

## What is Groundwater?

Groundwater is an often misunderstood resource that provides one quarter of New Yorkers, and half of all Americans, with their drinking water. It can be found virtually everywhere on the planet at depths ranging from very shallow to very deep.

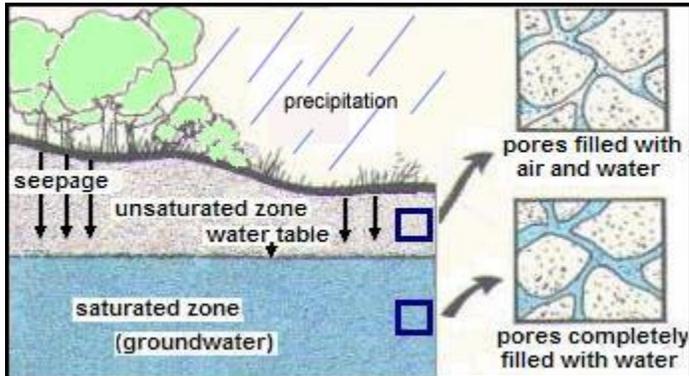


Figure 1. Where does groundwater come from?

Where does it come from? When rain falls to the ground, some of it is carried off as runoff down-slope into streams, lakes, and other bodies of water or into sewers. But some of it travels downward into the ground and through the underlying sediment, the upper part of which is not completely filled with water (the "unsaturated zone"). Continuing its downward route in the unsaturated zone it moves through the interconnected openings of sand, gravel, silt, and clay or openings in rock until it reaches the "saturated zone" where it becomes groundwater.

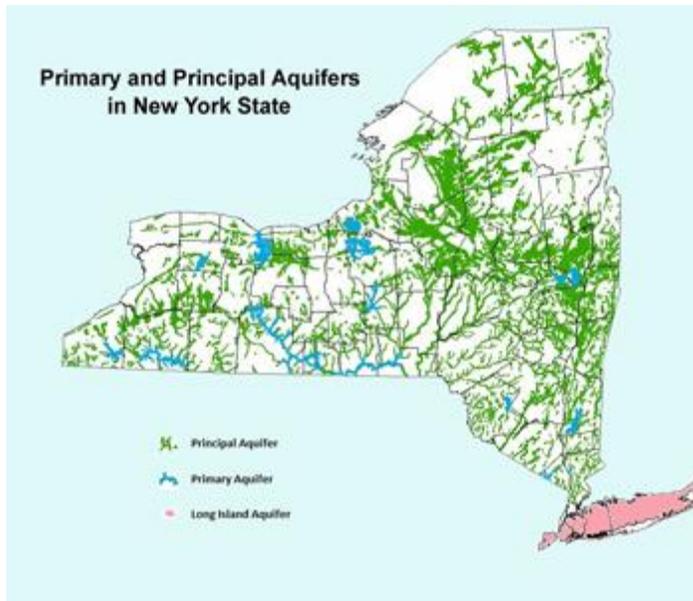
As the late Ralph Heath, a highly respected USGS geologist, lyrically wrote in 1964:

*"What is ground water? It is the water from springs, the water pumped from wells, and the water that bubbles up through the bottom of brooks, rivers, and lakes. It is a part of all streamflow and on streams without lakes or storage reservoirs, ground water seepage supplies the entire "fair-weather" flow.*

*"In its natural place ground water is invisible to human eyes (except when seen in limestone caverns). As a result, it has been the object of numerous misconceptions and superstitions for hundreds of years. Among the most prevalent are that ground water universally occurs in veins and underground rivers. This belief contrasts with the scientific data collected over the years by groundwater hydrologists and well drillers which shows that veins and underground rivers are relatively rare. In most places ground water occurs in and moves through an intricate network of very small openings. Remarkably few wells drilled in New York fail to penetrate at least a few of these openings."*

For more groundwater basics, check out the USGS webpage titled "Aquifers and Groundwater" in the right margin of this webpage.

## Groundwater Resources of New York



[Figure 2. Groundwater Resources of New York State](#)  
[Click map for full size-image](#)

The map in Figure 2 shows the location of New York's most productive aquifers. Although bedrock formations are a significant source of groundwater supply, the most productive aquifers in New York are generally located in unconsolidated sediments (e.g., sand and/or gravel deposits). The areas shown in blue on the map are "[Primary Aquifers](#)". These are aquifers that are capable of yielding a great deal of groundwater and are also heavily utilized. The green areas show the remainder of the unconsolidated aquifers in New York that are generally capable of providing 10 to 100 or more gallons per minute. These are termed "[Principal Aquifers](#)" and for the most part are not as heavily utilized as Primary Aquifers. Although other areas in upstate New York are capable of supplying groundwater, these delineated areas are the most reliable sources.

For a list of detailed aquifer map reports in upstate New York, please go to the USGS "Detailed Aquifer Mapping" link found in the right margin of this webpage. These reports can be downloaded.

The [Long Island Aquifers](#), one of the most productive aquifers in the United States, are shown in the light red. While the upstate aquifers are not as extensive as the Long Island aquifers, they are numerous and reliable sources of groundwater.

Bedrock aquifers are also an important source of groundwater. Most bedrock aquifers are not mapped in New York.

Statewide, New Yorkers use almost 900 Mgd of groundwater (USGS, 2000).

## **Groundwater Misconceptions**

*Misconception: Groundwater flows in underground streams and rivers.*

When you mention groundwater to many people, the image they see is one of vast underground rivers flowing like surface water. Underground flow in open channels rarely occurs, although we can see it in cave tours. The truth is that most groundwater occurs between grains of sand, gravel, silt, or clay ("unconsolidated sediments") or in the fractures, bedding planes, and joints of bedrock.

Imagine a jug filled with marbles. Now pour water into the jug. The water is located in the spaces between the marbles. That's how groundwater exists in unconsolidated sediments. Or to understand groundwater in bedrock, take a large block of wood and drill some long holes through it. Now submerge the block in water. Water will be found mostly in the holes.

*Misconception: Water can be found by dowsing or witching or divining.*



Dowser

Controlled experiments have proven water witching and similar methods to be no more successful than choosing a drilling location randomly. Water witching, dowsing, or divining methods can appear to be successful because statistically speaking, almost any hole drilled in New York State will probably result in the discovery of some amount of water. For more information see link in right column of this page under "Links Leaving DEC's Website".

*Misconception: Artesian well water always flows to the surface.*

An "artesian aquifer" refers only to groundwater that is under pressure due to being confined by relatively impermeable sediments. Well water within such an aquifer will rise to its potential water level (also known as the potentiometric level). However, water will flow out of the top of the well only if the potentiometric level is higher than the top of the well.

*Misconception: Artesian water is best.*

As pointed out above, the term artesian applies to the pressure conditions of a particular aquifer. However, since artesian water is usually protected from contamination by the overlying confining layers, it is less vulnerable to surface contamination.

*Misconception: Groundwater is found only in aquifers.*

It's true that good yielding wells are drilled into productive aquifers. However, while some sediment types such as clay or silt are not conducive to transmitting water at a productive rate, groundwater does exist between their grains, as pointed out in the first misconception above. And while a confining layer prevents water from moving through it quickly, water is found in that layer and does move through it, although at a greatly reduced rate than through a productive aquifer.

*Misconception: Surface water is far more plentiful than groundwater in the world.*

This is true but only if we include the water in our world's oceans (which represents 97% of Earth's water). Another 2% is stored as frozen water. Of the remaining 1% of water, groundwater accounts for 96% while streams, lakes, and wetlands make up most of the other 4%. The rest is atmospheric water. However, much of the world's groundwater is not easily recovered.

*Misconception: All groundwater or spring water is suitable for drinking.*

When water flows through soil sediments there is a filtering effect. However, harmful bacteria are still capable of entering wells and springs. In addition, contamination from a variety of sources may occur and flow toward wells and springs. Finally, some natural conditions such as high levels of salt, radon, or sulfates may render water nearly undrinkable.