

Water Hardness in the United States and Canada

Water hardness is primarily caused by dissolved compounds of calcium and magnesium and is expressed by the equivalent concentration of calcium carbonate.

Units:

The most common units of measurement used in the US and Canada are:

- milligrams per liter (mg/l) or parts per million (ppm).
(These units are used primarily by the scientific community.)
- grains per gallon (gr/gal) or grains per imperial gallon (gr/IG)
(These units are used primarily by the water treatment industry.)

Conversion Between Units:

Milligrams per liter (mg/l) and parts per million (ppm) are essentially equivalent. Dividing (mg/L) by 17.1 will convert to grains per gallon (gr/gal).

$$1 \text{ (gr/gal)} = 17.1 \text{ (mg/l)} = 17.1 \text{ (ppm)}$$

Sometimes water hardness in the UK and Canada will be expressed in grains per imperial gallon (as shown on the map of Canada shown below). Multiply by 1.2 to convert from grains per US gallon to grains per imperial gallon.

$$1 \text{ (gr/gal)} = 1.2 \text{ (gr/IG)}$$

Hardness Classification:

There is no wide agreement on what equivalent concentration of calcium carbonate is considered hard or soft. Below is an unbiased scale which corresponds closely to the classifications used by the U.S. Geological Survey.

Water Hardness Classifications

Classification	Milligrams Per Liter or Parts Per Million (mg/L) or (ppm)	Grains Per Gallon (gr/gal)	Grains Per Imperial Gallon (gr/IG)
	Soft	Less than 17.1	Less than 1.0
Slightly Hard	17.1 - 60	1.0 - 3.5	1.2 - 4.2
Moderately Hard	60 - 120	3.5 - 7.0	4.2 - 8.4
Hard	120 - 180	7.0 - 10.5	8.4 - 12.6
Very Hard	Over 180	Over 10.5	Over 12.6

**CONCENTRATION OF HARDNESS AS CALCIUM CARBONATE,
IN MILLIGRAMS PER LITER**

