Drinking water testing

Drinking (Potable) water

Testing for potable water purposes is based on the NZ Ministry of Health "Drinking Water Standards for New Zealand 2005 (Revised 2008). This is available at www.moh.govt.nz/water, see the "Publications" link.

For home/farm use the usual tests are based on the source of water. Note that other tests may be needed in specific circumstances.

Microbes are the major potential health issue with drinking water. The standard is to test for Escherichia coli (usually referred to as E coli). If this is found then it indicates that the water may have been polluted with faecal matter, and could contain pathogenic organisms, viruses, etc. All potable water should have NO E coli (ie the report should be <"1").

Appendix A lists some common problems found with water supplies, and possible treatments.

Appendix B shows an example report

Source = Groundwater (eg from a bore)

Our "Routine Water" (RW) suite covers the most important parameters to characterise the water, highlight any potential health issues and provide suitable information for designing treatment systems should these be needed. The microbiological test (Escherichia coli or E coli) can be included if required – very deep groundwaters will not contain E coli, but those impacted by surface drainage may. See Appendix B for a typical Routine Water Report.

If the water is causing a problem with white smears on glass, then this could be due to high silica levels. As this is not toxic there are no guidelines for acceptable levels, but our experience shows this can start causing issues at above about 60g.m-3. Request a Silica test as well as the Routine Water test.

Source = Surface water (Stream, Spring, Dam)

The major health risk is microbiological, so the E coli **must** always be tested for. Some form of treatment will always be required.

A standard Routine Water Test may also be done, plus turbidity and/or suspended solids, as filtration will always be required as the first step in treatment. Note that the composition of surface waters can vary considerably depending on the time of year, rainfall, etc, so several tests over a year may be required.

Source = Rainwater (eg from a roof)

Rain has a low pH (about 5.7 because of dissolved carbon dioxide). This means it will be aggressive towards metal fittings such as copper hot water pipes and elements, and the brass fittings inside taps. Typical symptoms are blue stains on whiteware or blond hair turning green in the shower.

Roof water **will** always contain bacteria, at some stage anyway, and these can cause diarrhoea or worse, in some cases. Most people who use rainwater develop an immunity to the normal bacteria present, but visitors can be affected by the microbes.

Treatment to remove microbes will be required if there are any symptoms in those using the water, or if the water is going to be used with visitors eg grandchildren during the school holidays or for bed-and-breakfasters.

Treatment to raise the pH may be required if staining or corrosion is a problem.

Testing of rainwater is usually not required, but testing after a treatment system is installed can be used to prove that this is working properly.

Appendix A

Common chemistry problems with water supplies

Note: Hill Laboratories staff are unable to provide specific information or services relating to water treatment, other than testing the water. For information on water treatment, search "Water Treatment" or "Water Filtration" on the internet.

Note that the possible treatment options mentioned below are not an exhaustive list.

1. **Low pH**. All rainwater has a low pH (about 5.7) and many groundwaters also. Can be treated by flowing the water through special granules.
2. **High pH** (Rare). Sometimes found with new concrete tanks, will normalise over time. Very high pH can cause problems with eye irritation.
3. **High nitrate/nitrite**. Can be removed by anion exchange resins or reverse osmosis.
4. **High chloride or sulphate**. Can be removed by anion exchange resins or reverse osmosis.
5. **High iron/manganese**. Perhaps the commonest problem, with low pH. Iron can sometimes be removed to acceptable levels by oxidation to cause iron oxide ('rust') to precipitate, then filtering the precipitate out. More often treatment will involve chemical oxidation before filtration. Manganese is more difficult to remove than iron. Both can cause staining, taste and blockage problems.
6. **Hard water.** Can be treated with a 'water softener' (an ion exchange resin) which replaces the calcium and magnesium with sodium. So the sodium levels in the treated water will go up. Using reverse osmosis doesn't raise the sodium, but is much more expensive.
7. **High boron**. Can be removed by anion exchange resins or reverse osmosis.
8. **High zinc**. Usually from a new bore when the galvanised pipe has not had time to form a stable oxide coating. May also be from farm supplies using zinc dosing for facial eczema if a back-flow preventer has not been fitted. Can be very toxic to sensitive plants. Remove with a cation exchange resin or reverse osmosis.
9. **High copper.** Usually because the water has a low pH and is dissolving copper pipe/hot water elements. Blue stains and blonde hair turning green are typical symptoms. First treat the low pH, the problem should disappear. . Remove with a cation exchange resin or reverse osmosis. Stray electric currents have also been found to accelerate copper pipe corrosion, so check the house electrical earthing if the problem persists.
10. **High silica** (over about 60g.m^{-3}, but does depend on other chemistry in the water). This can cause white, hard to remove smears on glass eg mirrors or shower doors. Can be removed by anion exchange resins or reverse osmosis. Not a health issue. There are no official guidelines for silica levels.

Appendix B

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	R J Hill Laboratories Limited	**Lab No:**	1993378 DWAPv1
Contact:	Miss Arneka Phillips	**Date Received:**	01-Jun-2018
	C/- R J Hill Laboratories Limited	**Date Reported:**	07-Jun-2018
	Private Bag 3205	**Quote No:**	
	Hamilton 3240	**Order No:**	
		Client Reference:	Kitchen Tap
		Submitted By:	Miss Arneka Phillips

Sample Type: Aqueous

		Sample Name:	Kitchen Tap 01-Jun-2018 7:25 am	Guideline Value	Maximum Acceptable Values (MAV)
		Lab Number:	1993378.1		
Routine Water + E.coli profile Kit					
Escherichia coli	MPN / 100mL		< 1 #1	-	< 1
Routine Water Profile					
pH	pH Units		6.3	7.0 - 8.5	-
Total Alkalinity	g/m³ as $CaCO_3$		23	-	-
Free Carbon Dioxide	g/m³ at 25°C		24	-	-
Total Hardness	g/m³ as $CaCO_3$		71	< 200	-
Electrical Conductivity (EC)	mS/m		32.2	-	-
Electrical Conductivity (EC)	µS/cm		322	-	-
Approx Total Dissolved Salts	g/m³		220	< 1000	-
Total Boron	g/m³		0.105	-	1.4
Total Calcium	g/m³		12.2	-	-
Total Copper	g/m³		0.26	< 1	2
Total Iron	g/m³		< 0.021	< 0.2	-
Total Magnesium	g/m³		9.9	-	-
Total Manganese	g/m³		0.00061	< 0.04 (Staining) < 0.10 (Taste)	0.4
Total Potassium	g/m³		7.5	-	-
Total Sodium	g/m³		34	< 200	-
Total Zinc	g/m³		0.046	< 1.5	-
Chloride	g/m³		20	< 250	-
Nitrate-N	g/m³		5.5	-	11.3
Sulphate	g/m³		65	< 250	-

Note: The Guideline Values and Maximum Acceptable Values (MAV) are taken from the publication 'Drinking-water Standards for New Zealand 2005 (Revised 2008)', Ministry of Health. Copies of this publication are available from http://www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2008

The Maximum Acceptable Values (MAVs) have been defined by the Ministry of Health for parameters of health significance and should not be exceeded. The Guideline Values are the limits for aesthetic determinands that, if exceeded, may render the water unattractive to consumers.

Note that the units g/m³ are the same as mg/L and ppm.

Analyst's Comments

#1 The samples do not meet the requirements of the NZDWS - samples were greater than 10 °C on receipt in the lab (11.5 °C). As such, please interpret these microbiological results with caution. Samples must be kept at less than 10 °C (but not frozen).

Routine Water Assessment for Sample No 1993378.1 - Kitchen Tap 01-Jun-2018 7:25 am

pH/Alkalinity and Corrosiveness Assessment
The pH of a water sample is a measure of its acidity or basicity. Waters with a low pH can be corrosive and those with a high pH can promote scale formation in pipes and hot water cylinders.
The guideline level for pH in drinking water is 7.0-8.5. Below this range the water will be corrosive and may cause problems with disinfection if such treatment is used.

The alkalinity of a water is a measure of its acid neutralising capacity and is usually related to the concentration of carbonate, bicarbonate and hydroxide. Low alkalinities (25 g/m^3) promote corrosion and high alkalinities can cause problems with scale formation in metal pipes and tanks.

With the pH and alkalinity levels found, this water could be corrosive towards metal piping and fixtures.
The presence of copper in the water also tends to indicate that the water is corrosive and has contacted copper pipework or heating elements. Blue stains in hand basins, especially under a hot tap, also reflect the presence of copper in the water. Copper concentrations above 2 g/m^3 are considered potentially hazardous.

Hardness/Total Dissolved Salts Assessment
The water contains a low amount of dissolved solids and would be regarded as being slightly hard.

Nitrate Assessment
Nitrate-nitrogen at elevated levels is considered undesirable in natural waters as this element can cause a health disorder called methaemaglobinaemia. Very young infants (less than six months old) are especially vulnerable. The Drinking-water Standards for New Zealand 2005 (Revised 2008) suggests a maximum permissible level of 11.3 g/m^3 as Nitrate-nitrogen (50 g/m^3 as Nitrate).

Nitrate-nitrogen was detected at a moderate level.

Boron Assessment
Boron may be present in natural waters and if present at high concentrations can be toxic to plants.
Boron was found at a low level in this water but would not give any cause for concern.

Metals Assessment
Iron and manganese are two problem elements that commonly occur in natural waters. These elements may cause unsightly stains and produce a brown/black precipitate. Iron is not toxic but manganese, at concentrations above 0.5 g/m^3, may adversely affect health. At concentrations below this it may cause stains on clothing and sanitary ware.

Iron was not detected in the water
Manganese was found in this water at a low level.
Treatment to remove iron and/or manganese should not be necessary.

Bacteriological Tests
The NZ Drinking Water Standards state that there should be no Escherichia coli (E coli) in water used for human consumption. The presence of these organisms would indicate that other pathogens of faecal origin may be present. Results obtained for Total Coliforms are only significant if the sample has not also been tested for E coli.

Escherichia coli was not detected in this sample.

Final Assessment
The parameter pH did NOT meet the guidelines laid down in the publication 'Drinking-water Standards for New Zealand 2005 (Revised 2008)' published by the Ministry of Health for water which is suitable for drinking purposes.

TECHNICAL NOTE

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Routine Water Profile		-	1
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1
Total Digestion	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	1
pH	pH meter. APHA 4500-H+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22nd ed. 2012.	1.0 g/m³ as $CaCO_3$	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D 22nd ed. 2012.	1.0 g/m³ at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 22nd ed. 2012.	1.0 g/m³ as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m³	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.0053 g/m³	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.053 g/m³	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00053 g/m³	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m³	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m³	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00053 g/m³	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.053 g/m³	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m³	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.0011 g/m³	1
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1
Nitrate-N	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.05 g/m³	1
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1
Escherichia coli	MPN count using Colilert , Incubated at 35°C for 24 hours. APHA 9223 B (2004), 22nd ed. 2012.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.