vomiting, or other gastrointestinal (gut) upsets. Some of them can also lead to more serious illnesses and even death.

The health effects from microorganisms generally occur quickly. Health effects from water contaminated with heavy metals and other chemicals may take much longer to become apparent. It is important that you ensure that the supply system is not contaminated with chemicals.

Disinfection kills most disease causing microorganisms in water but does not remove or inactivate toxic chemicals.

4. Understanding and Protecting your Water

Your drinking water supply system includes everything from the collection of the source water to the point where the water reaches the consumer. Keeping the supply safe involves:

- **planning** on how to respond to problems in the water supply system (see Section 4.a below);
- **understanding hazards** to your water sources;
- **water treatment** to remove or control any contamination (see Section 5, page 8);
- **monitoring and checking** on the quality of the water and the integrity of the water system (see Section 6, page 13), and
- **public warnings** for treated and untreated systems (see Section 7, page 15).

a. Water supply management plan

NSW Health recommends that you have a management plan for your water supply, to prevent contamination and protect water quality from the water source to the consumer.

Your management plan should address three key questions of risk assessment:

- **What problems could occur between the water source and the consumer? (i.e. understanding your water supply);**
- **How can they be prevented or fixed? (i.e. protecting your water supply, treating the water, and providing warnings), and**
- **How do you know that the problem has been prevented or fixed? (i.e. monitoring)**

When you start to check your water supply system, these three stages of risk assessment are useful questions to ask. They will help to apply these Guidelines more directly to your system.

The management plan for your water supply should set out how you:

- assess and protect the quality of the source water;
- make sure treatment processes are appropriate, maintained and working properly;
- regularly test to assess water quality;
- make the water supply safe if contamination has occurred;
- make sure that consumers are warned and/or provided with safe drinking water (e.g. by using boiled or commercially bottled water) if the normal supply is found to be unsatisfactory or quality cannot be guaranteed.

A list of what you need to consider for your water supply management plan is provided at the back of this booklet (see Section 10.a, page 20). A template is available as a separate document; contact your local Public Health Unit for a copy (see Section 9, page 19 for contact details).

Your plan should be kept in a central place that is easily accessible to staff.

b. Water Sources

Always use the best quality water source available.

Regardless of the source, carry out regular inspections to identify and remove contamination and to check the cleanliness of the system from the source right through to the consumer. (See Section 10.b, page 21 for an example of a regular maintenance checklist.)

i. Rainwater

If water from a rainwater tank is clear, has little taste or smell, is free from suspended material, and comes from a well-maintained catchment (roof and gutters), it is unlikely to cause illness in most users. However, this is not a guarantee of safety, and contamination is not always visible.

To avoid or minimise water quality problems:

- Regularly clean the roof and gutters collecting rainwater to remove leaves, bird droppings and other organic matter. These can be a source of bacteria and intestinal parasites. They can also cause taste and odour problems or be a source of nutrients to promote the growth of microorganisms.
- After a dry spell, divert water from the first rainfall using a first flush or bypass device. This reduces the amount of contaminants entering the tank.
- Remove overhanging tree branches that may drop leaves into gutters.
- Paint or remove any lead flashings used in the roof construction.
- Install screens on tank inlets and overflows to prevent the entry of leaves and small animals. Check the screens regularly to prevent tanks becoming breeding sites for mosquitoes.
- Tanks should be examined for build up of sediments every two to three years or if sediments are seen in the water flow. Any build up of sediment needs to be removed (desludged) as sediments can be a source of contamination and off-tastes and odours. Sediment can be removed by siphoning the tank without emptying it, or by completely emptying the tank for a thorough clean.
- If the water supply has not been used for 24 hours or more, and water has been stagnant in pipes, copper or lead can build up in the water, it is recommended that the pipes be flushed for a few minutes until fresh water flows through from the tank. The flushed water can be used safely on the garden.

Tanks built from different materials need to be treated differently during maintenance:

- Plastic tanks need to be anchored when empty.
- Concrete tanks should not be allowed to dry out in case of cracking.
- Tanks with a ‘cone scour’ base are easily cleaned by opening the cleaning outlet to allow the water to drain out with the sludge, then rinsing with a hose.
- Small, flat-bottomed tanks can be drained, rinsed with a hose, and tilted to drain.
- In-ground tanks need to be cleaned and refilled quickly in case of tank displacement from the ground. In some cases, when an in-ground tank is not weighted by water, tanks can be forced out of the ground. This is a particular risk if a tank is emptied after heavy rains, when the surrounding ground is waterlogged.

Do-it-yourself tank cleaning presents a number of risks including working and using disinfectants in confined spaces, and access into and out of the tank. It is important to be aware of occupational health and safety guidelines (Part 4.3, Division 9 of the *Occupational Health and Safety Regulation* 2001 and Australian Standard AS2865:2001).

Occupational Health and Safety information can be obtained by calling your local WorkCover office. (See Section 9, page 19 for contact details.)

For further advice on do-it-yourself tank cleaning, contact your local tank supplier or plumber. Professional tank cleaners are available in some areas. (Check the yellow pages under 'tank cleaners'.)

For further information please read ***Guidance on the Use of Rainwater Tanks* 2004 (enHEALTH)** and ***Rainwater Tanks* (NSW Health Brochure).** (See Section 8, page 18 for reference documents.)

ii. Carted Water

If your tank is to be topped up from another source, make sure that the top-up water is safe to drink (potable). If possible, use town drinking water to top up your system.

When water is added to an empty rainwater tank it may resuspend the sludge at the bottom of the tank creating taste and dirty water problems. Ideally, tanks should be cleaned prior to delivery of water.

Water carters delivering drinking water are required to be registered with the local Council and the NSW Food Authority and be authorised to extract water from the town water supply. Contact your local Council for the names of water carters registered and authorised to cart drinking water in your area.

Water carters should comply with the ***Guidelines for Water Carters*** (NSW Health Brochure). (See Section 8, page 18 for reference documents.)

iii. Surface water

Wastes from livestock, birds and humans can contaminate dams, rivers and creeks. These wastes can contain disease-causing microorganisms.

To avoid or minimise water quality problems with surface water:

- Make sure that surface water sources are fenced against livestock, and protected from septic tank overflows and spills of domestic, agricultural or industrial chemicals.
- If you are using surface water, check up-stream for contamination sources. Your local Council and/or Catchment Management Authority can provide you with information about activities higher up in a stream's catchment that might affect the quality of its water. (See Section 9, page 19 for contact details.)

- Filter the water. There are a number of different filtration methods available and the choice of filter depends on the contaminants that need to be removed. (See Section 5.a.i, page 10 for information on filtration.)
- Disinfect the water to kill disease-causing microorganisms and to protect the water should re-contamination occur. Chlorine is the most common and cost-effective disinfectant used for drinking water. (See Section 5.a.ii, page 11 for information on disinfection.)

iv. Groundwater (bores, springs or wells)

Groundwater can be a safe, reliable water source. Water from bores, spear-points (shallow installations), springs or wells may be of high quality if the source is well maintained and protected. However groundwater can be contaminated by sewage, animal wastes, agricultural run-off (which may contain fertilisers and pesticides), industrial pollution, seepage from rubbish tips and polluted stormwater.

To avoid or minimise water quality problems in groundwater:

- A groundwater source should be uphill and at least 250 metres from any wastewater disposal system such as a septic tank and trenches.
- Avoid contamination where groundwater is in contact with surface waters (open wells) or where water flows freely from the surface down into the groundwater (eg in limestone areas).
- Inspect the area around a groundwater supply regularly and protect it from surface contaminants. Bore heads should be raised above ground level to avoid floodwaters contaminating the source.
- Only extract groundwater from a place where subsurface contaminants are unlikely. Avoid sites with known contaminants, including heavy industrial and intensive agriculture areas.

For more information on the licensing, construction and protection of bores and groundwater sources, contact your local Department of Water and Energy office. (See Section 9, page 19 for contact details.)

c. Storage and distribution

Materials that come into contact with water, such as gutters, storage tanks, rainwater tanks, pipe work and plumbing fittings, can contaminate water in certain situations. All plumbing materials used in the water supply should be approved for use with drinking water, and certified to the appropriate Australian Standards.

(AS/NZ 4020:2005 *The Testing of products for use in contact with drinking water* and/or AS 2070:1999 – *Plastics materials for food contact use* and AS/NZS 4766:2006 – *Polyethylene storage tanks for water and chemicals*.)

d. Multiple Barriers

Using multiple barriers against contamination of the system is a good approach.

Barriers would include:

- ensuring a clean catchment for your supply. For rainwater tanks, this means keeping roof and gutters clean. For groundwater sources and surface water catchments, it means good land management in the surrounding area;
- regular maintenance of the supply system (eg tanks, pumps and other elements), and
- adequate treatment e.g. filtration and disinfection;

Should one barrier fail, the others will help to protect the quality of water.

5. Water Treatment

a. Routine treatment

A range of drinking water treatment processes can be considered for use in a private water supply. These include:

- Filtration (pre-treatment filtration and treatment filtration);
- Chlorine disinfection;
- UV disinfection.

i. Filtration

Commonly, filters are installed “in-line” in the plumbing system between the water source (tank, bore, dam, creek etc) and the other treatment steps.

Filters must be regularly maintained and replaced when necessary to be effective. If not bacteria can grow on them and can then be released into the filtered water. The manufacturer’s operating and maintenance instructions should be carefully followed.

Pre-treatment filtration removes coarse material from the water, and makes later treatment steps more effective. For water supplies with a lot of suspended particles (dirty water) it may also be necessary to use a treatment known as coagulation before filtering the water. Coagulation chemicals mix with water to make smaller particles clump together into larger ones, and so makes filtration more effective.

Filtration treats water by passing it through a suitably graded (fine) filter to remove contaminants. Not all filters remove harmful microorganisms.

There are a number of different filtration methods available and the choice of filter depends on the contaminants that need to be removed:

- **Ceramic filters** have a core or “candle” of ceramic material of small pore size through which the water is passed. They can remove some bacteria and parasites from water but not viruses. The core needs to be cleaned regularly.
- **Activated carbon filters** help to control taste and odour problems and algal toxins. They do not remove bacteria, parasites or viruses. The cartridge in these filters should be replaced regularly, as the carbon becomes “used up” or saturated with contaminants.
- **Resin-based ion exchange filters** help to soften the water by removing hardness or other dissolved salts. They do not remove microorganisms. The resin must be replaced or regenerated as it becomes exhausted or clogged.
- **Reverse osmosis filtration** removes most contaminants including minerals, microorganisms, and sediments.

If a filter is used for health reasons, then it should be certified against an appropriate Standard (such as Australian Standard: AS/NZS 4348:1995 *Water supply - Domestic type water treatment appliances - Performance requirements* or American National Standards Institute: ANSI/NSF 53 *Drinking Water Treatment Units – Health Effects*).

ii. Chlorine disinfection

Chlorination is the most common form of disinfection, and it successfully controls many organisms. It involves a regulated addition of chlorine into the water system. The process can be automated to maintain a suitable level of chlorine at the point of injection. However, regular monitoring (weekly or more frequently) of chlorine at taps is recommended to check the level of disinfection in the system (see Section 6.b.i, page 13).

Filtration is often necessary to remove suspended particles before chlorination, because suspended particles (dirty water) may prevent effective disinfection.

It is best to get professional advice on the selection of a chlorination system and the design of a water treatment system. Consult your local plumber or tank supplier for further advice.

iii. Ultraviolet disinfection

Another common and effective form of disinfection is ultraviolet (UV) light, which neutralises many kinds of microorganisms.

UV light cannot penetrate dirty or cloudy water and therefore is less effective in disinfecting that water. Filtration is often necessary to remove suspended particles before UV disinfection.

Filtration, chlorination and UV treatment can be automated; allowing a high level of disinfection, provided the equipment is adequately maintained.

b. Water treatment after contamination

Unusual events can contaminate water supplies that are usually clean. These events might include heavy rain and stormwater runoff, dead animals in the catchment or tanks, or faecal contamination (animal droppings or septic overflow). Also, water that has been treated can be re-contaminated, for example by dead animals in a storage tank.

If you suspect that water in your supply has been contaminated, it can be manually treated with chlorine. However, be careful not to over-dose the system and make sure you follow occupational health guidelines when using chlorine or other strong chemicals.

The chlorine will not make the water unsafe to drink, but it may create a distinct taste and odour. This should lessen in a few days (depending on temperature).

It takes about 5 milligrams of chlorine per litre to disinfect your tank following contamination. However, this will depend on the quality of the water. For effective disinfection, you need to add sufficient chlorine so that, after 30 minutes, testing shows that there is still 0.5 milligrams per litre (mg/L) present in the water – this is known as a “free chlorine residual”. The testing can be done with a suitable chlorine test kit (for example, a swimming pool kit). If the free chlorine residual is below 0.5 mg/L, repeat chlorine dosing until at least 0.5 mg/L is reached.

As a general guide, add:

- 125 millilitres (mL) of liquid bleach (4% available chlorine) for every 1000 litres (L) of water in your tank, OR
- 40 millilitres (mL) of liquid sodium hypochlorite (12.5% available chlorine) for every 1000 litre (L) of water in your tank, OR
- 8 grams (g) of granular calcium hypochlorite (65% available chlorine) for every 1000 L of water in your tank.

These methods provide initial chlorine doses of approximately 5 mg/L. Methods for calculating the volume of water in a tank are provided in Section 10.e, page 24. A chlorine ready reckoner is provided in Section 10.f, page 26.

Liquid bleach can be purchased from a supermarket or hardware stores. Check the product has at least 4% available chlorine and has no additives such as fragrances added to the product.

Sodium hypochlorite and calcium hypochlorite can be purchased from large supermarkets, hardware stores or swimming pool suppliers. Stabilised chlorine (which contains isocyanuric acid) is not effective in enclosed tanks and should not be used.

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 chlorine to the water rather than vice versa.** When adding the concentrated chemical mixture to the tank, spread it as widely as possible across the surface, to promote mixing, and let it stand for at least one hour before use.

Ideally the tank should not be used for at least 24 hours after initial dosing to allow the chlorine taste and smell to dissipate and for harmful microorganisms to be destroyed.

If you are uncertain about this procedure, contact an environmental health officer from your local Council or Public Health Unit for help.

6. Monitoring and Checking

a. Routine monitoring

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

Whether the water is treated or not, NSW Health recommends the following:

- Monitor the microbiological quality of the water supplied to consumers (i.e. at a kitchen tap or a tap where most people drink from.) at least monthly by testing for the organism *E. coli* (*Escherichia coli*). If *E. coli* is detected, this indicates faecal contamination and the possible presence of disease-causing microorganisms;
- Monitor the chemical and physical quality of the water supplied to consumers by testing at least annually;
- Test the water if there is any suspicion of Blue Green Algae (cyanobacteria) contamination. This will indicate the level of contamination in the supply, if any.

To ensure safety of the water supply the results of testing must meet values set in the *Australian Drinking Water Guidelines*. Guideline values for microbiological, physical and chemical characteristics in water are provided in Section 10.c, page 22.

Water samples should be tested at a laboratory accredited by the National Association of Testing Authorities (NATA) to ensure the highest level of accuracy.

Your local Council or Public Health Unit can provide further advice regarding your choice of laboratory. The *Guide for Submitting Water Samples to DAL for Analysis* (NSW Health, ICPMR, Division of Analytical Laboratories) gives information on sampling and transporting water samples (available at http://www.health.nsw.gov.au/pubs/g/pdf/water_sampling.pdf or by calling

(02) 9646 0222).

b. Checking treatment processes

Regular checking and maintenance of water treatment systems are important to ensure that the water supply continues to be safe.

i. Chlorine treatment

Where chlorine is used, it is desirable to have at least 0.5 mg/L free chlorine residual in water coming from all taps used for drinking and food preparation to maintain effective disinfection throughout the supply system.

Regular monitoring of the supply system will help to ensure that this level is maintained. If water varies in quality, for example surface water supplies, daily monitoring may be necessary. For rainwater supplies weekly monitoring may be sufficient. For further advice on the chlorine monitoring required for your systems contact an environmental health officer from your local Council or Public Health Unit.

Measure and monitor chlorine in the system, using a suitable chlorine test kit (such as a swimming pool chlorine kit) and adjust chlorine dosing if necessary. Keep a record of chlorine readings.

ii. Filtration

If there is a filter fitted to your supply system, the filter cartridges need to be checked, maintained and replaced in accordance with the manufacturer's advice. Filter cartridges should be free from build-up, and should allow a clean, steady flow of water to pass through.

Water quality should be regularly checked after filtration. If flow decreases or the water becomes turbid (dirty or cloudy), the filter cartridge needs to be checked and may need replacing. Some filters include a pressure gauge that indicates the need for replacement.

iii. UV disinfection

Ultraviolet (UV) disinfection units need to be checked and maintained regularly, following the manufacturer's instructions, to ensure they remain effective. The unit should be checked to ensure:

- a stable power supply is connected and the unit is switched on;
- the lamps are intact and operating;
- the lamps are free from scum.

If problems are found, maintenance should take place as soon as possible.

c. Checking the system and keeping records

Regular checks of your entire water system from catchment to the consumer will minimise the risk of contamination and help ensure the safety of your supply. Keep records of checks and any test results for at least two years. They should be made available for review if required by the local Council or Public Health Unit.

Records should include:

- name, date and observations i.e. identify potential contamination hazards in the catchment;
- results from any test;
- any actions taken to correct faults or prevent contamination affecting supply;
- equipment checks and maintenance, including any filter change or refurbishment;
- regular chlorine readings and adjustments to chlorine levels if required;
- any adverse events, e.g. broken pipe work, flooding, bush fire, aerial spraying, dead animals in the water source, and repairs to the system, and
- rainfall observations.

7. Public Warnings

a. for Treated Systems

Consumers should be warned if:

- tests show that *E. coli* is present, or
- the supply is not regularly tested

This can be done with a sign displayed at each drinking water tap and in bathing areas. Warning signs should be left in place until clear test results are obtained. A suggested wording for the warning signs is:

If water is contaminated, it is recommended that an alternative water supply (e.g. commercially bottled water) be provided, or that water be treated (Boiling, will control disease causing organisms but not blue green algae or chemicals). In these cases the signs could include the above sign and:

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

or;

Boil water before drinking, preparing food and cleaning teeth.

If a blue green algae bloom occurs in the water supply or chemical contamination is present then signs should say:

Contact your local Council or Public Health Unit if you have any questions regarding the quality of your water supply, or if you need further advice on managing your water supply and water delivery system.

Some consumers may wish to use rainwater for all purposes including drinking and cooking even if it is not treated or tested. In such cases a warning should still be made as required by the Guidelines.

b. for Untreated Systems

If a private water supply is not treated by a reliable process (e.g. filtration and chlorine or UV), 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 (as on previous page);
- an entry in the in-house directory, or
- an accommodation in-room notification card.

A suggested wording is:

WARNING

The drinking water supplied here is not monitored or treated.

The water quality may not meet Health Guidelines.

The warning can be removed if a suitable management plan for the water supply is put in place and regular testing shows that the water is free of contamination.

Some private water supply operators are required by legislation to provide a safe drinking water supply such as Caravan Parks or food businesses. Check with your local Council or the NSW Food Authority to see if this legislation applies to you.

8. Reference Documents

1. ***Australian Drinking Water Guidelines* 2004 (National Health and Medical Research Council)** – provides an authoritative reference on safe, good quality water, how it can be achieved and how it can be assured. The guidelines are concerned both with safety from a health point of view and with aesthetic quality.
   http://www.nhmrc/publications/synopses/eh19syn.htm

2. ***Guide for Submitting Water Samples for Analysis*** –an easy reference for sampling, reporting and submission of samples to NSW Health Labs.
   http://www.health.nsw.gov.au/pubs/g/pdf/water_sampling.pdf

3. ***Rainwater Tanks,* NSW Health Brochure** – explains rainwater systems and how they can be maintained to provide safe, high quality drinking water.
   http://www.health.nsw.gov.au/public-health/ehb/water/rainwater.html

4. ***Guidance on the Use of Rainwater Tanks* 2004, enHEALTH.** – presents information on a range of potential hazards that threaten water quality, preventive measures, monitoring, and possible maintenance and corrective action. http://www.health.nsw.gov.au/public-health/ehb/water/rainwater.html

5. ***Groundwater use in urban areas,* NSW Health Factsheet –** explains risks of contamination of groundwater sources in urban areas.
   http://www.health.nsw.gov.au/public-health/ehb/water/factsheets.html

6. ***Guidelines for Water Carters,* NSW Health Guidelines –** explains regulations and requirements for the operation of water carting vehicles supplying water for drinking and domestic use.
   http://www.health.nsw.gov.au/public-health/ehb/water/drinkwater.html

7. ***Australian Standards***
   AS/NZ 4020:2005 *The Testing of products for use in contact with drinking water.*

   AS 2070:1999 – *Plastics materials for food contact use*.

   AS/NZS 4348:1995 *Water supply - Domestic type water treatment appliances - Performance requirements.*

   AS/NZS 4766:2006 – *Polyethylene storage tanks for water and chemicals.*

   http://www.standards.com.au/

8. ***American National Standards Institute***
   ANSI/NSF 53: *Drinking Water Treatment Units – Health Effects*

   http://www.nsf.org

9. Contacts for Additional Information

Your local Council

For information on water quality and health and any building or planning regulations for rainwater tanks and other water supply installations in your area.

Your local Public Health Unit

For information on water quality and health. Look under 'Health Dept of NSW' in the 'White Pages' or at www.health.nsw.gov.au/public-health/phus/phus.html

NSW Food Authority

For advice on whether you are required to have a potable water supply under Food Legislation.

Analytical laboratories

For advice on chemical, microbiological and algal testing of water. If you wish to have some water tested your local Public Health Unit can help you find a NATA accredited laboratory for water analysis or look up 'analysts' in the 'Yellow Pages' to find a laboratory in your area.

Your regional Department of Water and Energy Office (formerly Department of Natural Resources)

For advice on construction and protection of bores and groundwater supplies, or water extraction licences for contact details of your regional office go to http://www.dwe.nsw.gov.au look under 'Water Access and Trade'

or phone: (02) 9895 6211.

Your regional Catchment Management Authority

For advice on what is happening in the catchment. Go to http://www.cma.nsw.gov.au/ *or contact Department of Environment and Climate Change on phone (02) 9995 5000.*

Your local WorkCover Office

For Occupational Health and Safety advice at http://www.workcover.nsw.gov.au *or under "WorkCover" in the 'White Pages'.*

Professional tank cleaners

These can be found in some areas. Look under "tank cleaners" in the 'Yellow Pages'.

Your family doctor

To discuss any specific health concerns.

10. Supporting Information

a. Water Supply Management Plan

Organisational details

1. Name of property/business
2. Owner/occupier
3. Contact details
4. After-hours contact

Responsibility for system monitoring and maintenance

1. Main person responsible
    - Role and responsibilities
    - Contact details (including after-hours)
2. Other person responsible
    - Role and responsibilities
    - Contact details

Description of system

1. Map showing location of:
    - Water supply system; water source, pumps, storage, treatment, pipelines etc.
    - Waste water system; septic tanks, septic trenches, composting toilets, dispersal areas etc.
2. Identify hazards and control measures: flood areas, contaminated sites, animal grazing/holding areas etc. (see common contaminants table in Section 10.d, page 24 for information on potential hazards).
3. Assessment of risks
    - Assess risks to the water supply system
    - Identify control measures
4. Document uses of the water supply: drinking, food preparation, bathing, clothes washing, irrigation etc.

System operation and maintenance

1. Document procedures for operation and maintenance of pumps, chlorination systems, filtration etc.
2. List manufacturer and supplier of pumps, filters, chlorine etc.

Contingency Plan

1. Document contingency plans for system failures (warning signs, supply of bottled water etc.)
2. Record contact details of who to contact in case of an emergency and local maintenance/repair contractors.

Monitoring and records

1. Keep a record of:
    - visual inspection notes;
    - all results of microbiological and chemical testing;
    - chlorine levels if applicable;
    - the posting of warning signs;
    - any maintenance to the water system (filter change, addition of chlorine, tank flush or desludge etc);
    - deliveries of carted water (include date and name of supplier)

b. Regular Maintenance Check List - Template

Item	Recommended Frequency
Tank	
• Structural condition	Annually
• Inlets and outlets covered (prevent mosquito entry)	3 monthly
• Presence of mosquito larvae in tank water	3 monthly
• Level of sludge and internal cleanliness	Annually
• Strainer clear of debris	3 monthly
Roof and Gutter	
• Clean gutters	3 monthly
• Check and trim overhanging branches	Annually
• Inspect and repair downpipes	Annually
• Check condition of roof	Annually
Testing	
• Microbiology test	Monthly
• Physical & chemical test	Annually
• Chlorine test	Regularly if chlorinating supply (Minimum weekly)
Treatment and Miscellaneous	
• **Filters** ▪ Clean/Change	As per manufacturer's advice
• **Chlorine injection unit** ▪ Check the unit is fully operational and chlorine supply is adequate.	Weekly
• **Bore** ▪ Check that system (pump, piping, casing) is fully operational, and maintain. ▪ Check control measures to guard against surface water contamination.	Annually 3 monthly
• **Surface water (creek, river and dam supplies)** ▪ Assess upstream catchment for new developments and other possible sources for contamination. ▪ Check that infrastructure (pump, piping, etc) is fully operational, and maintain. ▪ Check water quality after heavy rain, it may be necessary increase chlorine dose, and check filters, boil water if treatment system is not working properly.	Annually Annually After heavy rain.

c. Tests and Drinking Water Guideline Values for Private Water Supplies

Microbiological

- ***E. coli* (should not be detected in a 100 mL sample)**
  - Used to indicate the presence of faecal contamination. This is a requirement in the *Australian Drinking Water Guidelines*.
- **Cyanobacteria**
  - If there is a suspicion of Blue Green Algae (cyanobacteria) contamination, the water should be tested.

Chemical

It is advised that a comprehensive analysis be undertaken initially, to identify any unusual contaminants in the water supply. If none are present then the above list can be relied on for routine sampling.

For each of these characteristics, values should be **below or equal to** the corresponding *Australian Drinking Water Guideline* value.

Health-based Characteristic	***Australian Drinking Water Guideline* value**
Antimony	0.003 mg/L
Antimony is a metal that can be harmful in high concentrations. Its harmful effects are limited at lower concentrations. It is rare in source waters, but may leach from antimony solder or be deposited in pollution from smelters.	
Arsenic	0.007 mg/L
Arsenic is a harmful element. Long term consumption of water with a high arsenic concentration (greater than 0.3 mg/L) has been shown to increase the likelihood of skin cancers and other diseases. Arsenic is found in soil and rocks, but is also released by the burning of fossil fuels, and in drainage from old gold mines and some types of sheep dip.	
Cadmium	0.002 mg/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, or from some fertilisers.	
Chromium	0.05 mg/L
Chromium is a toxic heavy metal, which can cause cancers. Chromium is found in small amounts in most rocks and soils, and has been used in many industrial processes.	
Copper	2 mg/L
Copper is a common metal that can cause ill effects (nausea, abdominal pain and vomiting) in some people. Copper can be found in many rocks and soils, and is also frequently used in plumbing.	
Fluoride	1.5 mg/L
Fluoride is important for preventing dental decay, but can also be harmful at high concentrations. It is found naturally in rocks and waters, and is sometimes present in industrial air pollution.	
Lead	0.01 mg/L
Lead is a toxic heavy metal. It may enter a water supply from natural sources or from lead plumbing, solder, or roof flashings.	
Nickel	0.02 mg/L
Long term exposure to nickel can cause kidney problems. Nickel may enter water supplies from coal-fired power stations or in small concentrations from nickel-plated tap and plumbing fittings.	
Nitrate	50 mg/L
Nitrite	3 mg/L
Excessive nitrate or nitrite in water can lead to occurrences of ‘blue baby syndrome’ in infants fed with formula made up using the 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.	

Chemical (continued)

Aesthetic Characteristic These factors may cause taste or odour complaints in your water or may lead to corrosion or the formation of scale.	***Australian Drinking Water Guideline* value**
Manganese	0.1 mg/L
Although harmful at higher concentrations, the guideline value for manganese is set to avoid an undesirable taste and staining of laundry and plumbing fittings. Manganese is likely to enter water supplies from natural sources or from contaminated sites.	
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 500 mg/L can have purgative effects. Sulfate ions are likely to enter water supplies from natural sources. The highest concentrations are likely to be seen in groundwater.	

Physical

For each of these characteristics, values should be **below or equal to** the corresponding *Australian Drinking Water Guideline* value (or for pH, **between** 6.5 and 8.5):

Aesthetic Characteristic These factors may cause taste or odour complaints in your water or may lead to corrosion or the formation of scale.	***Australian Drinking Water Guideline* value**
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 or copper. Drinking water with increased alkalinity (pH greater than 8.5) can lead to encrustation of plumbing fittings and pipes. A pH greater than 11 may cause corrosion. **A pH greater than 8.0 can decrease the efficiency of chlorine disinfection.**	
Total dissolved solids (TDS)	500 mg/L
Dissolved material, usually salts, in the water supply can affect the water's taste. It can also develop scale on the inside of plumbing fittings and pipes, or lead to excessive corrosion.	
Total hardness	200 mg/L
Hard water can contribute to the formation of scale in hot water pipes and fittings, and makes lathering of soap difficult. Hardness is the measure of calcium and magnesium in the water and comes from the dissolving of these materials from soil and rocks.	
Turbidity	5 NTU (less than 1 NTU desirable)
Turbidity is the measure of dirtiness or cloudiness of water. It indicates the amount of suspended solids present in the water. This can affect the taste of the water and can make the water look 'dirty'. It can also reduce the efficiency of chemical and UV disinfection. Unusual increases in turbidity can indicate a disturbance in the water supply system.	

Notes:
1. Some laboratories will also provide tests for Aluminium, Chloride, Iron, Sodium and Zinc, which are of less health concern but have an influence on water quality.
2. Monitoring for additional characteristics may be required depending on the presence of particular materials or industrial activities in the catchment.

d. Common Sources of Contaminants and Preventive `Measures

Water Supply	Common Sources of Contaminants	Typical Preventive Measures
Ground Water (bore, well, spear point, spring)	1. Surface water seepage. (e.g. wastewater) 2. Sub-surface contamination Industrial, farming land usage, landfill. 3. Backflow water (eg from animal water troughs or surface water storage) 4. Leaching from bore casings, pipes or plumbing materials (e.g. metals, pH)	1. Bore heads should be raised above ground level. Inspect regularly. 2. Only extract groundwater from a place where subsurface contaminants are unlikely. 3. Installation of backflow prevention device. 4. Ensure that all materials in contact with water comply with AS/NZ 4020:2005.
Rain Water (tanks)	1. Roof and gutters (eg build up of organic matter – leaves/dirt) 2. Roof materials (e.g. lead sheeting, peeling paint) 3. Build up of sludge in tank, dirt in inlet strainers and/or insect screens. 4. Tank materials (e.g. pH of water with concrete tanks, high metals from metallic tanks, corrosion of metals from pipes.) 5. Insect, bird and animals in system (e.g. dead animals, mosquito breeding)	1. First flush device, regular cleaning of roof and gutters, removal of overhanging branches. Inspect regularly. 2. Ensure that all materials in contact with water comply with AS/NZ 4020:2005. 3. Regular cleaning and maintenance program. 4. Ensure that all materials in contact with water comply with AS/NZ 4020:2005. Flush pipes if water has been standing in pipes. (Chemical adjustment for pH in new concrete tanks may be necessary.) 5. Ensure that all inlets and outlets to tank are screened
Surface Water (dam, river, creek)	1. Surrounding land use (e.g. intensive farming, urban areas, industrial sites sewage discharge) 2. Pump and plumbing materials (e.g. piping, pump components) 3. Animal and human activities (cows, sheep, or recreational use)	1. Protect surface water storage from runoff. Inspect regularly. 2. Ensure that all materials in contact with water comply with AS/NZ 4020:2005. 3. Protect surface water storage by fencing storage.

Note: Investigation of treatment options (filtration, chlorination, UV) to protect a water supply and regular testing for microbiological and chemical characteristics is also required. (See page/s 10 –13 Section 5) for more detail.)

e. Calculating the Size of your Tank for Chlorination

Tanks come in a variety sizes ranging from 750 L (165 gallons) to over 50 000 L (11 000 gallons). To convert a tank volume in gallons to a volume in litres, simply multiply the number of gallons by 4.5.

To calculate tank water volume

- **Full Rectangular Tanks (box tanks, some in ground tanks) -**

  Volume (in litres) = (depth [m] x width [m] x length [m]) multiplied by 1000 (to convert cubic metres to litres.)

- **Full Cylindrical Tanks -**

  Volume (in litres)
  = (3.14 x radius [m] x radius [m] x tank depth [m]) multiplied by 1000 (to convert cubic metres to litres.)

  [The radius is the half the diameter or width of the tank].

Example: Tank radius = 2 metres Tank depth = 3 metres

Tank Volume = (3.14 x 2 m X 2 m x 3m) x 1000
= (3.14 x 4 m^2x 3 m) x 1000
= (3.14 x 12 m^3) x 1000
= 37.68 m^3 x 1000
= 37 680 Litres

- **Part-full Cylindrical Tanks -**

  Volume (in litres) = (3.14 x radius x radius [m] x water depth [m]) multiplied by 1000.

  (See diagram below)

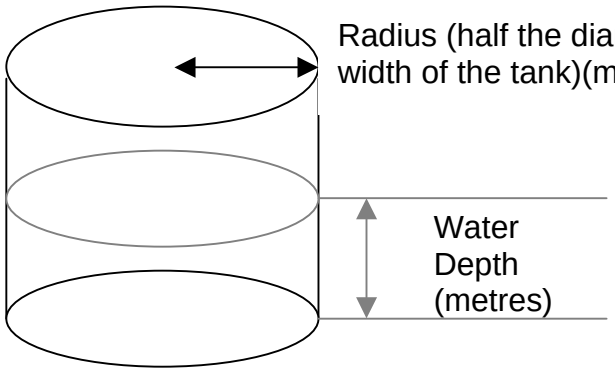

Diagram adapted from *Guidance on the Use of Rainwater Tanks,* 2004, enHealth.

f. Chlorine Concentration - Ready Reckoners for Water Tanks

1. To calculate millilitres of 4% liquid bleach required to disinfect the water in a tank.

	Concentration of Chlorine Required		
	1	2	5
Amount of Water in Tank (Litres)			
1000	25 mL	50 mL	125 mL
2000	50 mL	100 mL	250 mL
3000	75 mL	150 mL	375 mL
4000	100 mL	200 mL	500 mL
5000	125 mL	250 mL	625 mL
6000	150 mL	300 mL	750 mL
7000	175 mL	350 mL	875 mL
8000	200 mL	400 mL	1000 mL
9000	225 mL	450 mL	1125 mL
10000	250 mL	500 mL	1250 mL

For example: To achieve 5 mg/L chlorine in a 1000 litre tank add approximately 125 mL of 4 % liquid bleach.

Please note the above calculations are only estimates. The amount of liquid bleach required to be added to your water supply would depend on the quality of the water.

CHECK THE LABEL OF THE PRODUCT TO ENSURE THAT NO ADDITIVES SUCH AS FRAGRANCES ARE ADDED TO THE BLEACH.

2. To calculate millilitres of 12.5% sodium hypochlorite (liquid) required to disinfect the water in a tank.

	Concentration of Chlorine Required (mg/L)		
	1	2	5
Amount of Water in Tank (Litres)			
1000	8 mL	16 mL	40 mL
2000	16 mL	32 mL	80 mL
5000	40 mL	80 mL	200 mL
6000	48 mL	96 mL	240 mL
7500	60 mL	120 mL	300 mL
10000	80 mL	160 mL	400 mL
16000	128 mL	256 mL	640 mL
20000	160 mL	320 mL	800 mL
30000	240 mL	480 mL	1200 mL

For example: To achieve 5 mg/L chlorine in a 1000 litre tank add approximately 40 mL of 12.5% sodium hypochlorite.

Please note the above calculations are only estimates. The amount of chlorine required to be added to your water supply would depend on the quality of the water.

DO NOT USE STABILISED CHLORINE. THE CHLORINE USED MUST NOT CONTAIN ISOCYANURIC ACID.

3. To calculate millilitres of 65%Calcium Hypochlorite (granular or powdered chlorine) required to disinfect the water in a tank.

	Concentration of Chlorine Required (mg/L)		
	1	2	5
Amount of Water in Tank (Litres)			
1000	2 grams	3 grams	8 grams
2000	3 grams	6 grams	15 grams
5000	8 grams	15 grams	38 grams
6000	9 grams	18 grams	46 grams
7500	12 grams	23 grams	58 grams
10000	15 grams	31 grams	77 grams
16000	25 grams	49 grams	123 grams
20000	31 grams	62 grams	154 grams
30000	46 grams	92 grams	231 grams

For example: To achieve 5 mg/L chlorine in a 1000 litre tank add approximately 8 grams of 65% Calcium Hypochlorite.

Please note the above calculations are only estimates. The amount of chlorine required to be added to your water supply would depend on the quality of the water.

DO NOT USE STABILISED CHLORINE. THE CHLORINE USED MUST NOT CONTAIN ISOCYANURIC ACID.