

Overview of Groundwater and Groundwater Use

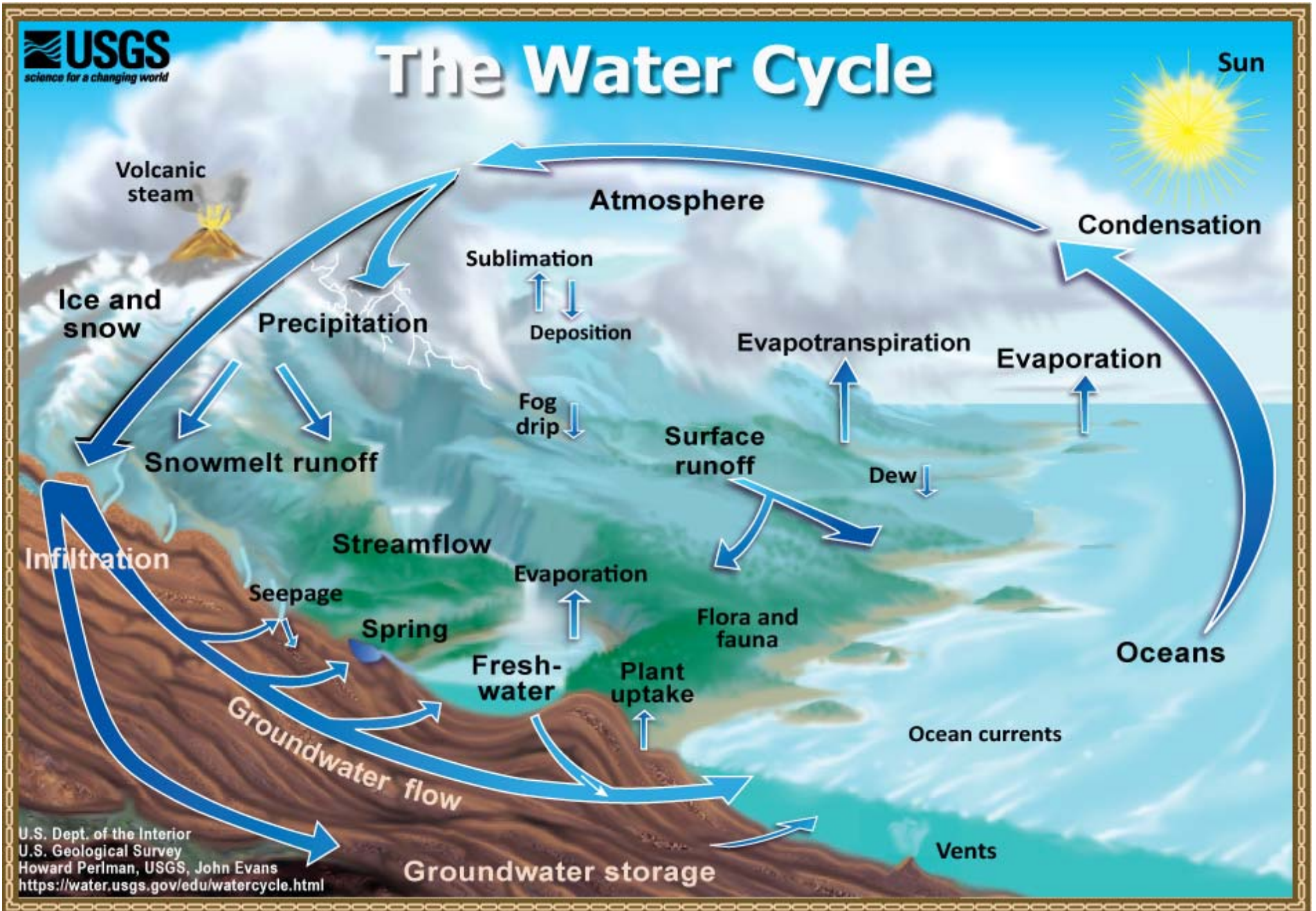
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The Water Cycle



U.S. Dept. of the Interior
U.S. Geological Survey
Howard Perlman, USGS, John Evans
<https://water.usgs.gov/edu/watercycle.html>

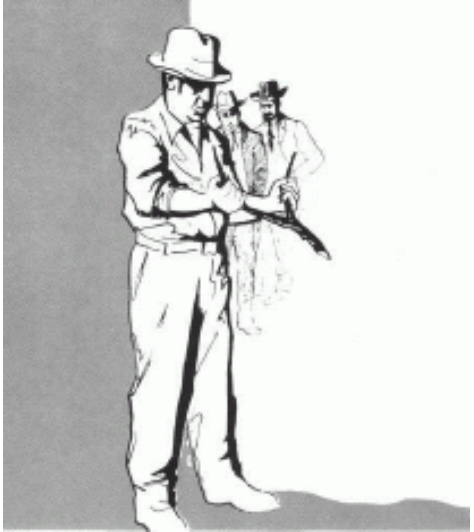
Groundwater Myths



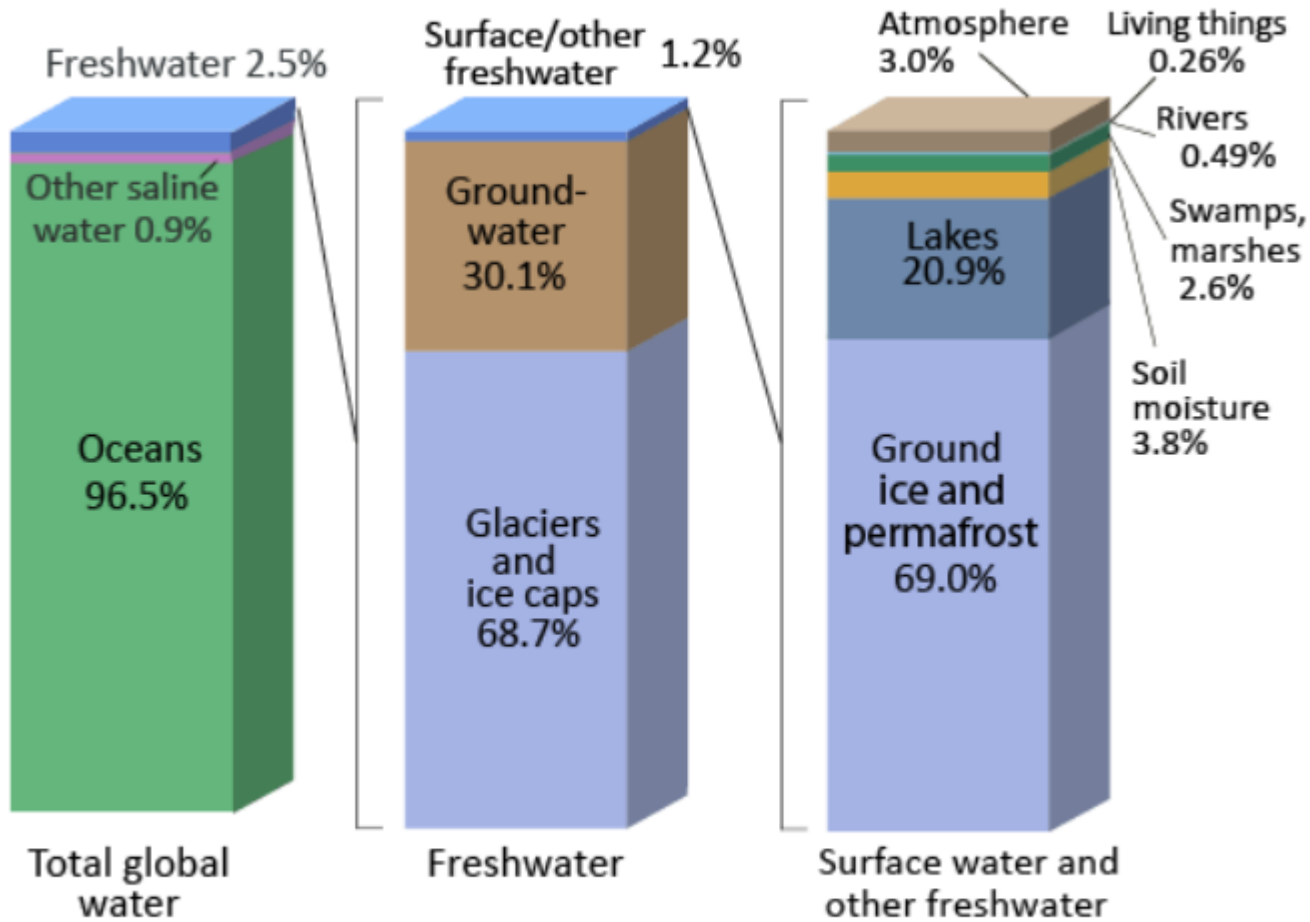
Ponce de Leon and the Fountain of Youth - <https://www.smithsonianmag.com/>

Groundwater Myths

- Groundwater is the purest water available.
- Groundwater is mysterious and has special health benefits.
- Groundwater flows in underground caverns and rivers.
- Groundwater is always pure because soil filters out all impurities.
- If groundwater tastes good and looks clear – it is safe to drink.



Where is Earth's Water?

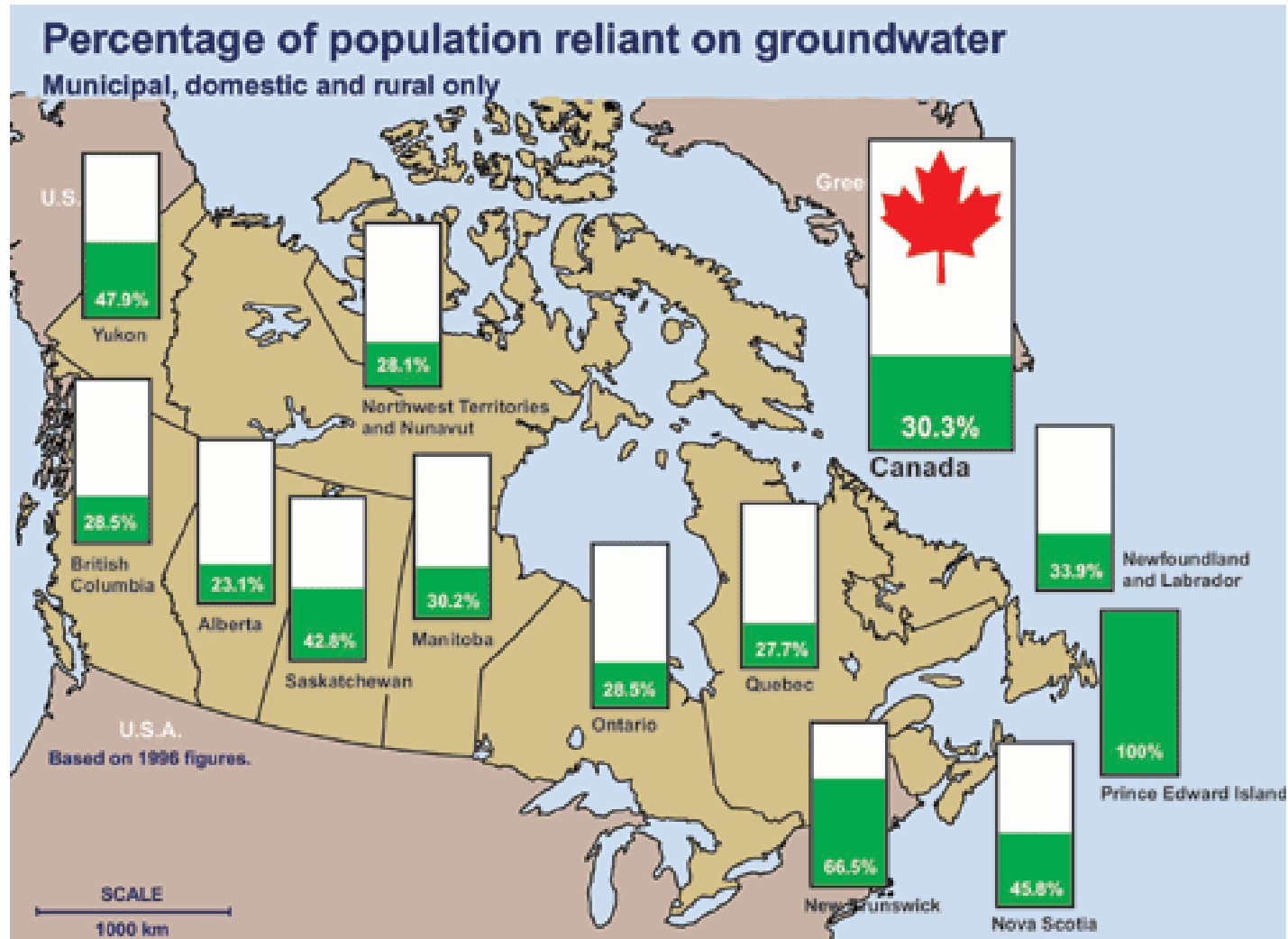


Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, *Water in Crisis: A Guide to the World's Fresh Water Resources*.

NOTE: Numbers are rounded, so percent summations may not add to 100.

Groundwater Use in Canada

(source: Environment Canada)

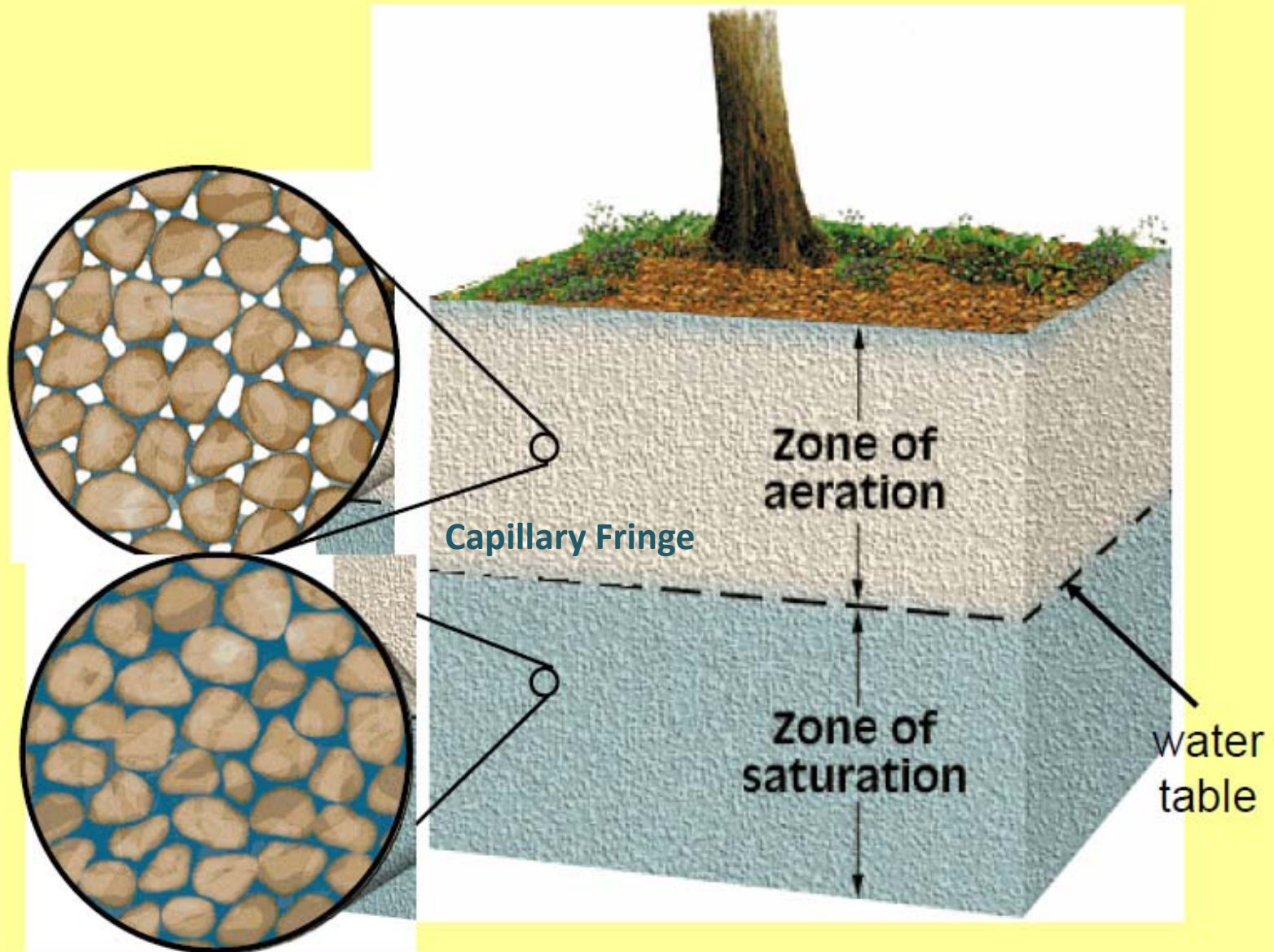


Groundwater Use in Newfoundland and Labrador

- 40 percent of municipal supplies sourced from groundwater
 - Range of population served: Fewer than 200 to nearly 8,000
- ~27,000 wells in Drilled Well database
 - Likely as many dug wells (unregulated)
 - Between 600 – 1000 wells drilled each year*

*(for which MAE receives records)

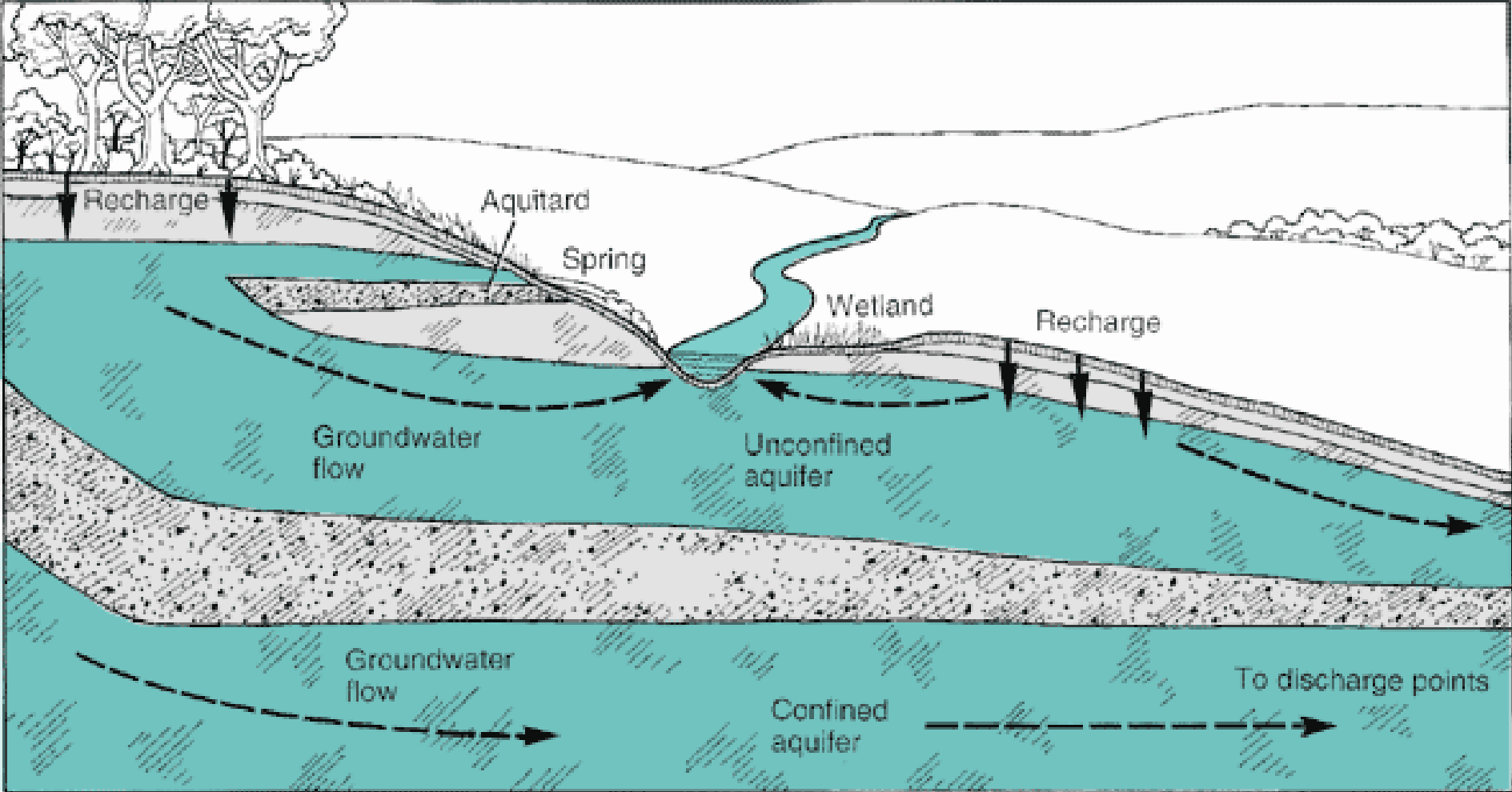
- All water beneath the surface is 'underground water'.
- Zone of Aeration/Unsaturated Zone
 - Immediately below the land surface
 - In most areas, contains both air and water
- Zone of Saturation
 - Water in this zone is only water actually called ground water
 - Only water from this zone can be used to supply wells and springs.



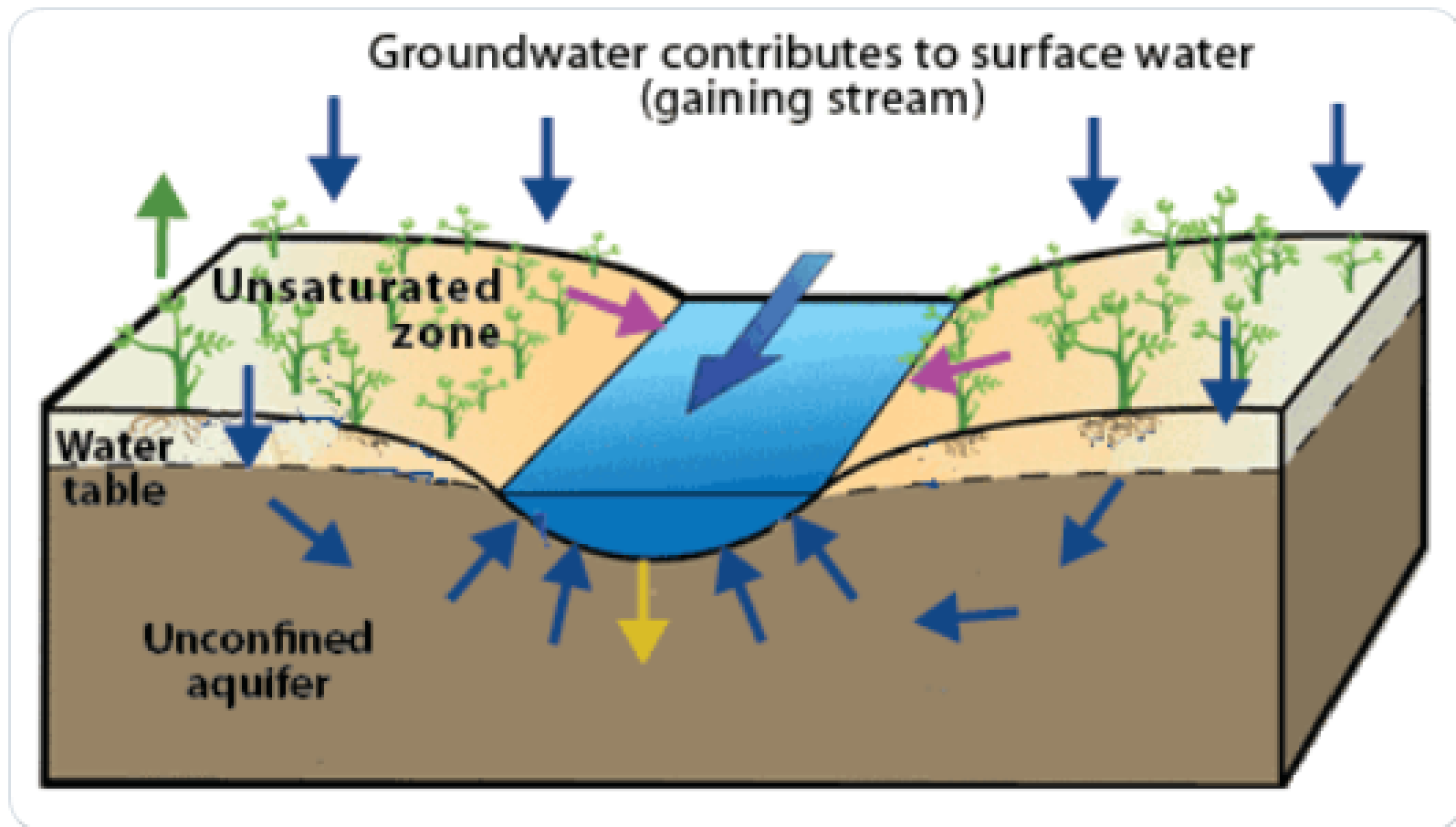
Importance of Groundwater

- Occurs almost everywhere beneath the land surface.
 - Widespread occurrence is the reason groundwater is source of drinking water for almost all the population served by domestic water systems.
- Commonly an important source of surface water
 - Contribution is ~40 – 50 percent to small and mid-sized streams
 - Also major source of water to lakes and wetlands

Groundwater flows from high to low elevations (i.e. from recharge zones to discharge zones)

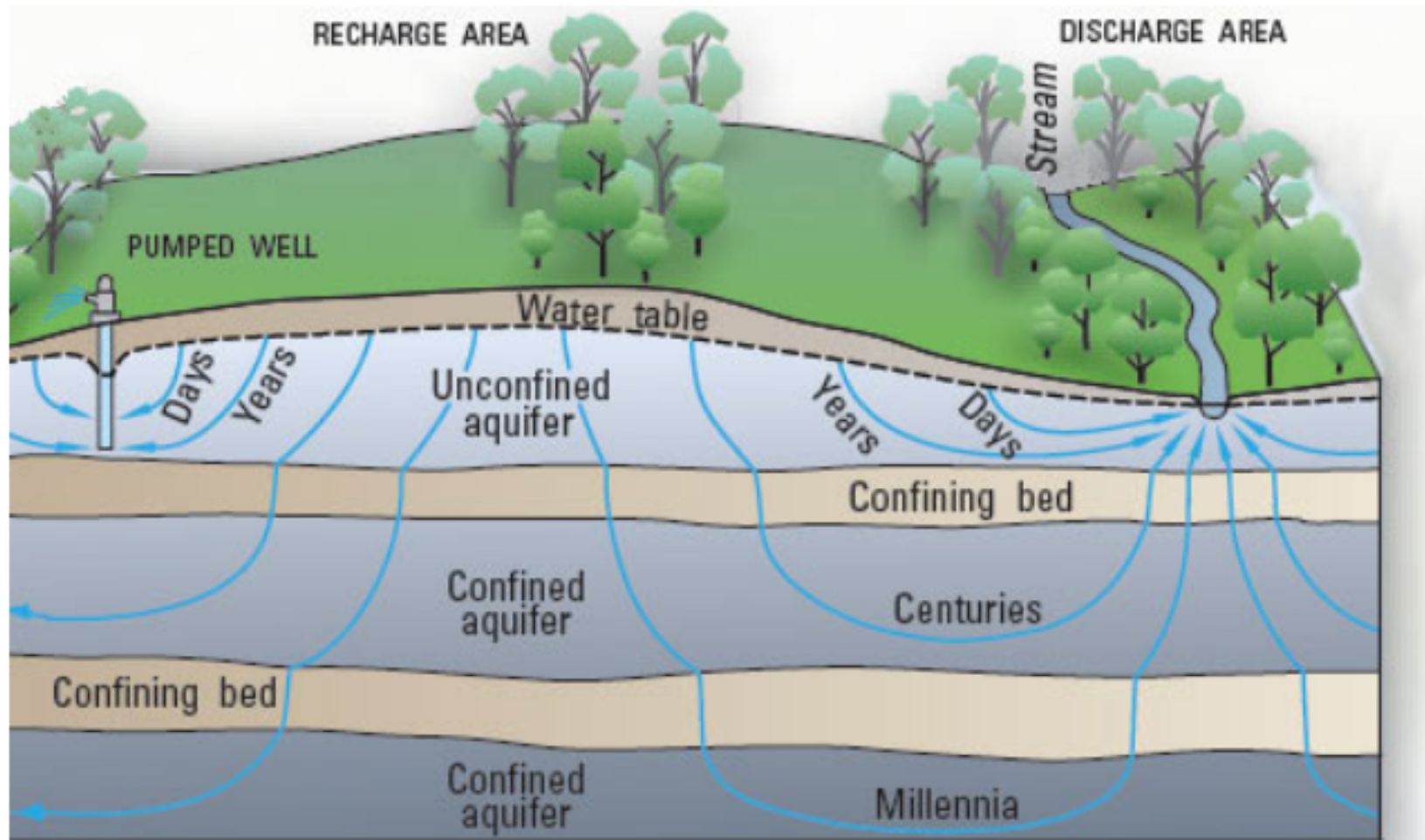


- In addition to providing drinking water, groundwater is an important source of recharge to surface water.

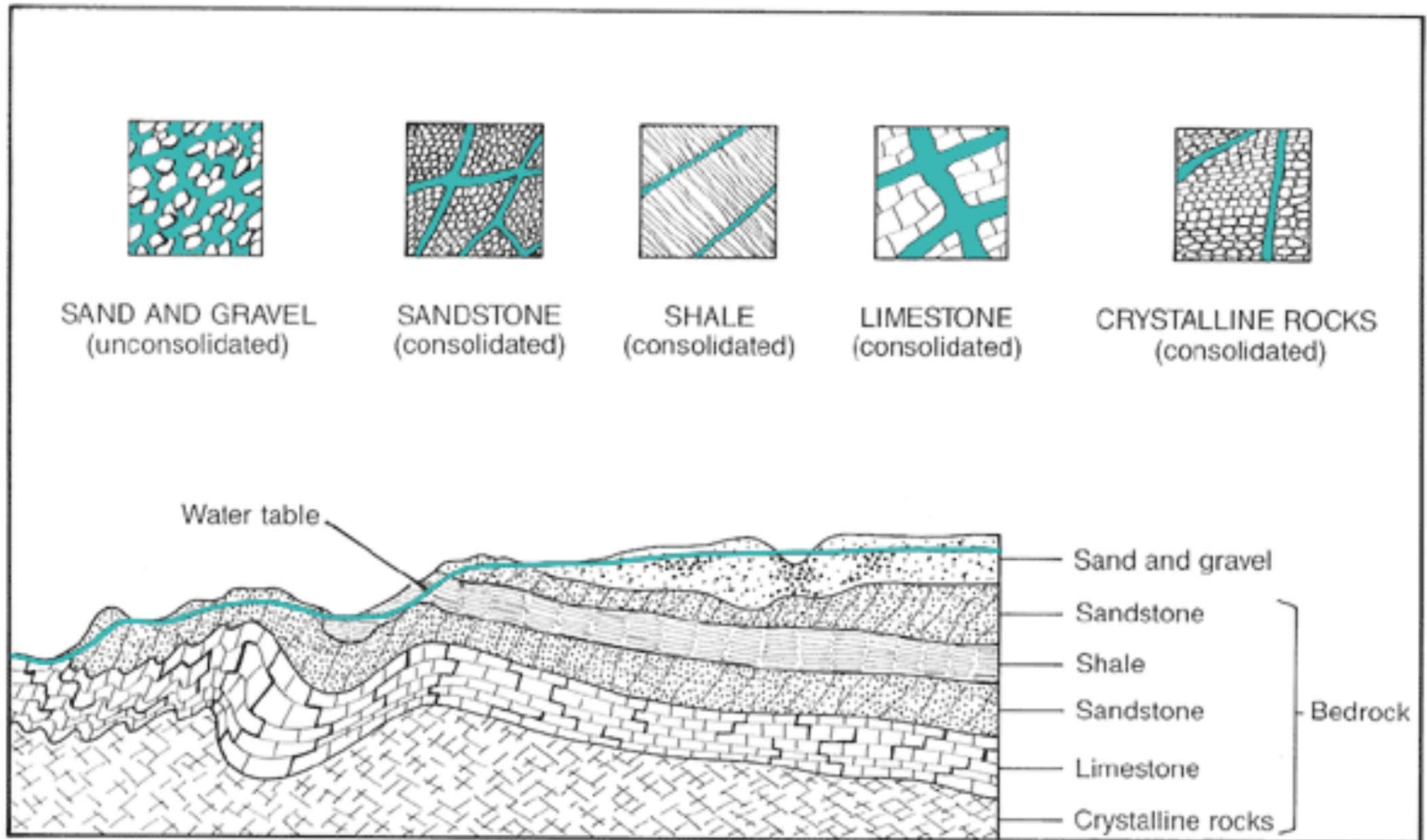


- An aquifer is any geologic formation that can both store and release useable water via well or spring.
- A confining layer can transmit and store water, but releases it very slowly.

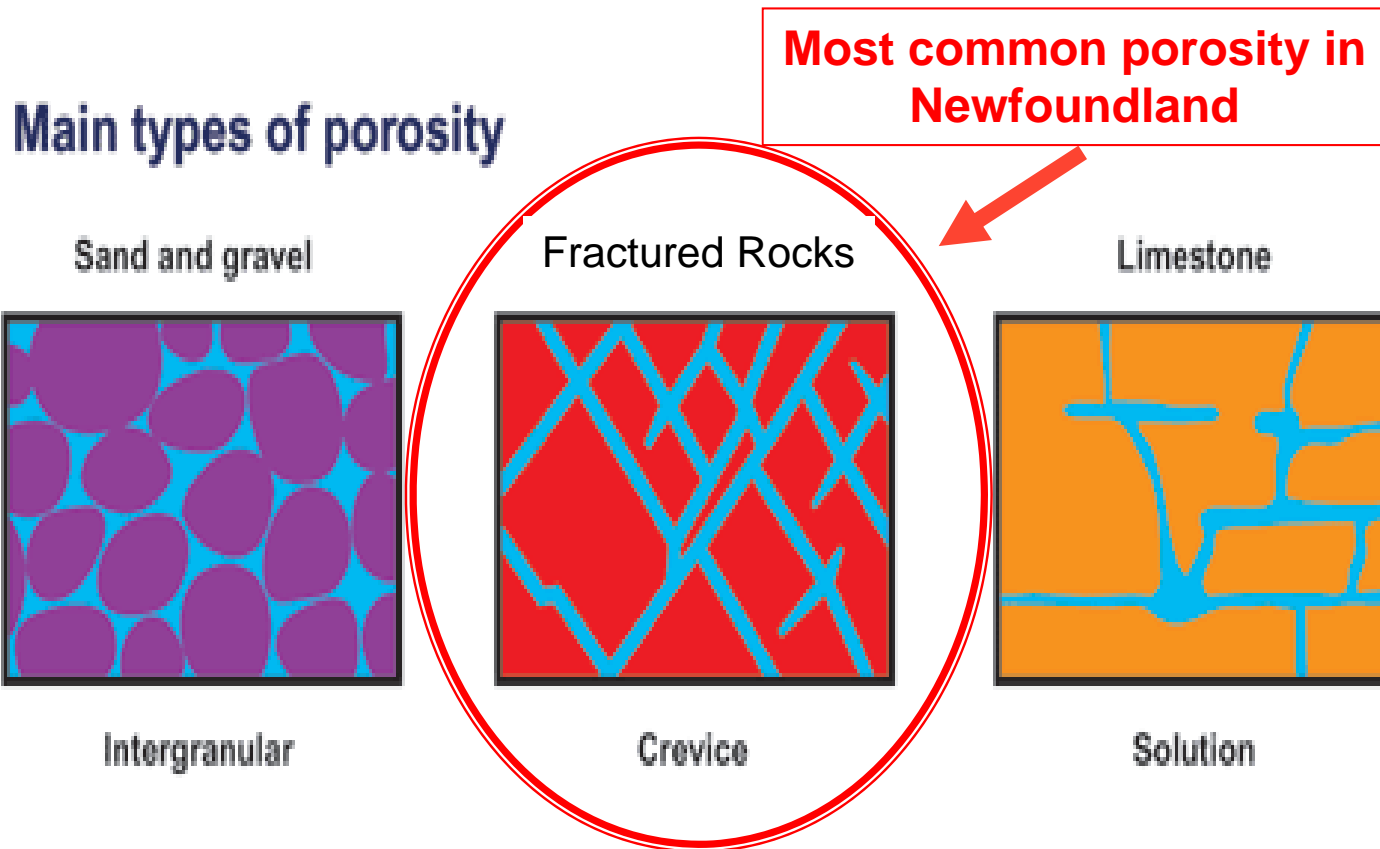
Groundwater flows underground



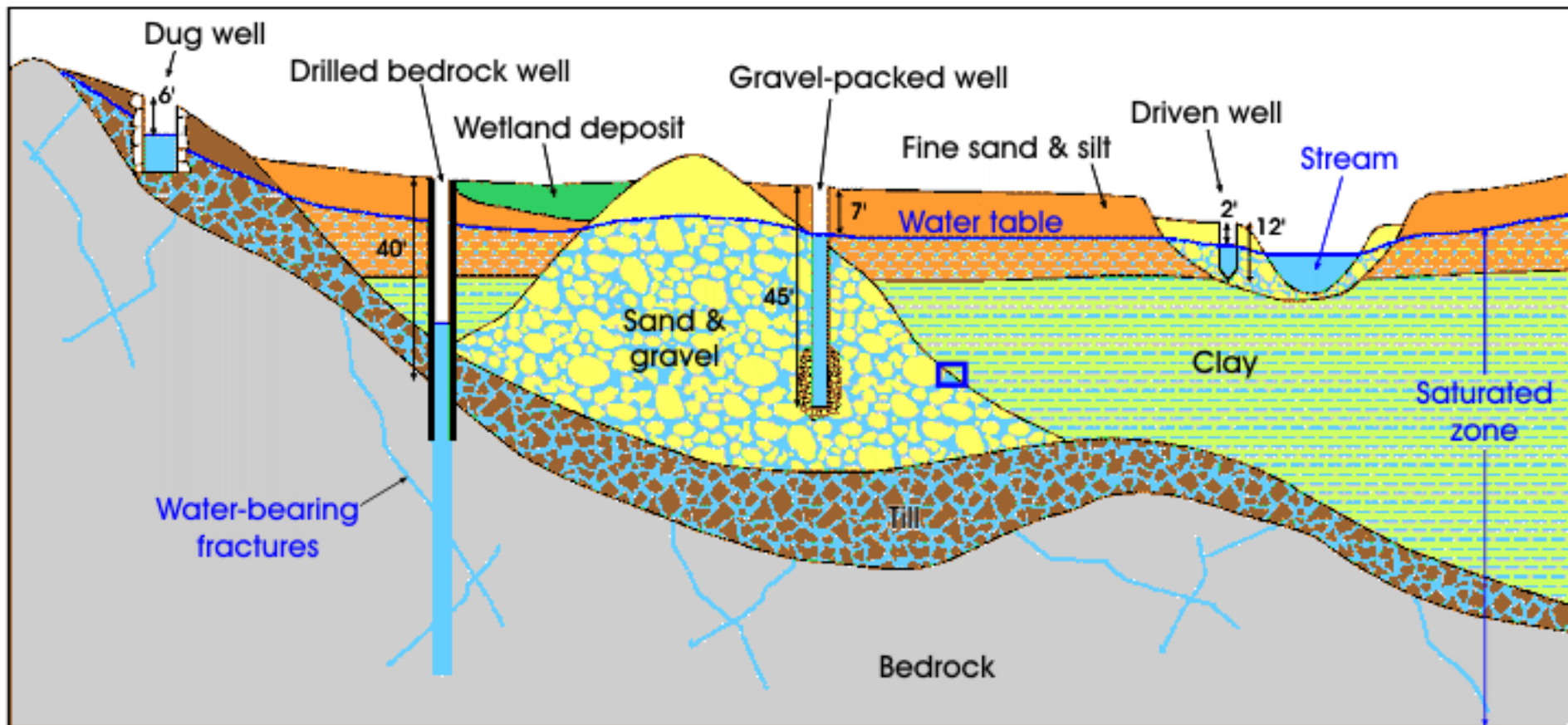
- Aquifers can consist of unconsolidated material (sand and gravel), solution openings (limestone) or fractured consolidated bedrock (shale, sandstone, igneous/crystalline)

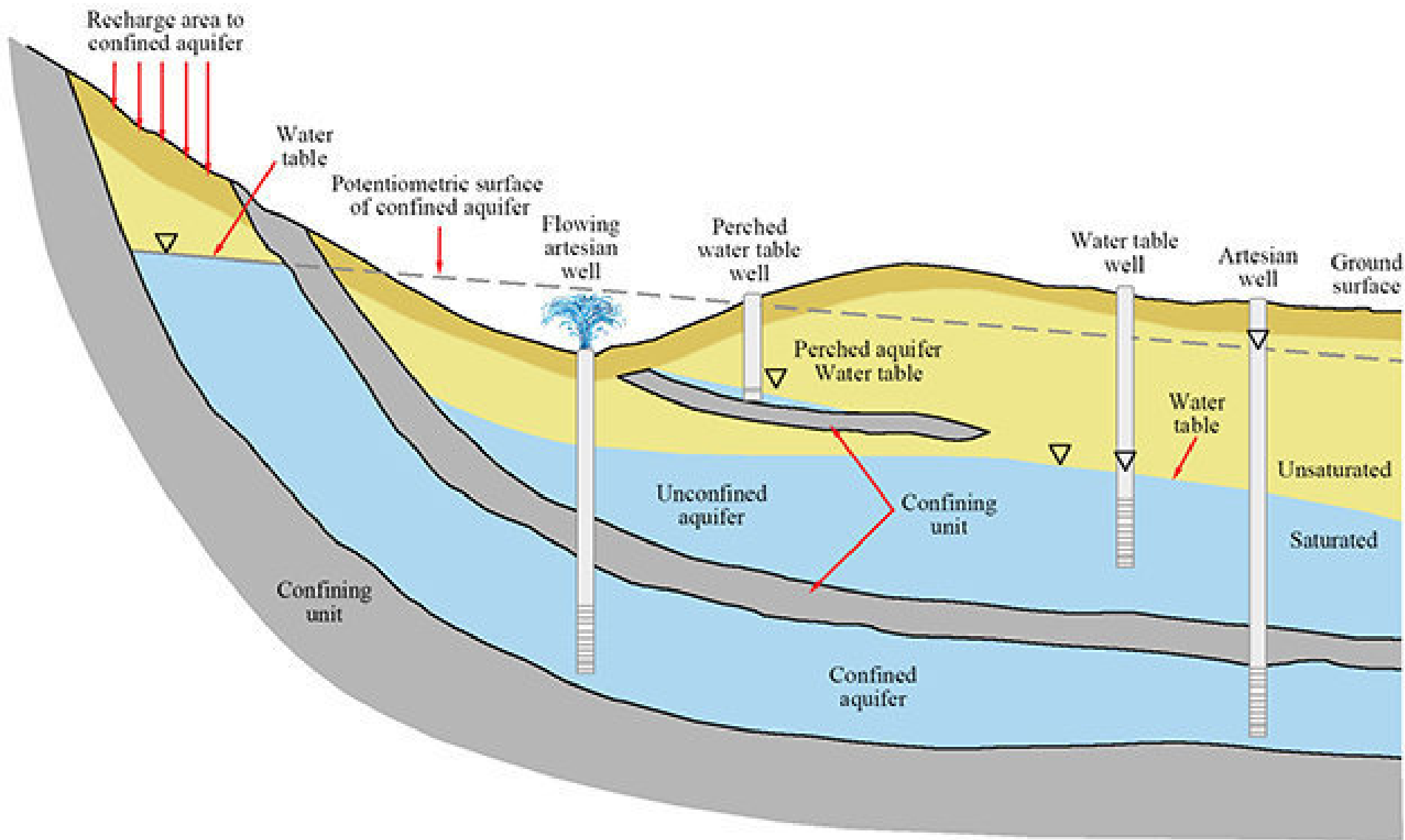


Where is groundwater found?



Where groundwater can be found. It fills the spaces between sand grains, in rock crevices, and in limestone openings.

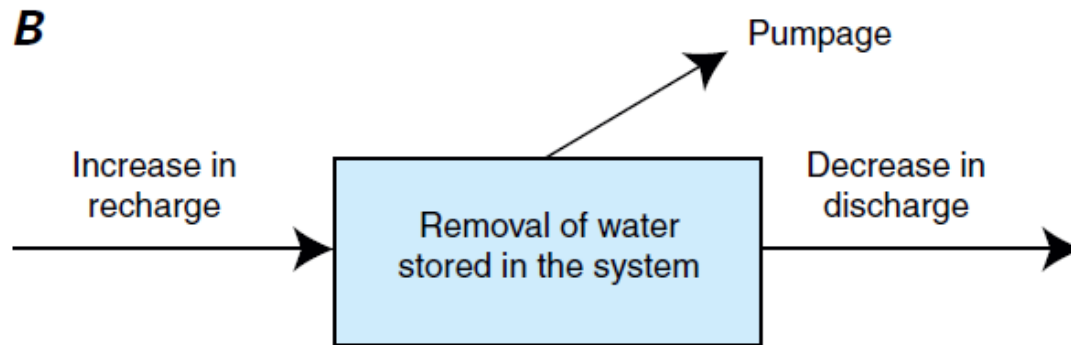
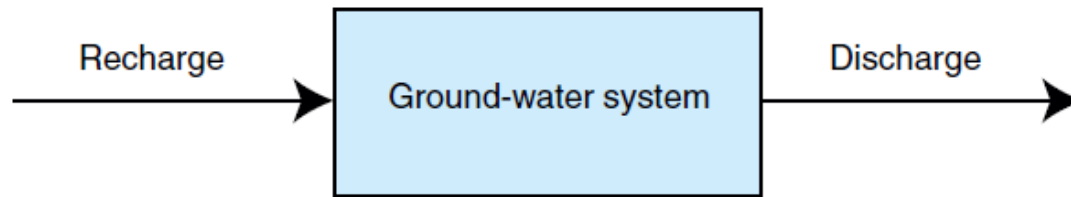


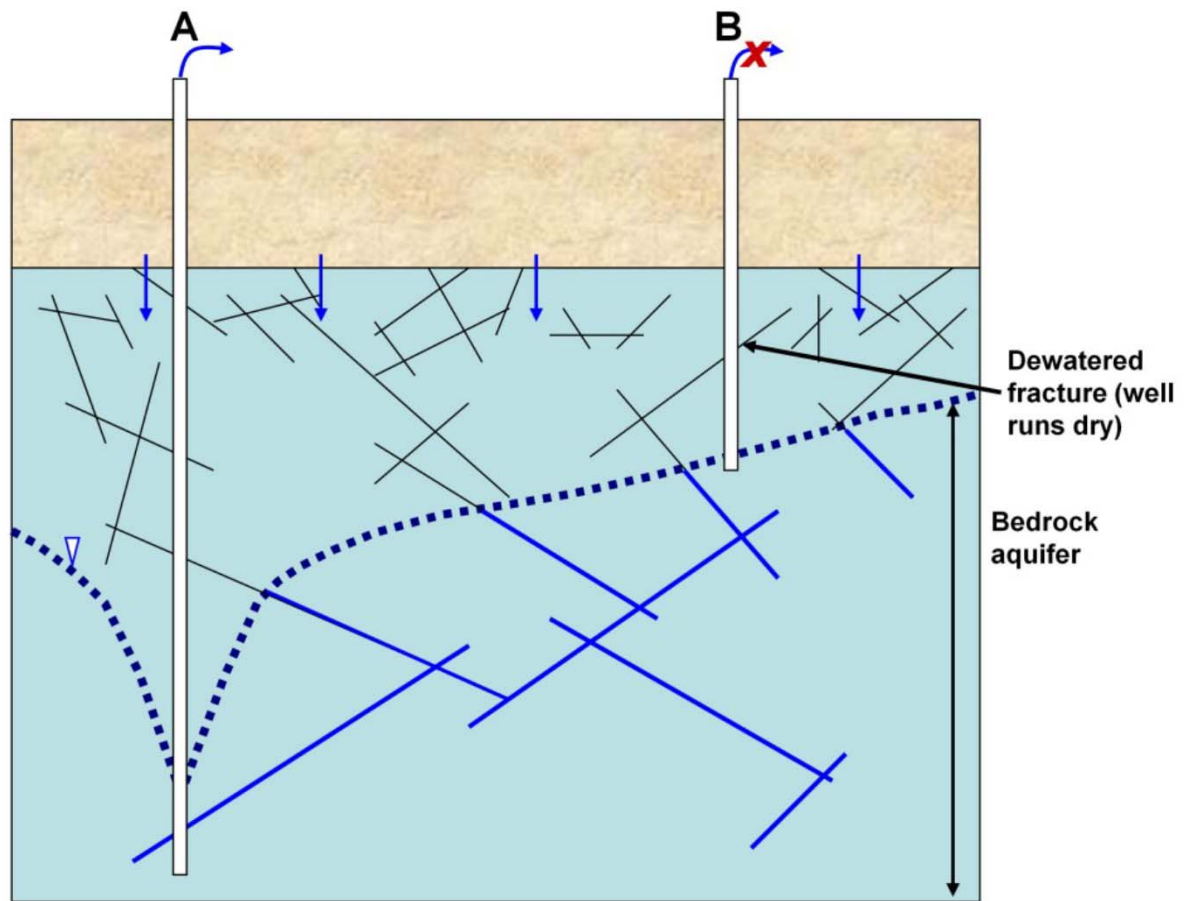


Groundwater Sustainability – Why?

- Groundwater is neither non-renewable, nor fully renewable.
 - Recharge from precipitation continually replenishes groundwater,
 - **BUT:**
 - Recharge may be at much smaller rates than the rate groundwater is being pumped from the ground.
 - *and*
 - Groundwater flows V E R Y slowly

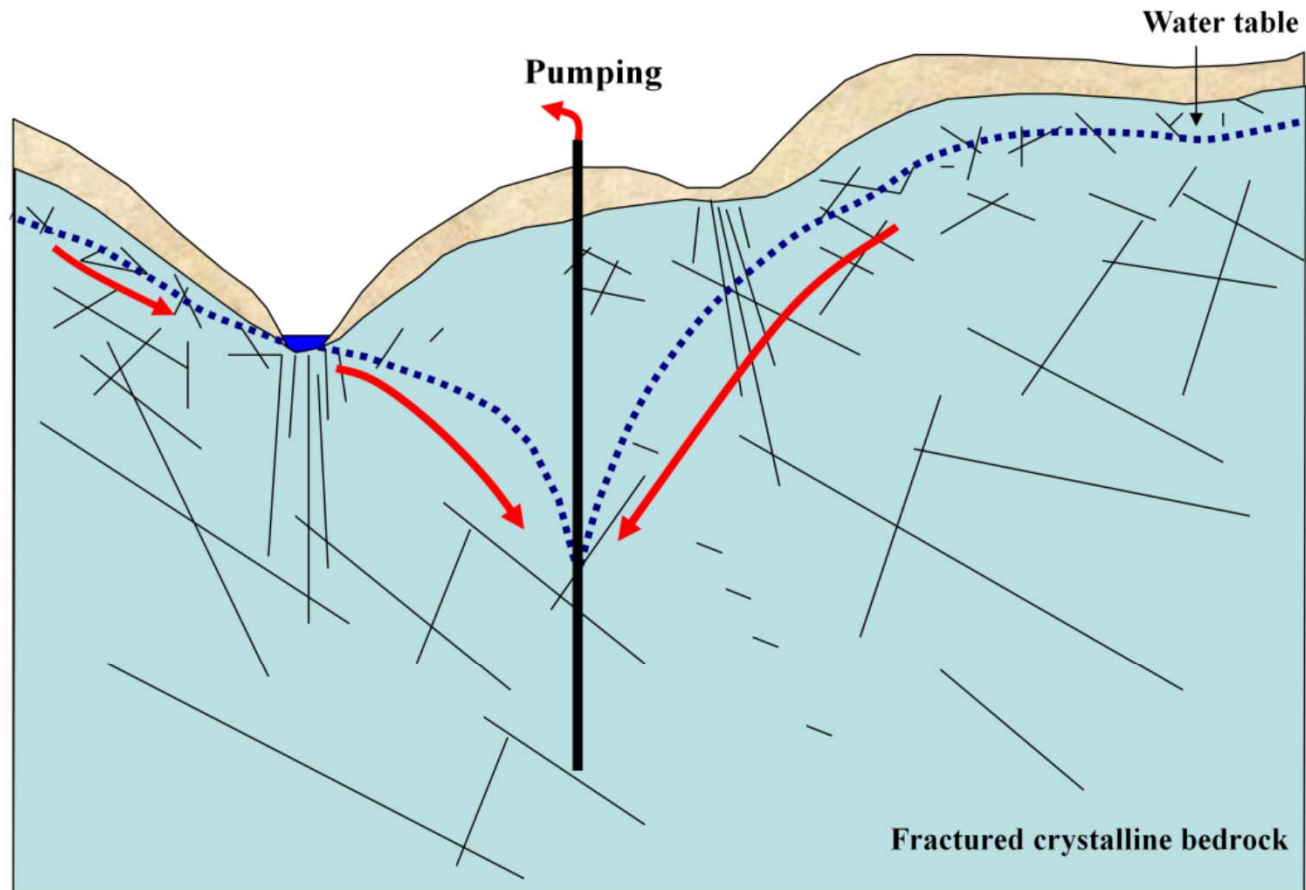
Groundwater Sustainability – Quantity



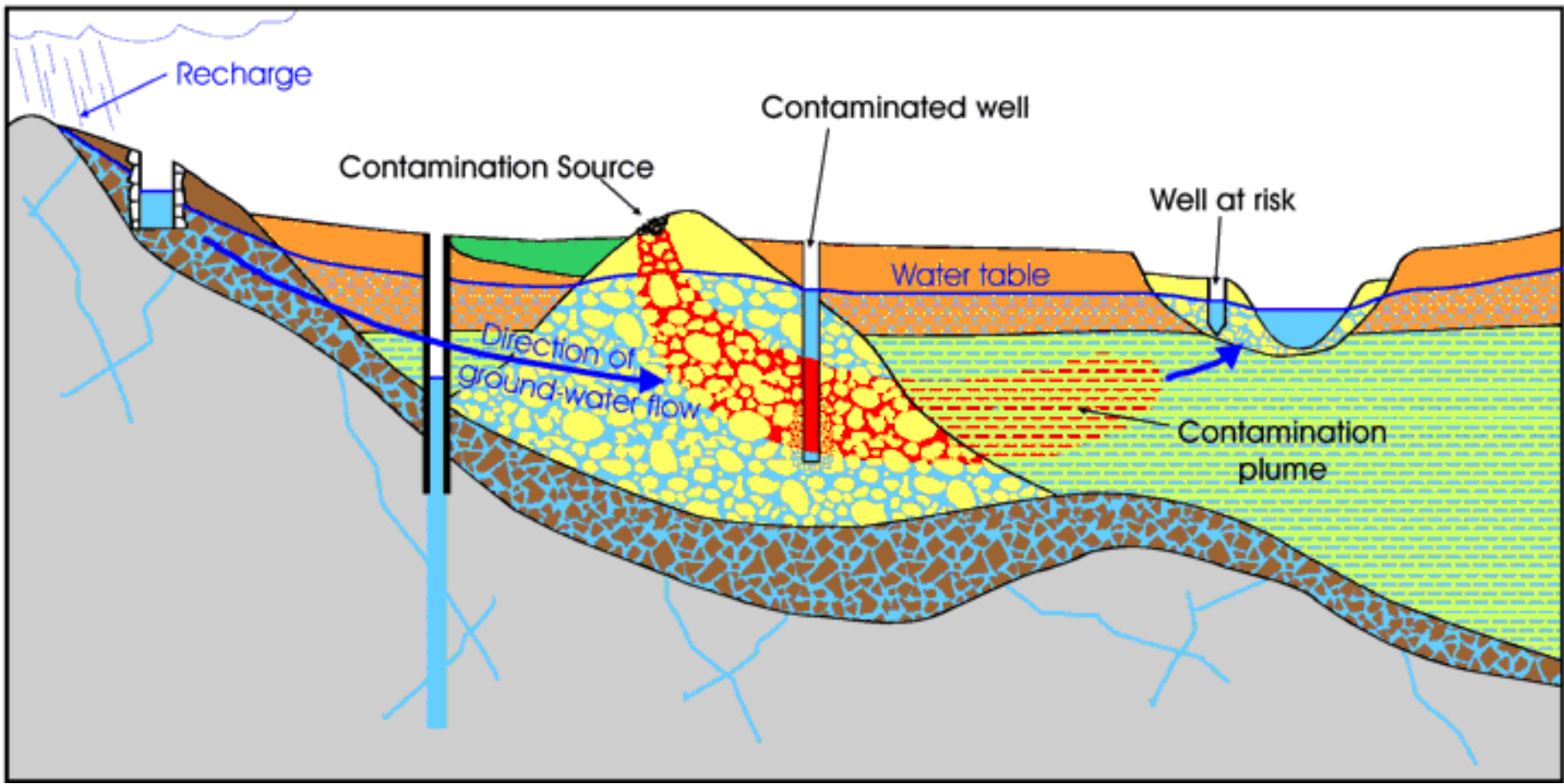


WELLS "A" AND "B" PUMPING

How can groundwater pumping affect streams?



Not to Scale



Wellhead Protection Area

