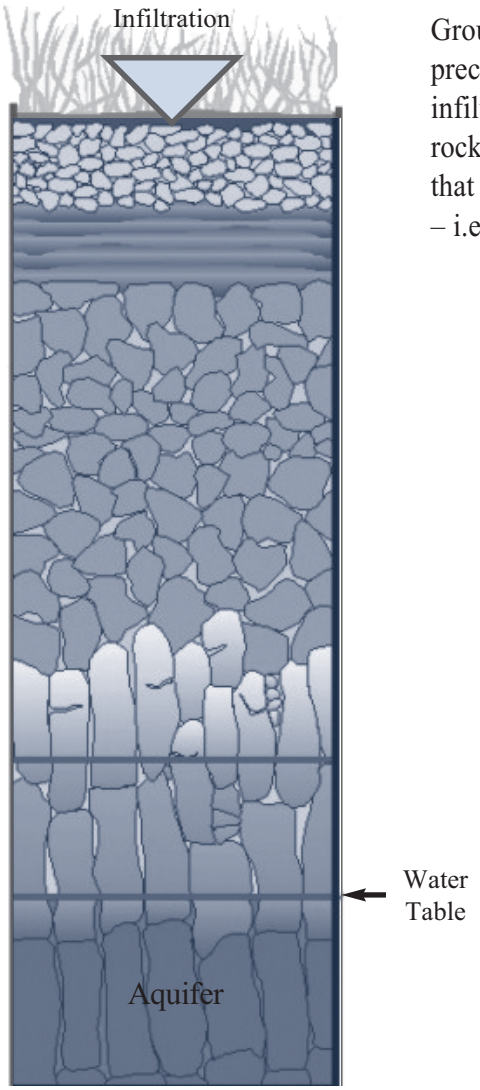
Groundwater basics

Your well gets its water from an underground water source called groundwater.

Groundwater originates from surface water and precipitation, including rain and melting snow, that has infiltrated the earth, filling the cracks and open spaces in the rocks and the soil. Saturated layers below the water table that store and transmit significant quantities of groundwater – i.e., enough to supply a well – are called aquifers.



Saturated layers below the water table that transmit significant quantities of groundwater are called aquifers. Credit: ***BMP: Water Wells***

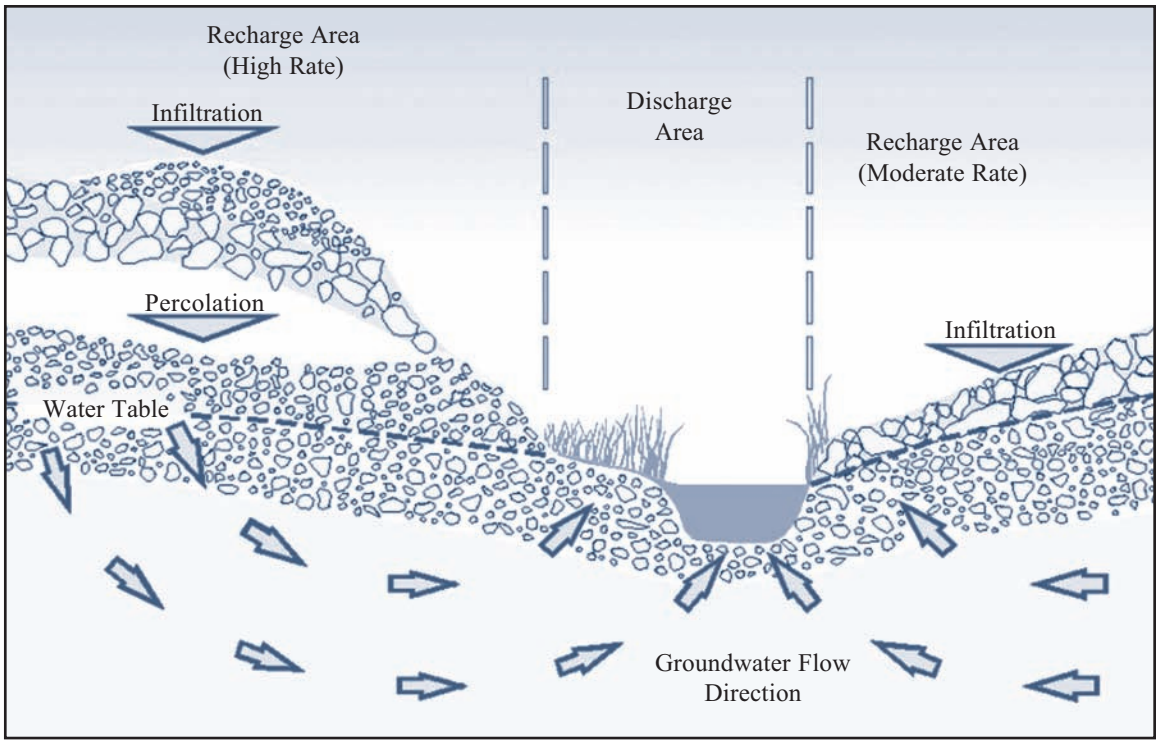
Keeping it clean

Surface spills of contaminants like fuel can infiltrate the soil and contaminate groundwater. The risk of contamination is greatest where the ground surface is highly water permeable, e.g., in areas with coarse soils or fractured bedrock at or near the surface.

Groundwater can also be contaminated by underground sources, such as leaking fuel storage tanks or malfunctioning septic systems. Poorly constructed or deteriorating wells can act as a direct pipeline for surface pollutants to contaminate the aquifer. Unused and unmaintained wells are a special concern if they haven't been safely plugged and sealed.

Depending on the type of soil or rock, groundwater may be filtered and very clean. But once an aquifer is contaminated, it can take a very long time to recover, if ever.

Groundwater belongs to all of us. It's a shared resource that we all enjoy and have a duty to protect.



Compared to surface water, groundwater usually moves very slowly – from a few millimetres to a few metres a day. Groundwater affects the quality and quantity of surface water where it discharges into streams, rivers, wetlands, and lakes. Credit: ***BMP: Water Wells***

Groundwater ***flows***

It is impossible to determine the exact direction of groundwater flow based on surface features alone. However, we know that water in the aquifer near a pumping well will flow toward the well.

The danger of groundwater contamination is greatest when the contaminant source is close to your well. However, on rare occasions contaminants have been known to spread over several kilometres.

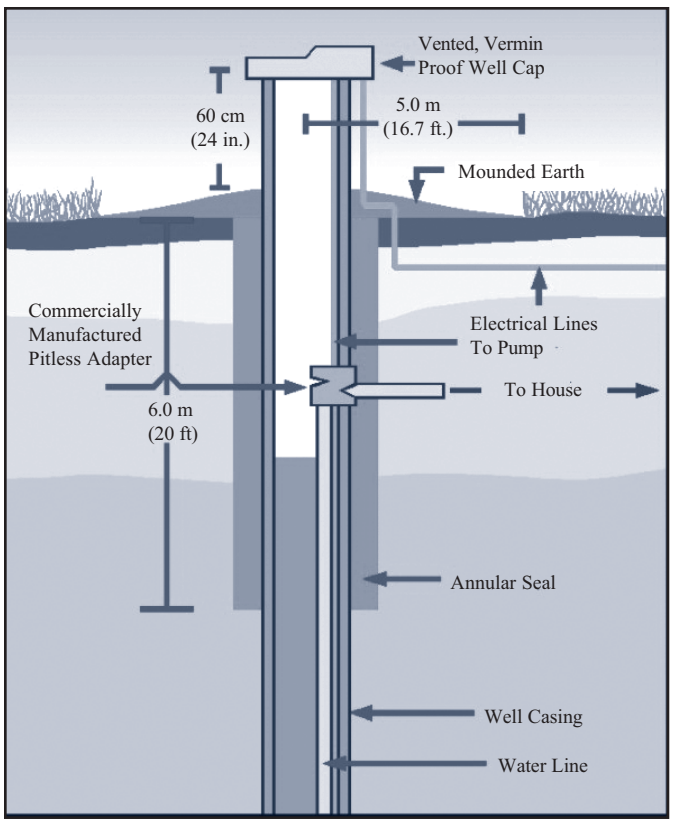
Well *type*

Drilled Wells

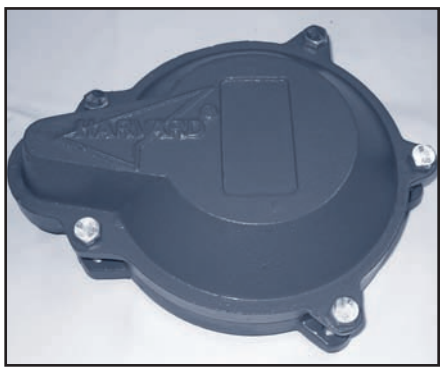
Drilled wells obtain water from deep groundwater aquifers.

Drilled wells are typically about 45 m (150 ft) deep and have a diameter of 15 cm (6 in).

There are two main types of wells found in Newfoundland and Labrador; dug, or shallow wells, and drilled wells.



Distances in illustration are minimums. Credit: ***BMP: Water Wells***

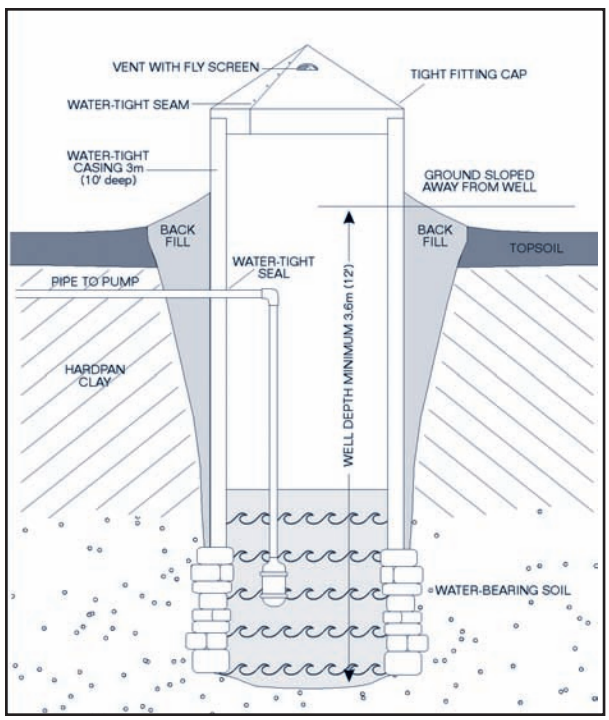


Vermin-proof well cap.

The Water Resources Act states all drilled wells must be constructed by a provincially licensed well driller.

Dug Wells

Dug wells are at higher risk of contamination than drilled wells because they obtain water from shallow groundwater aquifers. Contaminants are more likely to be found closer to the surface (see Protecting Your Well Water, p.13). If you own a dug well, be sure to test it often and consider replacing it with a drilled well if your water supply is not adequate or safe.



Shallow wells are at a higher risk of contamination than drilled wells.

Dug wells are typically 3.7m - 7.6m (12-25 ft) deep and have a diameter of about 1 m (3.3 ft)

Locating *a new well*

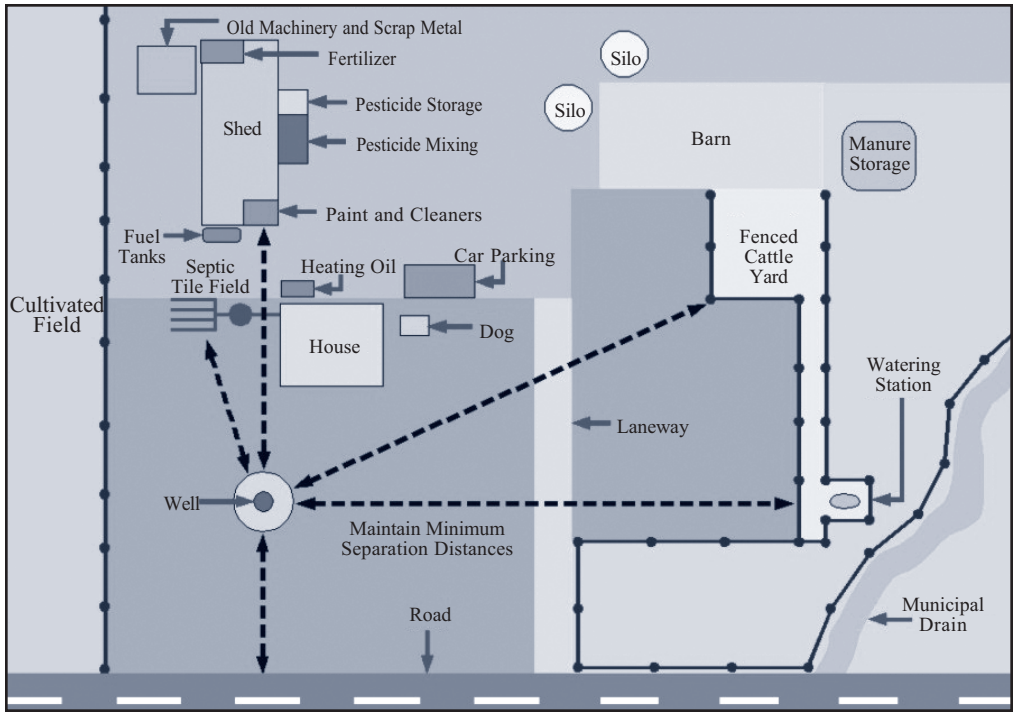
If you are constructing a new well, think carefully about the best location, that is, a high point of land with good access and separation from potential contaminants. Contact a Department of Environment and Conservation licensed well driller to locate a drilled well on your property. Contact a Government Services Centre approved designer for dug well construction information.

The ground must slope *away from the well*

Locate your well on a higher point of land so that run-off and contaminants drain away from the well rather than toward it. The area nearby can be landscaped and contoured to help direct run-off away from the well.

Access

Wells and well-related equipment must be sited so they can be easily accessed at all times for cleaning, treatment, repair, testing, and visual examination. During the winter months, remember to clear snow from the area surrounding your well.



Verify adequate separation from potential contaminants. Credit: ***BMP: Water Wells***

Separation from contaminants

Wells must be located a safe distance from potential sources of contamination such as fuel storage tanks, stockpiles of chemicals like pesticides or road salt, septic systems, gardens, manure piles, livestock, and roads and driveways.

The following tables show ***minimum*** required distances between wells and possible contaminants:

Drilled wells:

- 15 m from septic tank systems
- 30 m from cesspools of sewage
- 1 m from pumphouse floor drains
- 2 m from buildings
- 75 m from manure spreadings on agriculture fields

Dug wells:

- 15 m from septic tanks
- 30 m from septic fields
- 30 m from all other potential contaminants
- 75 m from manure spreadings on agriculture fields

These minimum distances do not guarantee safety. Increase the separation wherever possible, and eliminate sources of contamination.

Well construction

A properly constructed well forms an effective barrier against surface run-off that may enter and contaminate the well.

Water must infiltrate and pass downward through the soil and/or rock before it can reach the aquifer from which your well gets its water.

Over the years, well design has improved to reflect advances in technology and our understanding of potential pathways of contamination. The Well Drilling Regulations, under the Water Resources Act, outlines minimum construction requirements for drilled wells. Always hire a well driller licensed by the Department of Environment and Conservation who is familiar with these regulations.

Dug wells must be designed in consultation with an Environmental Health Officer (EHO). It is difficult to make a dug well as safe as a drilled well.

Well casing

New wells should be lined with a watertight casing designed to prevent the walls of the well from collapsing. Well casings must be of sufficient length to keep contaminants out of the well water. Steel casings are typically used, but casings can also be made from plastic.

The annular seal

When your well is drilled the hole in the ground is bigger than the well casing. The resulting gap – the annular space – must be filled with a watertight sealant such as bentonite that does not shrink or crack under the ground. For maximum protection, the sealant should extend the full length of the casing.

The annular seal serves as a barrier to run-off, surface water, and near-surface waters that could otherwise travel down the outside of the casing and contaminate the aquifer.

Well cap

Your drilled well must be capped with a commercially manufactured vermin-proof well cap. Vermin-proof caps have rubber gaskets and screened vents inside to prevent entry of "foreign material" such as vermin, insects, and decaying plant material. Loose fitting caps found on older wells make these wells a comfortable home for insects and vermin.

Upgrading *your well*

It is possible – even likely – that your existing well does not meet the new construction standards described in the preceding section. What should you do?

Consider upgrading your existing well for the sake of your family's health and safety and the security of your drinking water source.

Talk over your options with a DOEC licensed well driller or EHO who is experienced with upgrades and familiar with conditions in your area.

Faulty annular seal.

Upgrade your well, or construct a new one?

If there are water quality problems with your existing well, one option is to drill a new well.
A new well may be the best way to go if your existing well is:

- badly located, close to permanent sources of contamination, or at risk from flooding
- not producing adequate water supplies
- substandard and cannot be upgraded for technical or regulatory reasons

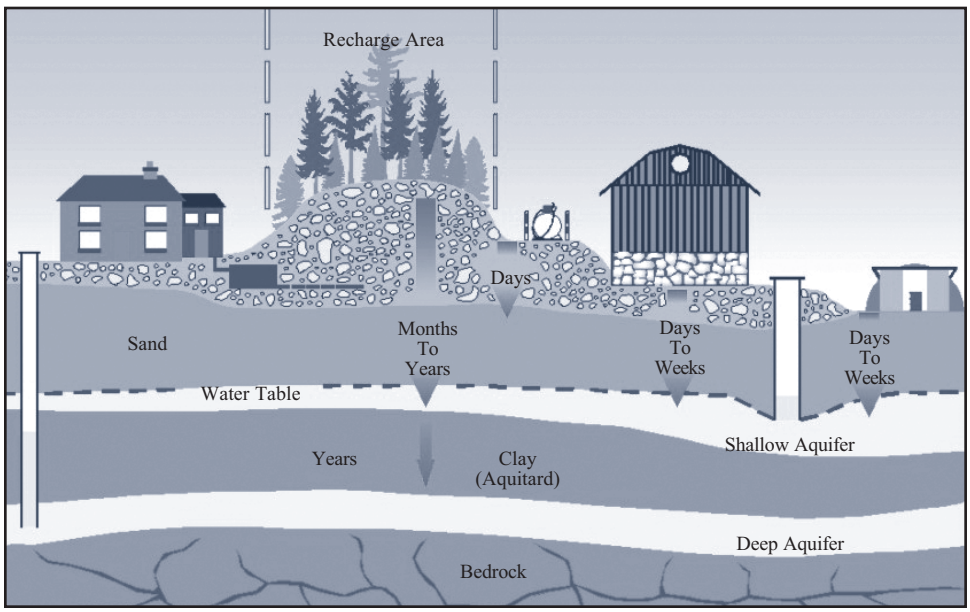
Do you have a ***high risk*** well?

Some wells are at higher risk of contamination and require extra care and attention. Consider the following factors:

- shallow, or dug, wells, less than 6 metres (20 feet) deep, are at higher risk than deeper, or drilled, wells because the water table is closer to the surface and can be contaminated more easily;
- older wells are at higher risk than newer wells because of casing deterioration and older, less advanced, well construction methods.

Another important risk factor is the type of soil and/or rock between ground surface and the aquifer from which your well draws its water. Put simply, your well is at lower risk if these materials effectively stop surface contaminants from reaching the aquifer; it is at higher risk if contaminants can infiltrate more rapidly.

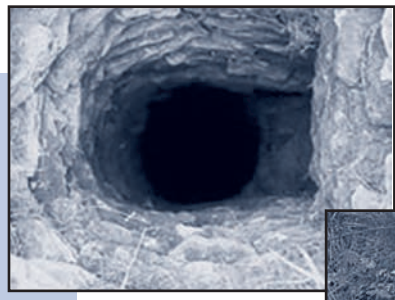
For example, coarse soils like sand and gravel are a less effective barrier than thick deposits of fine soils like clay loams or silty clay. If your well ends in bedrock, which is likely in Newfoundland and Labrador, it is at higher risk if bedrock fractures extend to ground surface or near the surface.



Water infiltrating from the surface may reach a shallow aquifer in days to weeks. It could take years to reach a confined deeper aquifer.
Credit: ***BMP: Water Wells***

Plugging *and* sealing

An unused and unmaintained well that hasn't been properly plugged and sealed poses health and safety hazards for animals and humans, especially children.



Unused and unmaintained wells threaten groundwater.

A well that is no longer used or maintained can become a direct pipeline for surface water or run-off to reach the aquifer. Unused and unmaintained wells threaten the groundwater that supplies your well, and possibly your neighbours' wells.

It is your responsibility under the Well Drilling Regulations to ensure that your unused wells are properly plugged and sealed.

Don't try to seal your own well – it is not as easy as it seems. If you simply fill up your unused well with sand, gravel, stones, debris, or garbage, you won't prevent the flow of surface water or run-off into the well. The material in the unused well may even contribute to contamination of your groundwater source.

If an unused and unmaintained well is on your property, you are legally responsible for ensuring that it is plugged and sealed properly.

Hire a DOEC licensed well driller who has the expertise and equipment to do the job properly. Newfoundland and Labrador has guidelines for sealing drilled groundwater wells that require filling the well with alternating layers of bentonite clay and sand or local soil. Dug wells can be filled in with clean, local soil and any exposed well liner should be removed.