

# Hardness in Groundwater<sup>1</sup>

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## What is water hardness?

Water hardness is primarily the amount of calcium and magnesium, and to a lesser extent, iron in the water. Water hardness is measured by adding up the concentrations of calcium, magnesium and converting this value to an equivalent concentration of calcium carbonate (CaCO<sub>3</sub>) in milligrams per litre (mg/L) of water. The Guidelines for Canadian Drinking Water Quality Hardness divide hardness into the following categories:

Hardness Category	Equivalent Concentration of CaCO <sub>3</sub>
Soft	< 60 mg/L
Medium hard	60 mg/L to < 120 mg/L
Hard	120 to < 180 mg/L
Very hard	180 mg/L or greater

The optimum range of hardness in drinking water is from 80 to 100 mg/L. Water with hardness greater than 200 mg/L is considered poor in most regions of the province and water with hardness greater than 500 mg/L is normally considered unacceptable for domestic purposes. On average, water in British Columbia has been found to range in hardness from less than 10 mg/L to 180 mg/L. Groundwater tends to be harder than surface water and can range to greater than 1000 mg/L.

## What are the known sources of water hardness?

Water hardness in most groundwater is naturally occurring from weathering of limestone, sedimentary rock and calcium bearing minerals. Hardness can also occur locally in groundwater from chemical and mining industry effluent or excessive application of lime to the soil in agricultural areas.

## What are the environmental health concerns?

Hard water is mainly an aesthetic concern because of the unpleasant taste that a high concentration of calcium and other ions give to water. It also reduces the ability of soap to produce a lather, and causes scale formation in pipes and on plumbing fixtures. Soft water can cause pipe corrosion and may increase the solubility of heavy metals such as copper, zinc, lead and cadmium in water. In some agricultural areas where lime and fertilizers are applied to the land, excessive hardness may indicate the presence of other chemicals such as nitrate.

<sup>1</sup> Information in this fact sheet is generally intended for private wells. Please note that any water supply system or well serving anything other than one single family dwelling is defined as a water supply system under the *Drinking Water Protection Act* and Regulations and must be sampled according to the Act and Regulations. The person operating such a system is defined as a water supplier.

## Other information sources:

Health Canada, Guidelines for Canadian Drinking Water Quality Supporting Documents. [http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc\\_sup-appui/index\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/index_e.html)

Health Canada, *It's Your Health*. [http://www.hc-sc.gc.ca/iyh-vsv/environ/index\\_e.html](http://www.hc-sc.gc.ca/iyh-vsv/environ/index_e.html)

B.C.'s Ground Water Protection Regulation: [http://www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/groundwater/index.html](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/index.html)

B.C. Ministry of Health, "Safe Water Supply Vital to Your Health." (1999) <http://www.healthservices.gov.bc.ca/protect/pdf/PHI052.pdf>

B.C. Ministry of Health, Health Files. <http://www.bchealthguide.org/healthfiles/index.stm>

Type "water" in the search section and look for various articles including:

- #45 "Should I Get My Well Water Tested?"



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## Where has hardness been found in B.C. well water?

The Ministry of Environment evaluated the results of groundwater samples obtained through the *Water Quality Check Program* carried out between 1977 and 1993. Nearly 12,000 samples were analysed for hardness, of which 5.4% had hardness concentrations over 500 mg/L. Additionally, 40% of samples had hardness of less than 60 mg/L, 22% had hardness between 60 mg/L and 120 mg/L, 10% had hardness between 120 mg/L and 180 mg/L, and 27% had hardness of equal to or greater than 180 mg/L. Soft water tended to be found in areas with mainly igneous rock formations, while areas with mainly sedimentary rock tended to have greater water hardness.

## What can well owners and water suppliers do about excessive hardness in well water?

People may become accustomed to a high level of hardness in drinking water. If well water is excessively hard, use bottled water or obtain water from an alternate source, such as a municipal system, or a nearby well that has been tested and found to have lower hardness. Some types of hardness can be removed by boiling. Water treatment methods such as reverse osmosis, ion exchange or oxidizing filters can be used to reduce other types of water hardness. With the ion exchange process, water is pumped through a tank containing a resin that causes calcium and magnesium ions to be exchanged for sodium or potassium ions. As sodium ion exchange increases the concentration of sodium in water, the Guidelines for Canadian Drinking Water Quality recommend that if this method is used for treatment, a separate, non-softened water supply should be maintained for drinking and cooking purposes.

When purchasing a treatment device, you should consider one that has been certified by an organization accredited by the Standards Council of Canada (SCC). The treatment device should meet the following standards: NSF/ANSI Standard 62 on drinking water distillation systems, or Standard 58 on reverse osmosis drinking water treatment systems, or Standards 53 on drinking water treatment units — with specific designation for the water quality parameters you are trying to remove (e.g. hardness). Certification assures that a device works as the manufacturer or distributor claims. Devices can be certified for treating a range of water quality concerns, so make sure that the device you purchase is explicitly certified for iron and manganese removal. Find an up-to-date list of accredited organizations at [www.scc.ca](http://www.scc.ca).

## Well water testing and source protection

Well owners are encouraged to test their water periodically to make sure it is safe to drink. Consult Public Health at your local Health Authority for advice regarding the specific parameters to test for and how often testing should be done. For more information on protecting well water source, a *Well Protection Toolkit* is available from the Ministry of Environment on the internet: [http://www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/groundwater/wells/well\\_protection/wellprotect.html](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/well_protection/wellprotect.html) to help water suppliers and communities develop a well protection plan to minimize the threat of land use activities on groundwater quality.

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