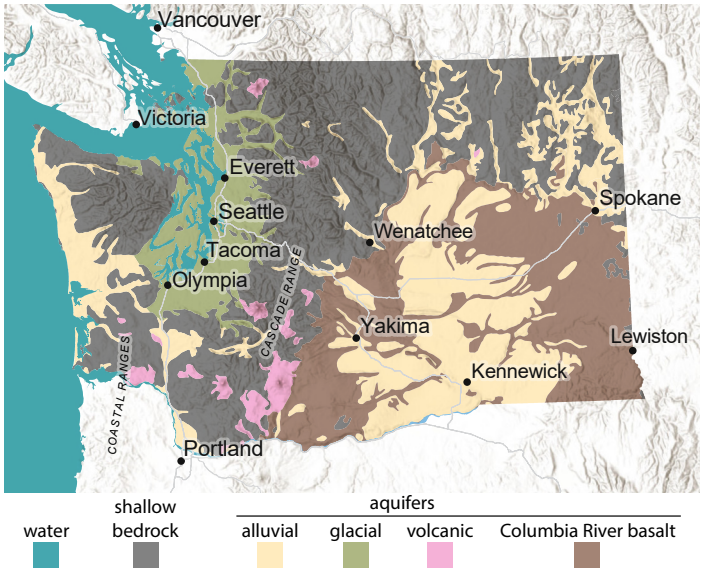
Groundwater in Washington State

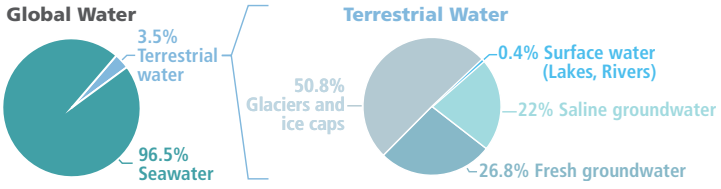
What is groundwater?

Water accumulates in the ground, filling open spaces in soil and rock. When those spaces are completely filled, or saturated, the subsurface water is called groundwater. Soil or rock layers are called aquifers when they contain groundwater that can be extracted in a large enough quantity and good enough quality to meet demand for drinking, irrigation, or industry.

Aquifers of Washington

Washington State has groundwater resources in several important bedrock, alluvial, and glacial aquifers near the surface and at depth:





Data from NASA

Where does groundwater come from?

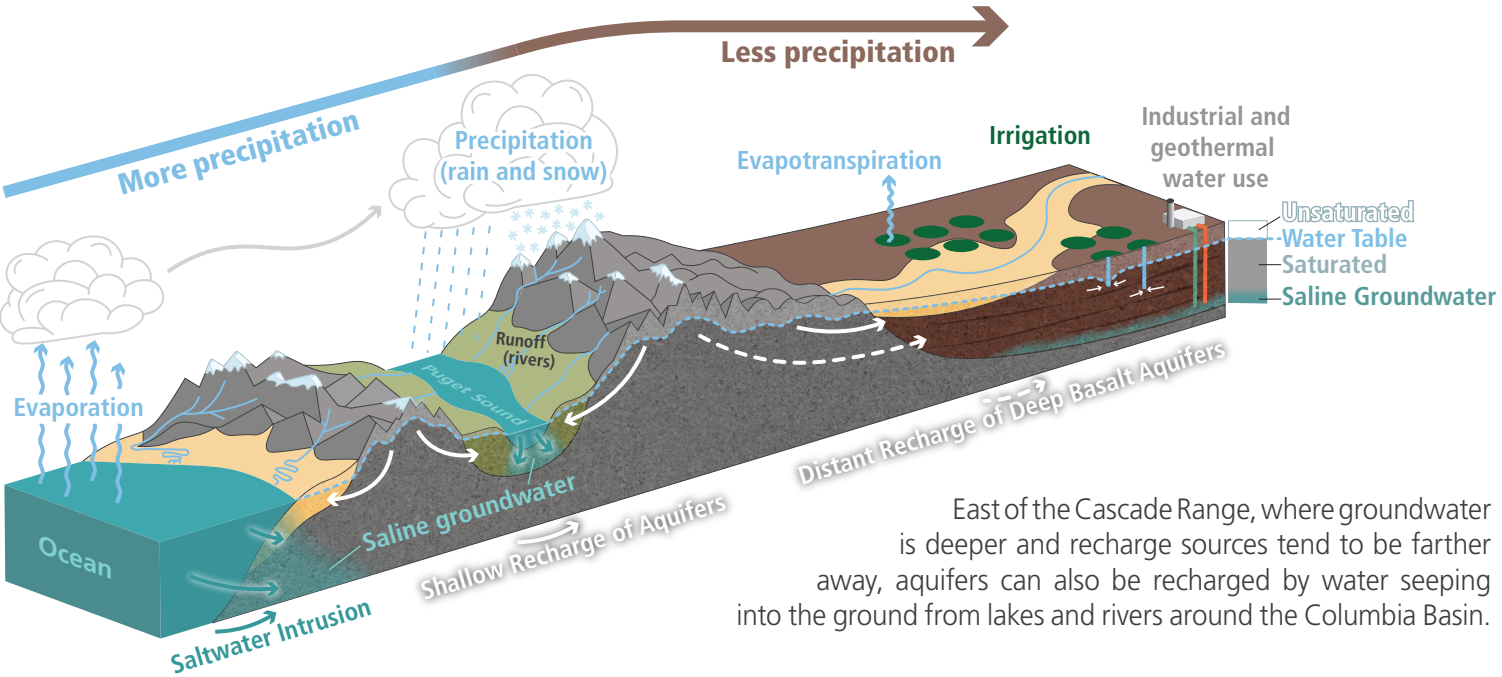
When rain falls or snow melts, water can take many paths. Surface water can:

- Return to the atmosphere as water vapor through evaporation or transpiration by plants
- Be consumed by vegetation during photosynthesis
- Return to oceans and lakes by flowing over the ground as runoff
- Recharge groundwater by infiltrating into the ground

Water that seeps into the ground passes through soil or rock until it reaches the saturated zone, recharging the aquifer. Groundwater recharge is most abundant where rainfall or snowmelt is plentiful (for example, in the western part of Washington State and areas of high elevation).

DID YOU KNOW?

You might think groundwater flows through tubes like an underground river. In fact, groundwater usually seeps through pore space in rocks the same way water percolates through a sponge.



East of the Cascade Range, where groundwater is deeper and recharge sources tend to be farther away, aquifers can also be recharged by water seeping into the ground from lakes and rivers around the Columbia Basin.

How is groundwater used?

Natural resources

Many ecosystems, such as wetlands, springs, and groundwater-connected lakes, depend on groundwater to provide a steady supply of water.

Household uses

Groundwater is often used to supply water to cities and households for drinking, cooking, bathing, cleaning, and watering.

Agricultural uses

Many agricultural areas rely on groundwater for watering livestock, processing dairy, irrigating fields, vineyards, and orchards, and protecting crops from frost.

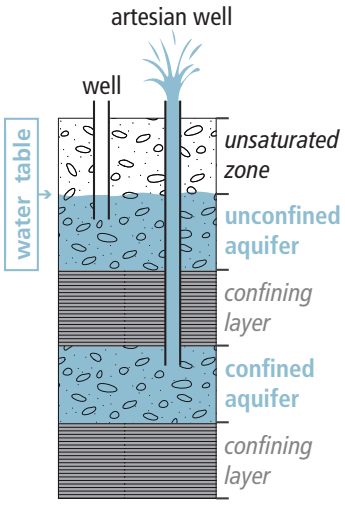
Industrial uses

Groundwater may also be used in factories, food and other processing facilities, and for heating and cooling buildings and data centers.

The Earth Resource Program

Scientists in the Earth Resource Program at the Washington Geological Survey are working to identify areas of deep mineralized groundwater by studying trends in groundwater chemistry and how groundwater flows in the deepest parts of Washington's aquifers. Aquifers with mineralized groundwater have the potential to sequester carbon dioxide or store thermal energy.

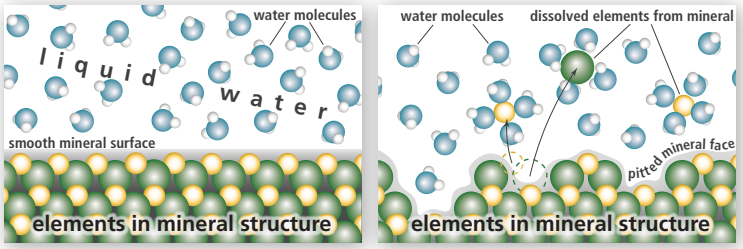
Confined and unconfined aquifers



Aquifers can be both confined and unconfined. Unconfined aquifers are usually shallow. In an unconfined aquifer, the water table is the top of the aquifer and is only subject to atmospheric pressure (just like surface water). Confined aquifers are usually much deeper and are constrained by dense rock from above and below that limits groundwater flow into or out of the aquifer. This can cause the aquifer to be pressurized beyond atmospheric pressure.

Potable and non-potable groundwater

Water is potable if it is considered safe for human consumption with minimal treatment. Groundwater can dissolve certain minerals found in soil and rock.



Potable groundwater typically has less than 1,000–3,000 parts per million (ppm) of dissolved solids and is free of contaminants. Groundwater with more dissolved solids can be made potable through extensive (and expensive) treatment. Groundwater with more than 10,000 ppm of dissolved solids is considered mineralized water and is non-potable. For comparison, typical seawater has about 35,000 ppm of dissolved solids.

Can mineralized groundwater be used?

In Washington State, non-potable groundwater is often deep below the surface but may still be an important resource for geothermal energy production, thermal energy storage, or deep injection of non-hazardous substances like carbon dioxide.

LEARN MORE

Earth Resource Program — Groundwater
www.dnr.wa.gov/geology-groundwater

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES
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