Earth's Freshwater

Where is most of Earth's freshwater located?

What is a River?

- A river is nothing more than surface water finding its way over land from a higher altitude to a lower altitude, all due to gravity.
- When rain falls on the land
  - it either seeps into the ground
  - or becomes runoff, which flows downhill into rivers and lakes, on its journey towards the seas.
- Sometimes people build change the flow of water through watersheds on the rivers.

What is a watershed?

- A watershed (sometimes called a drainage basin)
  - an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel.
  - Ridges and hills that separate two watersheds are called the drainage divide.
  - The water resources of a watershed include surface water--lakes, streams, reservoirs, --and all the underlying Groundwater.

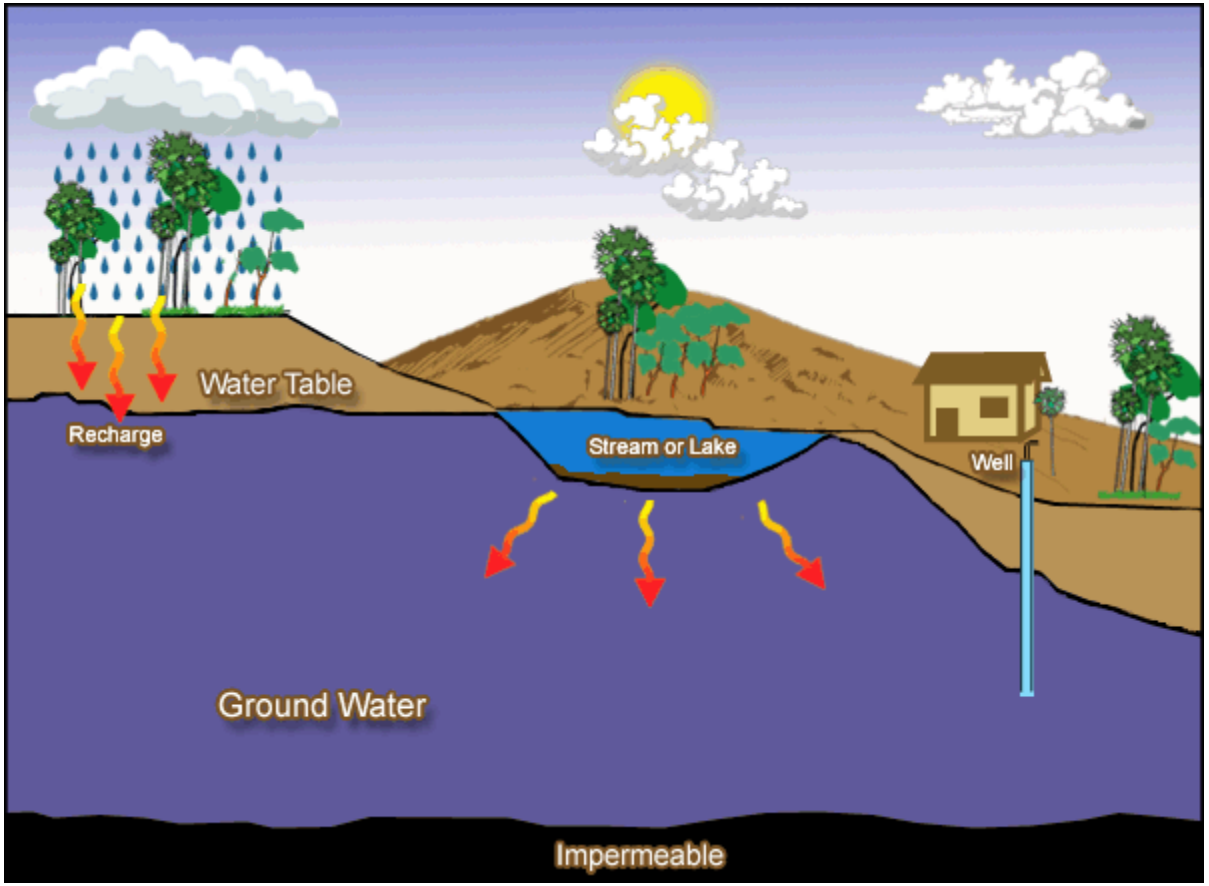

C A N A D A
MONTANA
NORTH DAKOTA
SOUTH DAKOTA
MINNESOTA
WISCONSIN
WYOMING
NEBRASKA
IOWA
ILLINOIS
INDIANA
COLORADO
KANSAS
MISSOURI
OKLAHOMA
ARKANSAS
KENTUCKY
TENNESSEE
MISSISSIPPI
GULF OF MEXICO
MISSISSIPPI RIVER BASIN ALLIANCE
MISSISSIPPI RIVER BASIN ALLIANCE
MAP OF THE
MISSISSIPPI RIVER WATERSHED
JUNE 2004

Earth's water: Groundwater

- The water in a river doesn't all come from surface runoff. Rain falling on the land also seeps into the Earth to form ground water. At a certain depth below the land surface, called the water table, the ground becomes saturated with water.

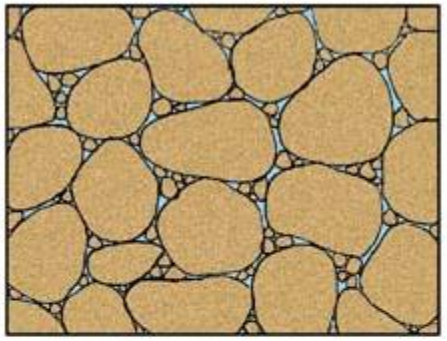
What is Groundwater?

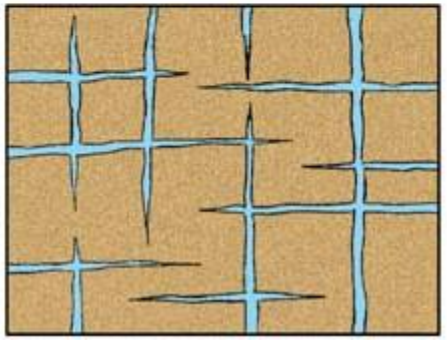
- Water that is found underground.



How does water get into the ground?

- When it rains, the water moves downward through empty spaces or cracks in the soil, sand, or rocks until it reaches a layer of rock through which water cannot easily move.
- The water then fills the empty spaces and cracks above that layer.
- The top of the water in the soil and rocks is called the **water table** and the water that fills the empty spaces and cracks is called ground water.





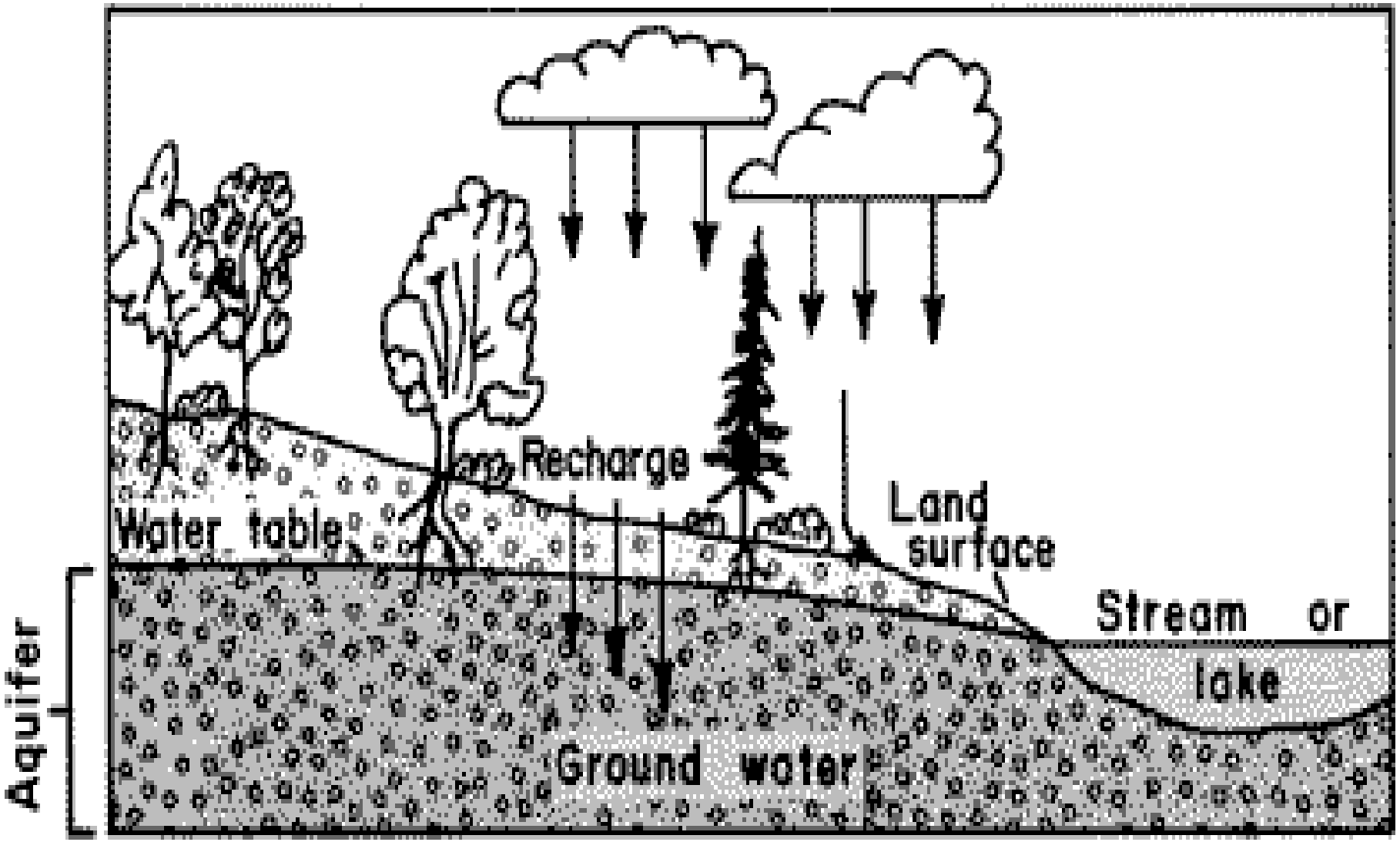
What is an Aquifer

- Aquifer is the name given to underground soil or rock through which ground water can easily move.
- The amount of ground water that can flow through soil or rock depends on the size of the spaces in the soil or rock and how well the spaces are connected.
- The amount of spaces is the **porosity**.
- **Permeability** is a measure of how well the spaces are connected.

Recharge Zones

- Like rivers, aquifers depend on the water cycle to maintain a constant flow of water. The ground surface where water enters an aquifer is called the **recharge zone.**

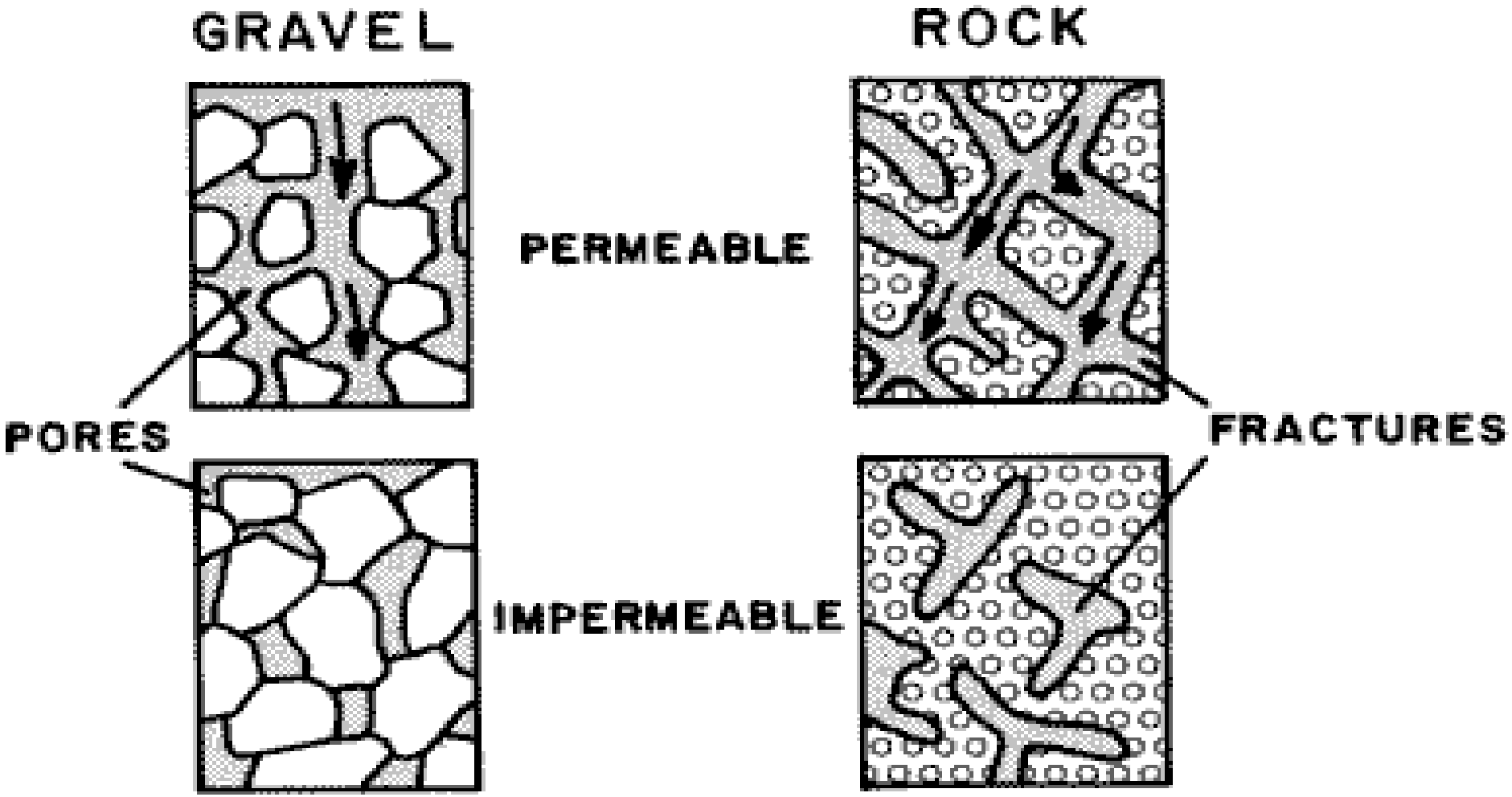
Aquifer


Recharge
Water table
Land surface
Stream or lake
Aquifer
Ground water

Permeable or Impermeable

- Aquifers typically consist of gravel, sand, sandstone, or fractured rock such as limestone. These types of materials are permeable because they have large connected spaces that allow water to flow through. The spaces in a gravel aquifer are called pores.
- If a material contains pores that are not connected, ground water cannot move from one space to another. These materials are said to be impermeable. Materials such as clay or shale have many small pores, but the pores are not well connected. Therefore, clay or shale usually restrict the flow of ground water.

Permeable and Impermeable Rocks and Soil



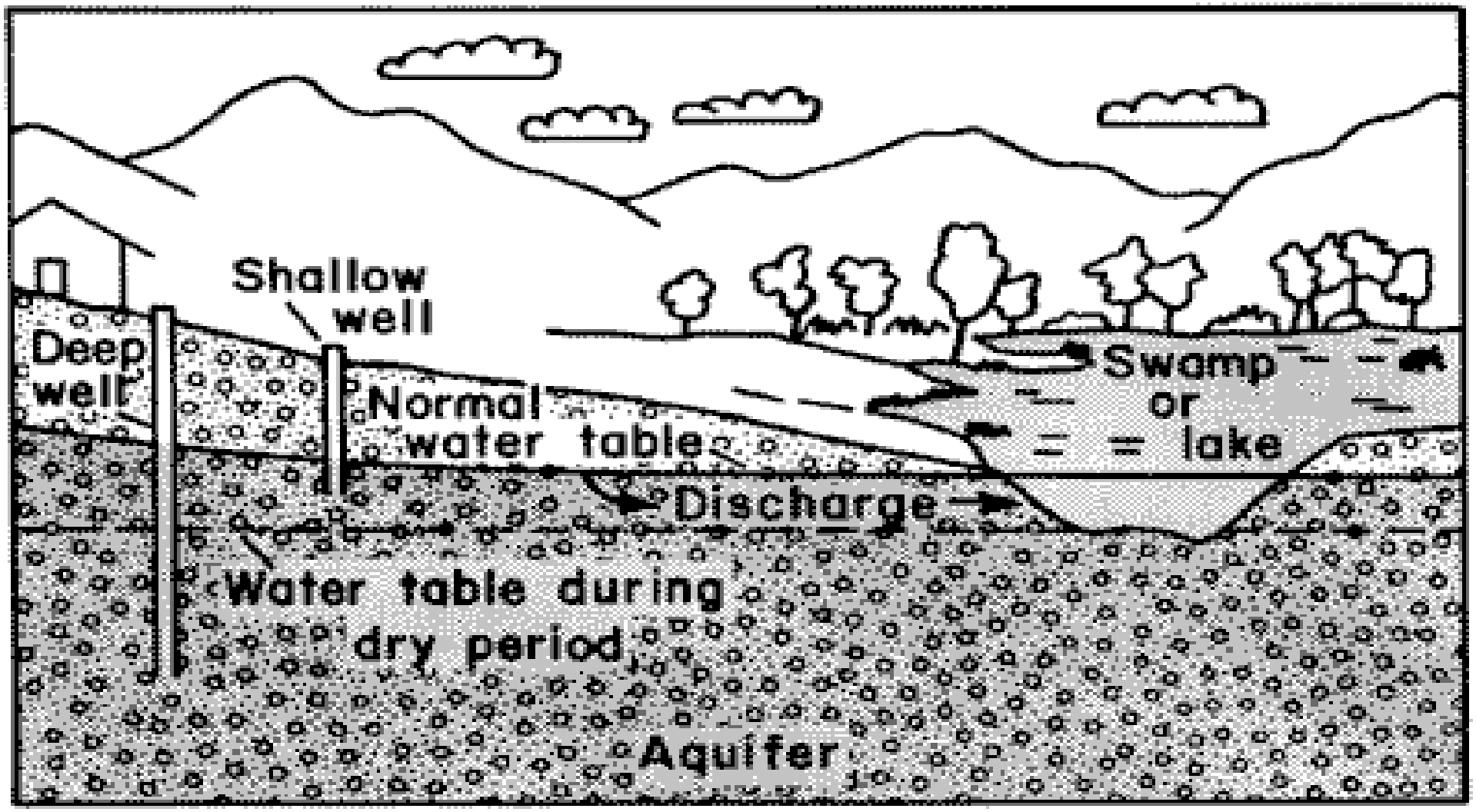
Who uses ground water?

- More than 50 percent of the people in the United States, including almost everyone who lives in rural areas, use ground water for drinking and other household uses. Ground water is also used in some way by about 75 percent of cities and by many factories. The largest use of ground water is to irrigate crops.

How do we get water out of the ground?

- Ground water can be obtained by drilling or digging wells.
- A well is usually a pipe in the ground that fills with ground water.
- This water can then be brought to the land surface by a pump.
- Shallow wells may go dry if the water table falls below the bottom of the well, as illustrated on the next slide.

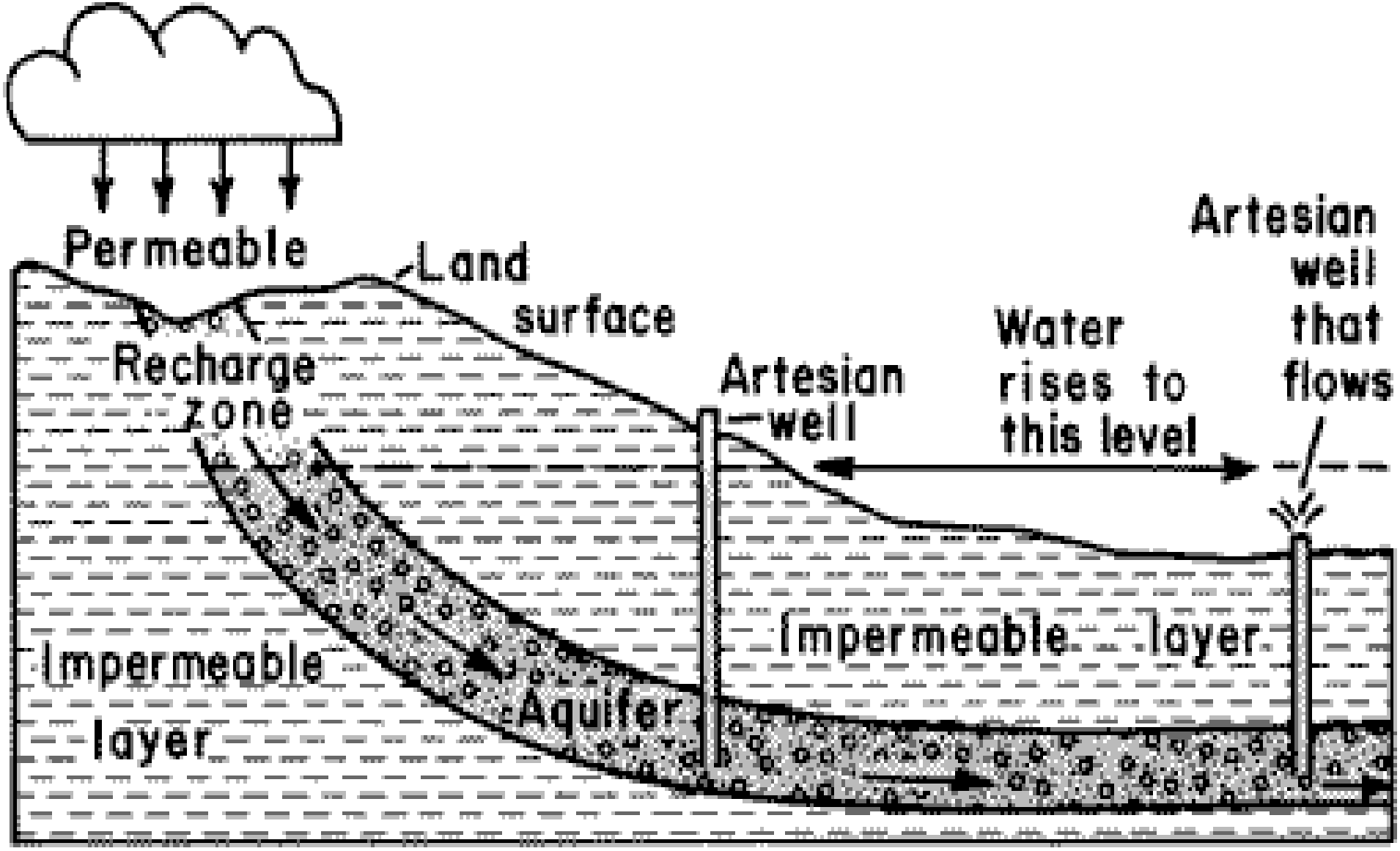
Well Water


Shallow well
Deep well
Normal water table
Swamp or lake
Discharge
Water table during dry period
Aquifer

Artesian Wells

- Some wells, called artesian wells, do not need a pump. These wells are drilled into an artesian aquifer, which is sandwiched between two impermeable layers. When a well is drilled into an artesian aquifer, pressure pushes water in the well above the top of the aquifer. If the pressure is high enough, water can flow from an artesian well.

Artesian Well



Underground Erosion and Deposition
CAVES

- Groundwater causes erosion by dissolving rock.
- Some groundwater contains weak acids, such as carbonic acid, that dissolve the rock.
- Also, some types of rock, such as limestone, dissolve in groundwater more easily than other types do.
- When rock erodes inside Earth, it forms caves.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SINKHOLES

- **Sinkholes**
- When the water table is lower than the level of a cave, the cave is no longer supported by the water underneath. The roof of the cave can then collapse, which leaves a circular depression called a *sinkhole.*


MASSIVE SINKHOLE OPENS AT MOSAIC FACILITY
CONTAMINATED WATER SEEPING INTO FLORIDA AQUIFER