Groundwater is Our Most Important Source of Freshwater.

Water Wells supply over 95% of U.S. freshwater needs.

Water is found where the crust is porous. Plant intake of soil water is not shown.

Permeability and Porosity

Groundwater is Fed by Snowmelt and Rainfall in Areas of Recharge.

The Water Table rises and falls with the seasons.

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Groundwater moves in response to hydraulic pressure.

Groundwater is Vulnerable to Several Sources of Pollution.

Groundwater may reside for days to millennia and Fractured Aquifers Hold Groundwater.

Wetlands

Base Flow

Porous Media...

Aquifer Terminology

Saltwater Intrusion
Sewage Waste

Common Human Activities Contaminate Groundwater.

It is estimated that there are >10 million underground storage tanks buried in the United States and that 70% of them leak.

Groundwater remediation includes several types of treatments:
- Air sparging
- Directional wells
- Recirculation wells
- Aquifer fracturing

Karst Topography

Hawaii's orographic effect

Speleothems
Pahoehoe
low porosity and low permeability
in "clinker" zones

Intrusive Dikes
low porosity and low permeability

Individual flow front per zone
high porosity and high permeability

During the Last Interglacial, Climate Was Warmer and Sea Level Higher than at Present.

Lava flows, dikes, what is another geological element to Hawaii?

Oahu’s coastal plains are fossil reef – with cavernous porosity.

Well A produces saltwater from below the transition zone; well B produces brackish water from the transition zone, and well C produces freshwater from the bottom of the freshwater lens. Well D produces large volumes of freshwater by skimming water near the top of the freshwater lens. Location F indicates a perched water body containing minor amounts of water.
Many windward streams in Hawaii have gone dry from lowering of groundwater. For human use, Molokai water wars

West Molokai Ranch has historically been owned by absentee companies who have tried several different ways of generating a profit from the land.

• Profit goes offshore
• Portion of local population does not want tourism
• Portion does want tourism
• Highest per capita welfare/unemployment and subsistence living off the land

West Molokai Ranch attempts to bring water onto their arid land have been met with lawsuits and vandalism.

The Waiahole Water Ditch was constructed in the early 1900’s by sugar interests on Oahu in order to bring water from the Windward (wet) side of the island to the Oahu Sugar Company plantations on the Leeward (dry) side.

Waiahole Water Wars This system virtually eliminated the stream water from many areas of the windward side. As a result, the marine life population was depleted and most importantly many taro (Hawaiian staple food) farmers were unable to continue growing.

Decision – Divides flow in half
Windward gets almost 5 times more than historical
But may be reduced in future

The commission’s final order divides the 27 million gallons a day of water in the Waiahole system as follows:
14 mgd is to go to the leeward side; 6 mgd is to be restored to windward streams; and 7 mgd is to remain, for the time being, in windward streams.

Of that last 7 mgd, 1.6 mgd is proposed to be placed in an agricultural reserve, while 5.4 mgd is categorized as “non-permitted” for now, but subject to future allocation by the commission.