

# Water Softeners, Septic Systems & Ground Water

If you live in an area with hard water you may use, or consider using a water softener in your home. Before you make the decision whether or not to switch from hard water to soft water, weigh the environmental and health effects.

## What Makes Water “Hard”?

Water containing high concentrations of magnesium and calcium is described as “hard”. While hard water is not a health risk, it can be a nuisance to homeowners because of mineral build-up (called calcite) on water fixtures and poor soap and detergent performance. Water softeners can be used to treat hard water.

Soft water is good for showering and laundry purposes because less soap or detergent is required in cleaning.

## What do Hardness Numbers Mean?

You’ve had your water tested and the lab report shows the hardness level of your water is 50 ppm. What does that mean? Because hardness is a property that is attributed to several factors, a common method has been developed for expressing concentrations in quantitative terms. This table illustrates the relationship between the calculated value and the “hardness classification”.

**Water Hardness Classification**

Classification	mg/l or ppm	grains/gal
Soft	0 – 17.1	0 - 1
Slightly hard	17.1 – 60	1 – 3.5
Moderate hard	60 – 120	3.5 – 7.0
Hard	120 – 180	7.0 – 10.5
Very hard	180 & over	10.5 & over

Call the Gallatin Local Water Quality District at (406) 582-3168 for a listing of laboratories that test water hardness.

## Health Effects of Softened Water

If you use a water softener, make sure your drinking water faucets are not connected to the water softener system. Because of the high sodium concentration in softened water, it should never be used for drinking or cooking. People on low sodium diets should avoid consuming softened water.

## How Do Water Softeners Work?

Water softeners are used to continuously remove calcium and magnesium from the well water via an exchange process. In this process the hard water passes through a resin media bed saturated with salt (sodium chloride). As hard water passes through the system, calcium and magnesium atoms attach to the resin in the media bed and sodium atoms are released from the resin bed into the water, making the water “soft”.

Eventually, the resin becomes saturated with magnesium and calcium and runs out of sodium. To replenish the system, the resin bed must be flushed and recharged. This is done by passing a sodium-rich solution (large amounts of salt dissolved in water) through the resin. Sodium atoms in the solution replace the magnesium and calcium atoms on the resin. The resin bed is once again saturated with sodium allowing the softener to do its job. Wastewater produced during this flushing (backwash) process contains high concentrations of calcium, magnesium, sodium and chloride. If you use a septic system, this “salty” wastewater is discharged to your septic tank.

Once that soft water goes down the drain, most people don’t think about what effect it may have on their septic system and ground water.



## Are Water Softeners Bad for Septic Systems?

Bacteria are an essential component of the septic system. These organisms partially digest the organic matter that enters the septic tank and the solids “settle” in the septic tank, to be pumped out at a later time. Relatively clear water (effluent) is discharged from the septic tank to the soil through a distribution system, commonly a drainfield or leach field. When using a water softener, the sodium, calcium, magnesium, and chloride-rich wastewater produced during the recharge process is discharged to your septic tank. These contaminants are not treated by the bacteria in the septic tank and pass through to the drainfield. There is debate as to whether or not this “salty” wastewater is harmful to septic systems. Here are two viewpoints:

***View 1:*** Studies have been conducted which provide good news to the homeowner who uses a water softener or is considering installing one.

The University of Wisconsin-Madison and the National Sanitation Foundation each conducted research to address the following questions:

1. Is the salt discharged from a water softener toxic to the bacteria in a septic system?
2. Does the liquid flow rate produced during the water softener’s regeneration cycle upset the septic tank digestion process and cause untreated sewage solids to enter into the drainfield?
3. Will the sodium in the septic effluent cause some soils to “swell” and reduce the water percolation rate through the soil?

The studies indicated that increased sodium in the softened water was actually helpful to the bacteria in the septic tank by stimulating biological action in the tank, and did not hurt the soil’s ability to absorb water in a normal drainfield. The volume of softener backwash during regeneration was easily within the limits of what the septic tank could handle. In fact, an automatic washer would pose a greater threat to the septic tank than a water softener. And, finally, the salt-rich effluent thought to possibly interfere with soil permeability in the drainfield might actually improve soil percolation, particularly in fine textured soils such as clay.

***View 2:*** Several studies and indicate that homeowners should make every effort to minimize the input of salts to their septic systems. This includes, in addition to water softeners, certain cleaning solutions and household chemicals, which contain high levels of sodium (drain opener, certain laundry detergents). A lack of or excessive amounts of salt will kill the beneficial bacteria in the septic tank. Therefore, excess salt concentrations in septic tank effluent can have a detrimental effect on the sewage treatment capabilities of the septic system. Because the bacteria are reduced, untreated sewage is released into the drainfield reducing the effectiveness of the system and increasing the need to have the septic tank pumped. The regular addition of salt will have this effect continuously over the life of the septic system.

In addition, some experts believe that water containing high concentrations of sodium is potentially harmful to the water absorption characteristics of soil. That is, high sodium loading of septic tank effluent to a drainfield will eventually make the soils impermeable (non-absorbing) after prolonged use. This is an important problem where the soils are composed of clay minerals that shrink and swell when dry and wet, respectively.

A report from the Department of Soil Science, North Carolina University, suggests more studies need to be conducted to assess water softener impacts on the performance of septic systems in different soil types. This includes using potassium chloride instead of sodium chloride in water softeners and determining impacts on soil water absorption properties.



Another observation suggests that the increased salt load from the water softener to the septic tank may increase the density of effluent in the tank enough to retard settling

of solids. This could result in solids eventually being transported into the drainfield, reducing its lifespan.

## Do Water Softening Systems Impact Ground Water?

**Yes.** Since the sodium, calcium, magnesium, and chloride contained in the “salty” discharge water from the water softener is not treated in the septic tank and passes through to the drainfield; there is an impact to ground-water quality.

In general the soils in the drainfield area can trap the calcium and magnesium in much the same way as the resin bed in the water softener system does. However, sodium is much more soluble in water and does not readily attach to the soils. The chloride does not attach to the soils in the drainfield area. Most of the sodium and chloride discharged to the drainfield moves with the treated wastewater downward to the water table.

**For the most part, all of the salt that you buy to make your water softener work ultimately ends up in the ground-water system.**

Regardless of whether or not sodium has a positive or negative impact on the functioning of a septic system, **the effects of excess salt on ground water are detrimental.**

Although sodium from an individual septic system may make an insignificant contribution to ground water contamination, the sheer number of such systems and their widespread use in densely developed areas without a public wastewater treatment system makes them a potential source of ground-water contamination.

Locally, a septic system hooked to a water softening system may have a significant impact to ground water, and it may impact your own well.

## Best Practices for Softening

If you decide to install a water softening system, consider a few of the finer points: Always make sure the water softener is working correctly and efficiently. Have a water laboratory analyze a sample of un-softened water to determine its hardness; you can properly calibrate your softener to use just the right amount of softener salt. This saves salt from going down the drain and saves you money.

Consider switching from traditional sodium chloride salts to potassium chloride salt. Potassium will provide the same softening and mineral exchange properties, but does not have the potential environmental and health effects of normal salt, although it will cost more.

Make sure not to plumb softened water to your kitchen tap or to outside irrigation lines. The Montana Department of Environmental Quality does not allow the softener to backflush to the septic system if it is also connected to outside irrigation lines. When installing a new septic system and drainfield, size it appropriately to accommodate additional flow from the water softener.

### References:

- MT Dept of Environmental Quality. Circular DEQ 4: Montana Standards for Subsurface Wastewater Treatment Systems
- National Sanitation Foundation Study, “The Effect of Home Water Softener Waste Regeneration Brines on Individual Aerobic Wastewater Treatment Plants”.
- National Drinking Water Clearinghouse, “Ground Water Protection Begins at Home”.
- National Small Flows Clearinghouse, “Pipeline Newsletter”, Winter 2001, Volume 12, Number 1.
- University of Wisconsin Study, “Potential Effects of Water Softener use on Septic Tank Soil Absorption On-Site Waste Water Systems”.
- U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water, “Citizen’s Guide to Ground-Water Protection” (EPA 440/6-90-004)
- The Water Resources Research Institute, “Impact of Wastewater Quality on the Long-Term Acceptance Rate of Soils for On-Site Wastewater Disposal Systems” (Report 316, July 1998).

