Clutha District Council

INDIVIDUAL WATER SUPPLIES

1 INTRODUCTION

An individual supply is a stand-alone system which supplies fewer than 25 people. It will generally serve an individual household or premises. The requirements of the Building Act 1991 should be complied with. The Building Code [Approved Document G12 - Water Supplies] requires premises to be provided with water that is suitable for drinking and for tooth brushing, washing up and food preparation. Bathing, showering, and toilet flushing can use water that is not suitable for drinking, such as salt water or stream water, provided it is safe to do so.

The Drinking Water Standards for New Zealand set the standards that drinking water must meet. Because of the wide variety of circumstances relating to individual household supplies, no recommendations regarding how often to test the water of individual supplies are given in the Standards. However, under Section 39 of the Health Act 1956, it is illegal to let or sell a house unless there is a supply of drinkable water.

Many New Zealanders rely on an individual supply. These people are unlikely to be able to afford the same level of safety in their water supply compared to people whose water comes from a reticulated supply.

2 WATER SOURCE

2.1 GENERAL

Waters from different sources tend to have different qualities. Sometimes the chemical quality and the aesthetic quality of water sources may be inter-related. For example, soft corrosive waters can cause high concentrations of some metals due to corrosion of pipework and fittings.

Apart from some chemicals, the principal health risk is usually from the presence of pathogenic micro-organisms. It is for this reason that biological quality should be given the most importance.

2.2 GROUNDWATER

For the purposes of the New Zealand Drinking Water Standards, ‘unconfined’ groundwater systems, or ones where it is not certain that the groundwater is secure, should be treated as if they were surface sources. A groundwater that is truly artesian (one that flows without pumping) is generally confined and can be considered as secure. This does not include springs. More information on Bore supplies is included on page 10.

2.3 SURFACE WATER

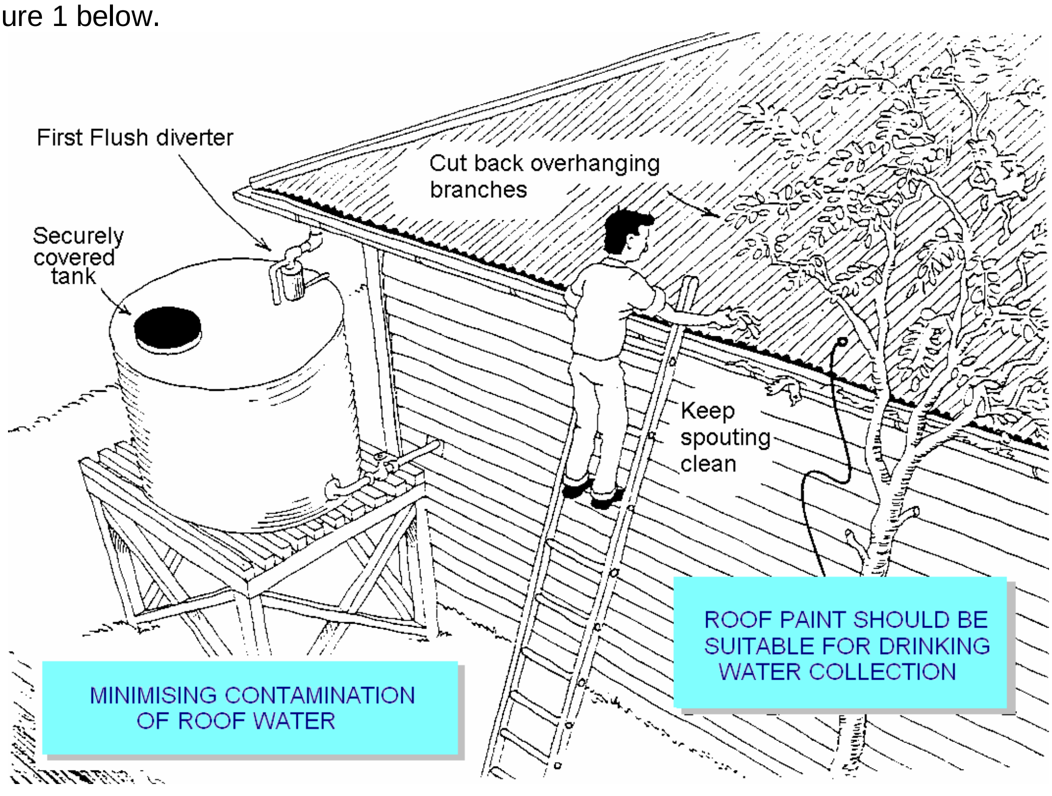
Surface water is water from streams, rivers, ponds, lakes, springs and shallow or unconfined groundwater systems, roofs or any other kind of impervious surface. As rain falls through the atmosphere, it dissolves carbon dioxide from the air, and becomes slightly acidic (i.e. it has a low pH) and is therefore corrosive. In the natural environment when rainfall reaches the ground surface it picks up mineral compounds, organic matter, material from plants and animals, soil particles and micro-organisms such as bacteria and parasites. A portion of the rainfall will also soak into the ground. This water may flow either at a shallow depth to subsequently enter a river or stream, or it may soak further down to reach deeper levels of groundwater. While flowing through the ground the water will pick up organic matter from the top layers of soil, and it will also dissolve minerals from the ground itself.

Because surface water is subject to biological and physical contamination, it is necessary to regard it as unsafe for use in the home or within other premises unless reliable treatment is provided. A ‘controlled surface water catchment’ is one where animals or people are prevented from entering. Such a catchment will reduce the level of contamination, but wild animals such as possums, household and farm animals and birds will still be able to enter these areas and through their droppings will bring harmful organisms such as Giardia and Cryptosporidium.

Surface water taken from catchments which are controlled, have few animal or human impacts, and are usually clear and free of suspended solids. They have low levels of algae but may have moderate to high colour, depending on the vegetation and soil type. These sources may undergo rapid increases in turbidity following heavy rainfall. They are also usually soft, corrosive and may easily change their acidity or alkalinity.

Surface water from streams, rivers and lakes draining catchment areas where there is considerable human and animal presence will have higher turbidity and levels of suspended solid. They may also have high algae concentrations during summer. These sources are often contaminated by animal effluent, sewage effluent and agricultural fertilisers.

Water from roofs are often contaminated by bird, possum and cat droppings or by carcasses. There may also be physical contamination by windborne material, and chemical contamination from the soft corrosive water or by material that has come from poor choices of roof paint, lead flashings or plastic gutters. While roofs are being painted, disconnection of the tank is recommended during preparation and while paint is being applied and for a period immediately following application. Most reputable roof paint manufacturers provide advice on the paint container label. Similarly care is required if fungicides or other chemicals are used for cleaning a roof. The contamination of roof water can be minimised by the diversion of the first flush of water, by keeping gutters clean, and by cutting back overhanging vegetation to control debris, birds and possums. See Figure 1 below.



2.4 SANITARY SURVEY

A sanitary survey is an inspection of any direct or potential causes of contamination. The general principles of sanitary surveys are discussed in Section 3.3.2 in Chapter 3. Depending upon the source type, a detailed sanitary survey, including inspection of all aspects of the system and water quality testing, should be carried out at least every six months or whenever testing or some other evidence gives cause for concern. Basic inspection, e.g. gutter cleaning or checking spring or well head security, should be carried out at least monthly.

3 WATER QUALITY

Water quality contaminants of particular concern vary from supply to supply. The more common aspects of interest are:

Microbiological Characteristics

- Total coliforms, faecal coliforms or E. coli as indicators of the presence of pathogenic organisms
- Pathogenic protozoa (Giardia cysts and Cryptosporidium cysts)

Physical Characteristics

- Turbidity and clarity
- Taste and odour
- pH [acidity or alkalinity]

Chemical Characteristics

- Hardness
- Manganese, Iron
- Nitrate, nitrite and ammonium
- Salinity
- Corrosivity and carbon dioxide.

Common contaminants, the problems they cause and their likely sources, are shown in Table 1 below.

Table 1 Common Contaminants, Related Problems, and their Likely Sources

CAUSE	***PROBLEM***	***LIKELY SOURCE***
Bacteria	Waterborne disease.	Human and animal wastes.
Aggressiven es	Corrosion.	Soft low pH water (rain water) and well water.
Colour	Appearance, taste.	Decaying vegetative matter, or high manganese/iron.
Copper	Possible health problems. Taste and staining (blue water) can occur at lower concentrations.	Corrosive water and plumbing materials.
Hardness	Scale, excessive soap use.	Dissolution of limestone-type rocks.
Iron	Staining, taste, pipe clogging.	Soluble iron salts produced by reduction in oxygen-free conditions.
Lead	Poisonous to humans, especially infants, young children and unborn children.	Corrosive water and plumbing materials/roof paints.
Manganese	Possible health problems. Taste and staining can occur at lower concentrations.	Soluble manganese salts produced by reduction in oxygen-free conditions.
Nitrate	Bottle fed infants can have breathing problems (blue baby syndrome).	Fertilisers, sewage, animal effluent, clover pasture.
pH	When less than 6.5 corrosion of plumbing materials possibly causing copper or lead to be dissolved into the water.	Soft water, C02 rich groundwaters.
	When greater than 8.5 scale formation on hot water cylinders and heating elements causing reduced efficiency and early failure.	Groundwater.
Protozoan Cysts	Waterborne disease.	Human and animal wastes.
Taste & Odour Causing Substances	Taste and odour.	Many causes including algae, minerals, chlorination by- products, leaching of organic materials, corrosion products.
Turbidity	Appearance, and interference with disinfection.	Suspended particles of natural and human origin.
Viruses	Waterborne disease.	Human and animal wastes.

4 TREATMENT

4.1 APPROACH

The purpose of treating water is to ensure reliable, safe, water Anything less than microbiological safety poses a risk to the consumers of the supply.

Only the water used in drinking, washing, cooking, and food preparation is required to be both microbiologically and chemically safe. This typically represents only two to three percent of household use. It is recommended that if the whole supply is not being treated to meet drinking water standards, the minimum acceptable situation would be to treat the water used for these purposes. This may be achieved via a point of use device such as a filter. [See page 5] Labels should be fixed to taps and pipes so that visitors and others may be aware what water has been treated and what has not.

Because of the greater risks associated with separate supplies, and the fact that there may not be a great increase in expense to treat the whole supply, it is recommended that all water outlets inside the building provide treated water which complies with the Drinking Water Standards, at least with respect to microbiological quality. If for some reason drinking water is supplied that does not satisfy the Standards, then a notice at each point of use should advise consumers to boil for three minutes (or treat in some other approved manner) all water used for drinking.

Secure groundwater sources should not need any treatment. For some water sources, treatment of the whole supply may be necessary to remove or control a specific contaminant, e.g. iron removal. Chlorination is likely to be the most effective method of disinfection. Disinfection must be carefully controlled. Enough disinfectant should be added to water to destroy micro-organisms. It is advisable to keep records of the disinfection, e.g. dates, doses and volumes, so the process can be fine-tuned as necessary. Records will be helpful when different people treat the water and if the quality of the raw water should vary.

Disinfection using chlorine can be done on by simply pouring into the storage tank, or by using a proprietary chlorinator. The chlorinator will dose chlorine into the water as it is used, or as it flows into a secure storage tank. If chlorine is added directly into the tank, the dose should be sufficient to give a free and available chlorine level of at least 0.2 mg/L in the water 30 to 60 minutes after mixing. The free and available chlorine can be measured using a test kit based on the DPD colorimetric method or by a combination test kit which includes pH measurement. These kits come with all necessary test tubes, chemicals, colour chart and instructions, and are available from swimming pool chemical suppliers and some pharmacies.

The sources of chlorine most commonly used for batch dosing are sodium hypochlorite (ordinary, unscented, uncoloured, fresh, household bleach) or calcium hypochlorite (swimming pool chlorine).

For water which comes from very safe to reasonably safe sources a dose of either:
• 4 to 7 ml of sodium hypochlorite bleach per 100 litres of water - make sure it is fresh stock (at 3 percent available chlorine this is equivalent to a dose of 1 to 2 mg/l), or
• 0.15 to 0.3 g of calcium hypochlorite (65 percent available chlorine) per 100 litres of water
will generally give the required free and available chlorine level. The disinfected water should be left to stand overnight before its is used.

4.2 GENERAL TREATMENT

Table 2 on the next page summarises the common contaminants found in water, and some possible methods of treatment that are suitable for individual supplies.

Please see table on next page

Table 2 Contaminants and Treatment Methods

CONTAMINANT	TREATMENT
Arsenic	Cartridge filtration if particulate; ion exchange or reverse osmosis if soluble.
Bacteria	Ultraviolet radiation (only effective in low turbidity waters and while lamps are performing near full efficiency - Refer ozone chlorine/reverse osmosis/boiling/ultrafiltration.
Boron	Ion exchange.
Carbon Dioxide	Aerate/calcium carbonate/marble/dolomite granules or chips.
Colour	Activated carbon/reverse osmosis.
Copper	Make water less corrosive, treat as for carbon dioxide. If present in source water other treatment will be necessary. Seek specialist advice.
Hardness	Ion exchange/magnetic treatment.
Iron	Aerate & filter/chlorinate & filter/ion exchange.
Lead	Make water less corrosive, treat as for carbon dioxide. If present in source water other treatment will be necessary. Seek specialist advice.
Manganese	Ion exchange/chlorinate & filter/potassium permanganate and filter
Nitrate	Ion exchange or reverse osmosis.
pH	If too low, treat as for carbon dioxide; if too high, treat as for hardness.
Protozoan Cysts	Reverse osmosis/boil/cartridge filter (5.0 mm nominal pore size).
Taste and Odour (many causes)	Activated carbon/boil/reverse osmosis.
Turbidity	Cartridge filter/reverse osmosis/ultrafiltration.
Viruses	Chlorine/reverse osmosis/boil/ultraviolet radiation/ultrafiltration.

4.3 DISINFECTION OF REMAINDER OF SUPPLY

If the absolute minimum approach is taken (i.e. the use of a point of use device for treating, drinking, cooking, food preparation and hand washing water), the following recommendation is made for the remainder of the supply. This is to ensure microbiological safety for washing water (bathing, showering and cleaning) which is typically one third of household consumption.

It is recommended that, if the water source is other than a confined aquifer (i.e. a secure groundwater), then the remaining water supplied to the inside of the building should be disinfected to the requirements of Drinking Water Standards for New Zealand.

4.4 POINT OF USE DEVICES

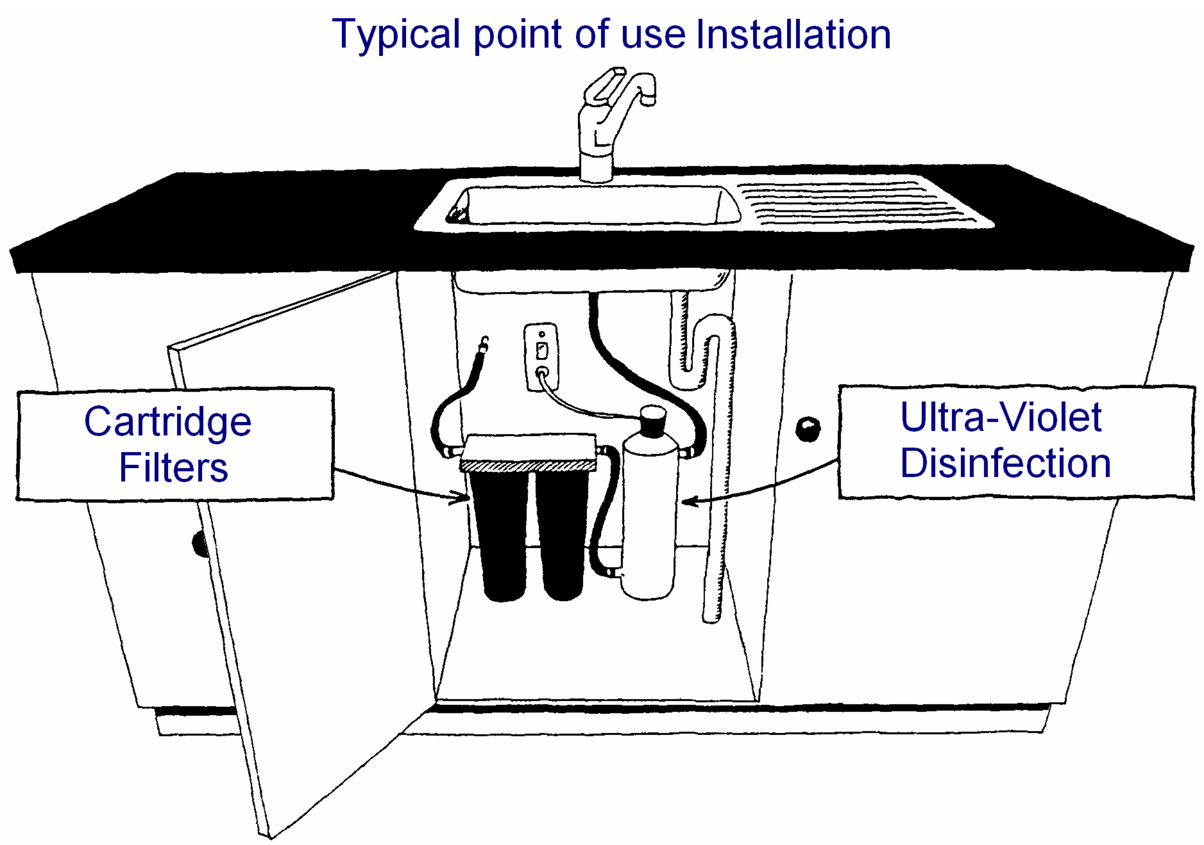
A point of use device is like a miniature water treatment plant. It can be used to treat all household water, or it can be put on the end of a tap for treating drinking water only. See illustration on page below.

Many people simply use a cheap, effective point of use device found in most kitchens - an electric kettle! If water is boiled for three minutes, all biological contaminants (including Cryptosporidium cysts) and most dissolved gas contaminants will be removed or destroyed. Unfortunately most chemicals will be left unaltered. This technique is unlikely to be a good choice for food premises and accommodation providers. The use of an electric kettle or jug with an automatic cut-off switch is also effective in killing micro-organisms.

There is a wide range of point of use devices on the market. They are available as plumbed-in, tap mounted, and stand alone units. The point of use devices available vary widely in quality, type and performance. It is important to obtain clear, written specifications from the vendor about what the device <u>will</u> treat and, more importantly, what it <u>will not</u> treat. In the event of the device not being suitable for its purpose there may be a remedy available under the Consumer Guarantees Act 1993. It is also advisable to ask for New Zealand tests information for the performance claimed by the manufacturer and vendor. The range of options for filtration is discussed in more detail below.

Neglected maintenance is probably the biggest problem with point of use devices. For example, micro-organisms can accumulate and grow in poorly maintained devices. It is important to be familiar with the maintenance requirements of each treatment unit. Some units require more maintenance than others. All should be maintained according to the manufacturer's recommendations. Some units have dealer or manufacturer maintenance contracts available to ensure proper operation over the life of the unit. One of the major problems is the difficulty of knowing when a point of use device has stopped working properly. "Use-by" dates or the manufacturer's instructions as to the maximum volume of water which can be treated should be strictly complied with. It could be helpful to install a water meter or to measure any drop in pressure as the unit starts to clog up. Once again, reputable suppliers can offer good advice.

Table 3 shows the different types of point of use devices and how effective they are in dealing with various contaminants, assuming that they are used and maintained properly. A point of use device should state clearly and permanently on its casing, what type of unit it is and what it can and cannot do.



Clutha District Council

Use Devices – their Effectiveness Against Various Contaminants

T	Activated Carbon 1	Boiling (4)	Ceramic Candle 2	Filtration (plain) 2	Ion Exchange 8	Reverse Osmosis 8	Ultra Filtration 8)	Ultra-violet (6)	Calcium Filtration 9	Magn Treatr
	P	N	N-G	N-G	N-G	Ex	N-G	N	P-G	7
	N 1	Ex 4	G	P	P-M	Ex	Ex	Ex 6	P	N
	N	N	N	N	Ex,	N	N	N	N	N
/Corrosivity	P	G	N	N	P	P	N	N	G	N
	M	N	N	N	P	G	P-M	N	N	N
	P	M 5	N	N	G 7	M	M	N	N	G
	P	N	N	N	G 7	G	M	N	M	M
luble	P	N	N	N	G 7	G	M	N	M	M
	P	N	N	N	G 7	G	P	N	N	N
	G 2	Ex 4	Ex	G 2	N	Ex	EX	P(6)	P(10)	N
	G 3	M	N	N	P	M	P	N	P	N
	M	N	P	P	G	Ex	Ex	N	P	N
	M	Ex (4)	P	P	M	Ex	Ex	Ex(6)	P	N

nt removal, where equipment is in good conditio
emoval to an acceptable leve
t removal, constituent may still give a problem. poor performance, most of constituent levels unaffected. no removal at all

Explanatory notes for Table 3

1 Activated carbon filters should not be used for water containing biological contaminants. The water should first be disinfected because bacteria can survive and grow on the Carbon itself.

2 Either plain or activated carbon cartridge type filters or ceramic candles can remove parasitic cysts, provided the filter size is 1 micron or less. However, see note 1 above.

3 Activated carbon will eventually become saturated with contaminants. The carbon must then be replaced or the contaminants will start coming through in the water, often at a higher concentration than in the original water.

4 Boil water continuously for at least three minutes.

5 Boiling hard water removes some of the hardness (the carbonate, or temporary hardness). The hardness removed forms a scale on the jug heating element making them less efficient. They will also break down much quicker as they have to work harder to heat the water.

6 Ultraviolet disinfection becomes less effective if there are impurities which can screen the micro-organisms from the ultraviolet light. Dissolved iron, manganese, organic matter, or turbidity [haziness] will all make UV disinfection less effective. In order to work properly the water must be as clear as possible before it passes through the UV device.

7 Ion exchangers can selectively remove specified chemicals from a range of chemical contaminants if appropriate resins are chosen. General purpose resins are often not suitable for drinking-water treatment.

8 While some treatment methods work well for some contaminants, they can be upset by the presence of others. For example, ion exchange, reverse osmosis, and ultrafiltration, are capable of effectively removing a range of contaminants. However, when fouled with excess turbidity and bacterial growths, their efficiency falls off dramatically and they can break down.

9 The calcium in the filter device is in the form of calcium carbonate, marble or dolomite.

10 The effectiveness of these devices varies depending upon the exact details of the filter.

11 Arsenic is removed by filtration processes if it is there as a solid particulate, where it has been dissolved and is in solution removal will require either ion exchange or reverse osmosis.

5 WILL A FILTER :HELP?

Domestic water filters can be used to improve the taste of water or remove certain chemicals from it. But they may not be so useful in dealing with health risks.

Your choice on which sort to buy depends on what you want to remove from the water. A simple activated carbon filter will remove chlorine and other tastes and odours. If you are concerned about other chemicals, talk to a health protection officer at Public Health South [Tel [03]474 1700] about what may be present in your water supply and how it can be removed. Do not rely on advertising pamphlets - they are often vague and misleading.

The common varieties of filter are outlined below.

Where giardia removal is indicated, the pore size must be 1 micron or smaller.

ACTIVATED CARBON

This will remove: Organic compounds, chlorine, and giardia cysts if the pore size is 1 micron or smaller.
It will not remove: Nitrate, fluoride, minerals, bacteria or viruses.

How it works:
Activated carbon is a form of charcoal which has been exposed to steam at high temperatures. The small granules are extremely porous and their surfaces attract impurities.

Eventually the pores fill with contaminants and the carbon stops working. You cannot tell when the filter is no longer working unless you have the water tested. Backwashing the filter with hot water will not restore its working ability. Many contaminants will not wash out and to make matters worse bacteria will also survive on the carbon.

Carbon filters should not be used on water known to be contaminated with bacteria, as they allow bacteria to multiply in trapped organic material and can eventually deliver water that is dirtier than that which went in. Some filters get around this by being impregnated with silver. Tests have shown this inhibits the growth of some bacteria but not others. Some systems now also use chemicals which can kill bacteria.

The filters must be replaced regularly and the manufacturer's instructions should .be closely followed. Cartridges should be date-stamped with start and recommended finish dates.

Activated carbon filters may be combined with any of the other three types listed below:

CERAMIC
This will remove Giardia cysts and some bacteria, depending on pore size. It will not remove: Organic or Inorganic chemicals and viruses:

How it works:
Water passes through "candles" of a fine ceramic material with very small holes in it. Frequent cleaning is needed as the pores quickly become clogged and the amount of water coming through is reduced to a trickle. They have many of the same problems as carbon filters.

REVERSE OSMOSIS
This will remove: Some organic contaminants, chloroform, Inorganic contaminants, giardia cysts. It will not remove: Bacteria, viruses.

How it works:
Water passes through a semi-permeable membrane which stops large contaminant molecules getting through. These contaminants are then washed away. The reverse osmosis system is slow, taking several hours to process. It is also wasteful - only 10 to 25 percent of the water that passes through the system is used. The rest goes down the drain.

The membrane needs replacing from time to time as the pores can become clogged. Some membranes may be damaged by high chlorine levels and allow contaminants through. It is not easy to tell when the membrane is no longer effective.

ION EXCHANGE
This will remove: Inorganic chemicals including fluoride and chlorine. It will not remove: Organic chemicals, giardia cysts, bacteria and viruses.

How it works:
Beads of plastic resin absorb inorganic chemicals until the resin is saturated and then need to be replaced. Some resins will change colour as they become full so you can see when they need replacing. They may be used as water softeners - the sodium in the resin is exchanged with the calcium in the water.

FILTER COSTS
Costs vary, according to the treatment system used and the unit. The simplest are small jugs you can keep water in the fridge. Others can be attached to an existing tap, plumbed in under the bench with a special tap, or inserted into the main plumbing. Replacement filter cartridges are an extra cost. Filters for the cheaper units will probably need to be replaced more often.

Domestic water treatment filters are normally satisfactory. For areas where the water has already been treated to remove harmful micro-organisms. However, if you live in a small rural area where the water supply is suspect you should seek the Council's advice.

CARBON FILTER CARTRIDGES
Activated carbon filters are the most popular type of water filter. They range from very small units which fit directly onto a tap or over a jug to units which are plumbed into cold water pipes.

The very small units are cheap but will only last a very short time - maybe only a few weeks. How quickly a filter is used up will depend upon how much water passes through it, how many impurities there are in the water and the amount of carbon in the filter. The larger filters are better value as they will last much longer.

6. MONITORING
It is recommended that water supply owners should have the water being used for drinking, cooking and food preparation tested for total and faecal coliforms at least once every six months. A specialist water testing laboratory (see "Laboratories - Analytical, and Laboratories - Testing" in the Yellow Pages; but check that they routinely carry out water quality analyses) should be used, and can give advice on the correct procedures and container to be used when taking samples. The laboratory used should be on the list of analytical laboratories recognised by the Ministry of Health as suitable for tests related to the Drinking-Water Standards for New Zealand. Advice is also available from Medical Officers of Health or other designated officers of the Ministry of Health.

Other contaminants should be tested when there is a change in the source or treatment process, every two to three years or when there is some cause for concern. Cause of concern may arise because of a new or worsening problem with the water (refer Table 1 for some of the more common contaminants and their related problems). If analysis shows that a particular contaminant has reached or is greater than 50 percent of its maximum acceptable value, the cause of its appearance should be investigated and it should be monitored every three months until it has dropped below the 50 percent level, and/or the source of the contamination is removed or controlled.

7. PRIVATE BORE WATER SUPPLIES

7.1 BACKGROUND
The installation of a bore is permitted where the water is to be used for reasonable domestic needs, fire fighting, or stock watering, provided that it will not or is not likely to have an adverse effect on the environment. Where the proposed use is outside these activities contact the Otago Regional Council for advice on whether a water permit is needed.

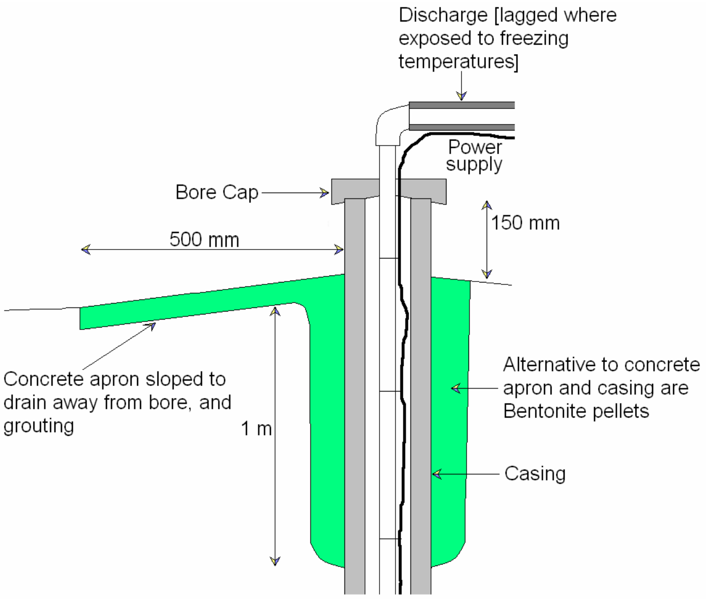
7.2 CONTAMINATION PREVENTION

Bore Head Design
The bore shall be protected from the infiltration of stormwater and other contaminants by securing the well head as shown in the on the following page.

Bore Location
The bore shall be located:

(a) As far away as practicable from any foul water system, offal pit, stock yard, agricultural effluent system, or any other potential source of contamination; and
(b) In an area that is not prone to flooding or ponding; and,
(c) In an area that is not used for stock, unless the bore is protected by an enclosure or is fenced off.

See diagram on next page



Cross Connections Prohibited
Unless approved backflow prevention is provided cross connections are prohibited between the water supply and:
(a) any recreational bathing facility
(b) any pipes, fixtures or equipment containing chemicals, liquids, gases and other non-potable substances
[c] any farm services (stock troughs, washdowns etc).

Backflow Prevention
Backflow prevention shall be provided in accordance with Approved Document G12 "Water Supplies".

Consideration should be given to fitting vacuum breakers on outdoor hose connections.

7.3 DEPTH
Where practicable the water should be drawn from a confined aquifer. The water quality of confined aquifers is excellent in terms of microbes (such as bacteria) and chemicals such as nitrates, which are the primary contaminants of health concern.

Disadvantages of confined aquifers are:
- Yield: The yield of confined aquifers may not be as reliable as unconfined aquifers.
- Cost: Deep bores typically cost $9,000 from drilling alone, while an unconfined aquifer bore costs $2,000 - $3,000 complete. A submersible pump is needed in confined bores, while a surface centrifugal or jet unit may be used in unconfined aquifer bores.
- Water Quality: Iron, manganese, aggressivity and hardness are much more prevalent in confined aquifers. All of these may cause problems for use in drinking water, laundry and personal washing due to tastes, etc.
- Geology: Some areas have no practicable confined aquifer bore options.

Comment:
It is far better to extract water from a safe source and protect it than to attempt to treat water of doubtful quality.
Pump test data carried out when the bore is installed will often show whether the aquifer is confined and can give an indication of yield reliability (recharge).

7.4 ACCEPTABLE MATERIALS
Pipes
Acceptable pipe materials are:
(a) Polybutylene, polyethylene or UPVC for cold water pipes; and

(b) Polybutylene for hot water pipes.

Comment:
Shallow groundwaters in particular can be aggressive. Because of this water contact surfaces should not be metallic because this may leach [dissolve] metals.

When using polybutylene, ensure that junctions and other pipe fittings are also made of polybutylene and not copper. This is because the copper used in such fittings is particularly prone to corrosion and wears rapidly.

Pump and Hot Water Cylinder
The pump and hot water cylinder shall have a minimum durability of 5 years in accordance with the "Durability" requirements of the New Zealand Building Code. The pump supplier or plumber installing the respective pump or cylinder must therefore ensure that the type to be used is sufficiently resistant to corrosion from aggressive bore water (if applicable).

7.5 WATER QUALITY

Testing
A water sample shall be taken upon the installation of a bore and laboratory tested for the parameters listed on page 5 (except for protozoan cysts, which are difficult to test for), and the results submitted to the Clutha District Council.

Treatment
Effective treatment must be provided if E Coli is identified within the water because this indicates recent contamination from faeces [poo] and the water is not safe to drink. Treatment can be as simple as boiling or more sophisticated methods can be used such as a UV system. Automatic systems can treat the entire supply or just at the point of use. Point of use devices are quite acceptable because contaminants are only a problem for certain uses, such as high iron concentrations staining laundry.

Automatic treatment systems are very effective when they are kept in good working order. It is important that they be installed by a qualified person as treatment devices are often only functional under certain conditions (e.g. turbidity interfering with UV treatment). The down side of automatic treatment systems is that being mechanical they are prone to failure, and if poorly maintained they can be unreliable.

Installation of automatic systems should be carried out by a reputable supplier who is experienced with local conditions and who will notify customers when cartridges, UV lamps and the like need replacing.

7.6 MONITORING

Water from the kitchen tap should be tested every six months for faecal coliforms (if treatment is not provided for this contaminant) and nitrate (if the initial installation test exceeded half the guideline value). Other contaminants should be tested every two or three years or when there is some cause for concern.

8.0 FIRE FIGHTING

Where a house within 15 minutes travelling time of the nearest fire station does not have an accessible supply of water such as a pond or stream within 150 metres of the house, a reserve supply is recommended. The bore could serve as the reserve supply, provided the bore is fitted with a compatible valve for fire service hose and that valve is at least 4 metres clear of the house. An alternative is a 10,000 litre tank 20 metres clear of the house.

Residential fire sprinkler systems are an option, and fire extinguishers are recommended - especially for houses 15 minutes or more away from the nearest fire station. Fire engines require a 4 x 4 metre clearance at any access gates.