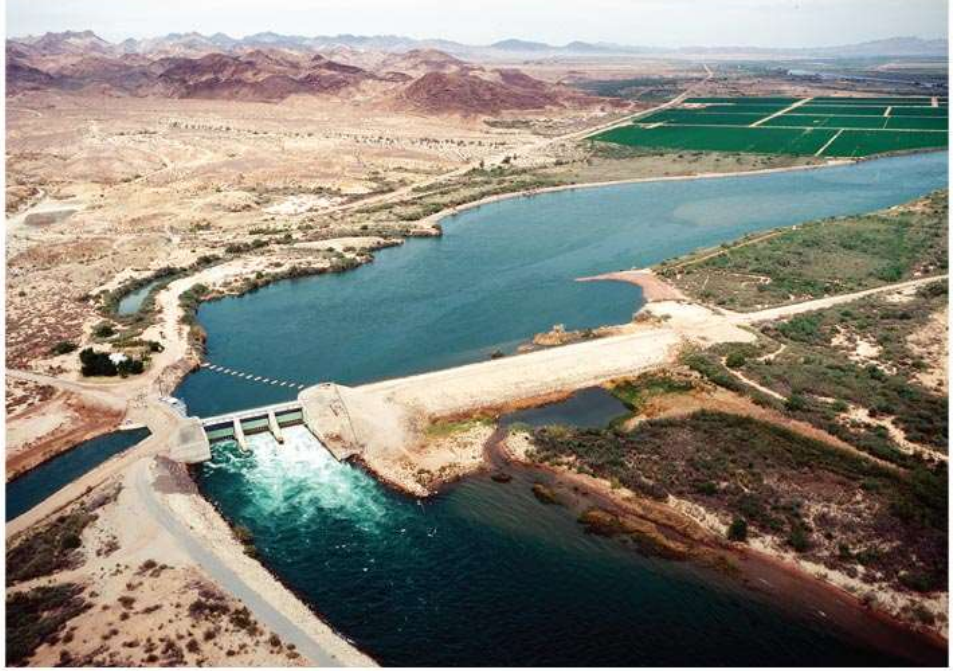
Surface Water Parsing



(a)

(b)

Figure 10-5 Parceling Out the Colorado

(a) People have built dozens of dams, reservoirs, diversions, canals, and aqueducts to control flooding on the Colorado River and distribute its waters to thousands of municipalities and farms. This is the Palo Verde Dam, which diverts about 50 m^3 (1800 ft^3) of water per second to irrigate 490 km^2 (120,000 acres) of land on the west side of the Colorado River in California.

(b) Because so much water is diverted for human use, the river that finally reaches Mexico and the sea (if at all) is shallow and salty.

[The story of water in Los Angeles: Cadillac Desert]

Saline Waters from Irrigation

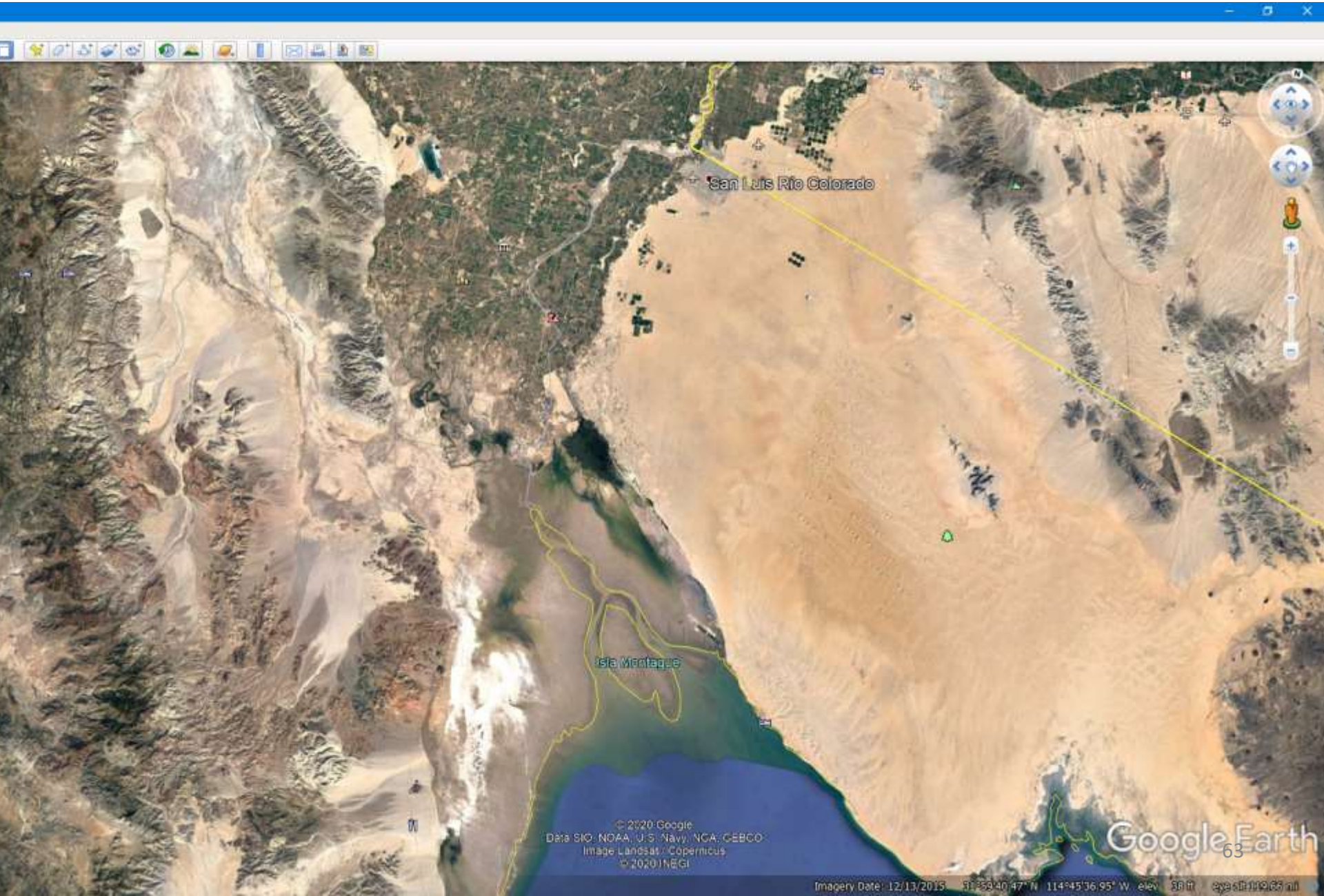
Figure 10-6 The Colorado River Desalination Plant

This plant was constructed to treat river water that became salty through irrigation practices (picks up salts from soil). The water is taken from the river, treated to remove the salts, then put back into the river for further use. Desalination is typically performed by reverse osmosis, which basically pushes water through a microscopic screen. The water passes through, but the salts are filtered out. Reverse osmosis requires energy to pump water, and that is why the process is expensive.

Colorado River

- Does not regularly flow into the Gulf of California anymore.
- Dries up ~80 miles north of former delta.
- Human impacts on humans…Mexican fishing people on the river can't fish a river with no water.
- The U.S. has parsed the water in the Colorado river so much, that it doesn't flow into the ocean anymore.
- **We can do better than this, and be better to our neighbors than we have been!**

Colorado River Mouth at Gulf of California

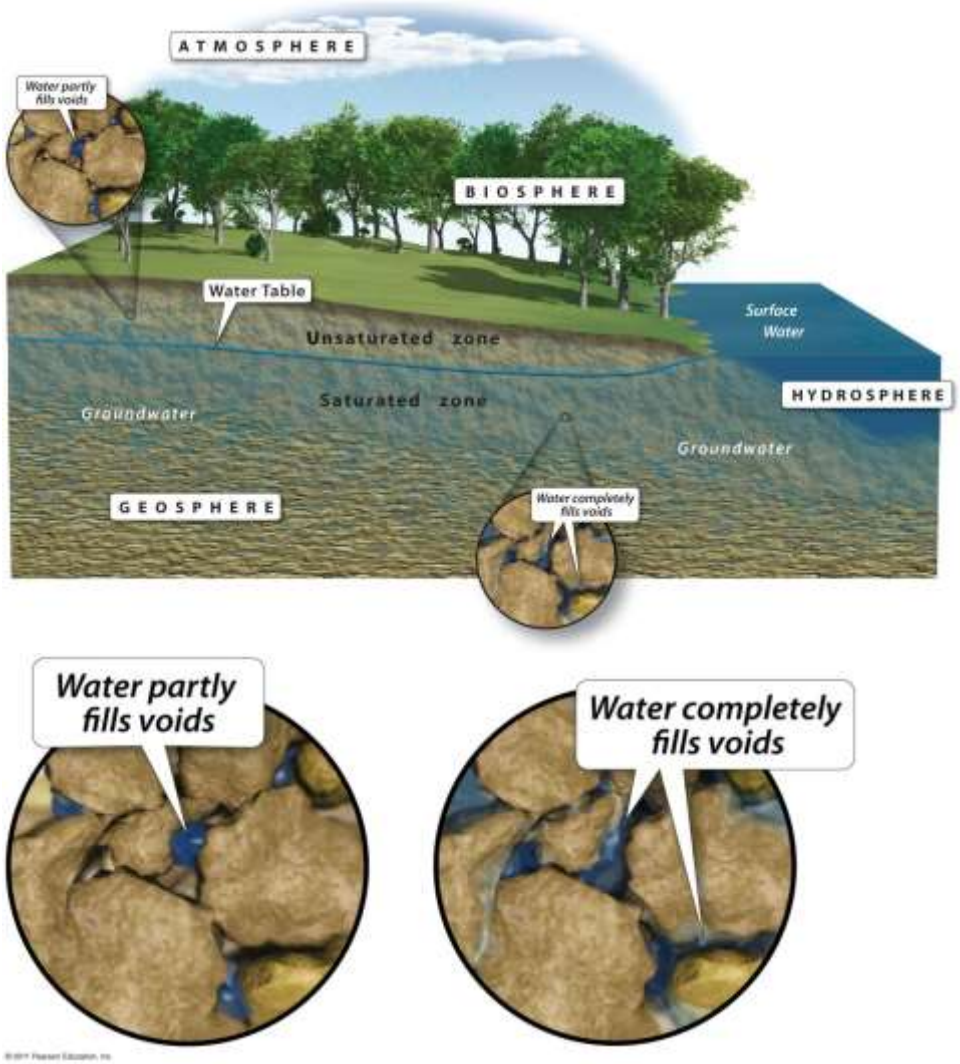


Colorado River near Mouth at Gulf of California – Note there is no water in the stream channel

Groundwater Resources

Figure 10-7 Water Underground

Water that soaks into the ground partly fills open spaces (voids) in the unsaturated zone. The water table marks the depth at which the voids become completely filled with water. Below the water table the completely water-soaked ground is called the saturated zone. Surface bodies of water mark where the water table is exposed and where groundwater is connected to surface water.



Aquifer – saturated zone that is high in **porosity** and **permeability**, a target for groundwater mining. A good explanation of groundwater flow in this video.

Types of Aquifers

- **Unconfined aquifers** can be easily recharged by water migrating freely down from the ground surface.
- **Confined aquifers** contain water below an impermeable layer. Because such aquifers are overlain by impermeable material, they can fill with water only through limited areas exposed at the surface–commonly a considerable distance away.
  - Confined aquifers are typically under pressure. ~artesian wells
  - Artesian wells are a blessing if you have one… NO PUMP NEEDED!
- **Perched** aquifers develop in an unsaturated zone where downward movement of water is stopped by an impermeable layer before it can reach the main (or regional) water table.
  - Birds perch in trees…they sit above the ground surface. Perched aquifers are above the typical aquifer surface.

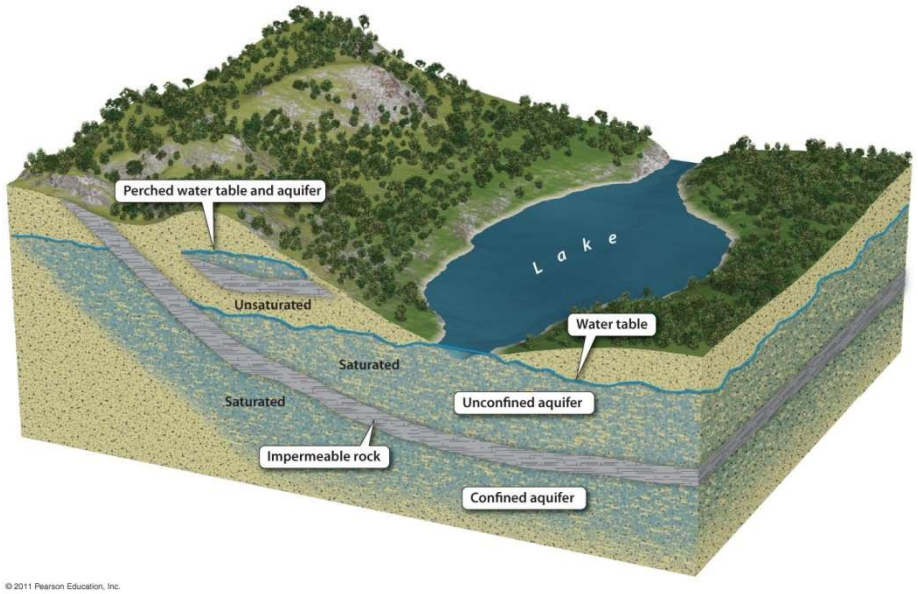
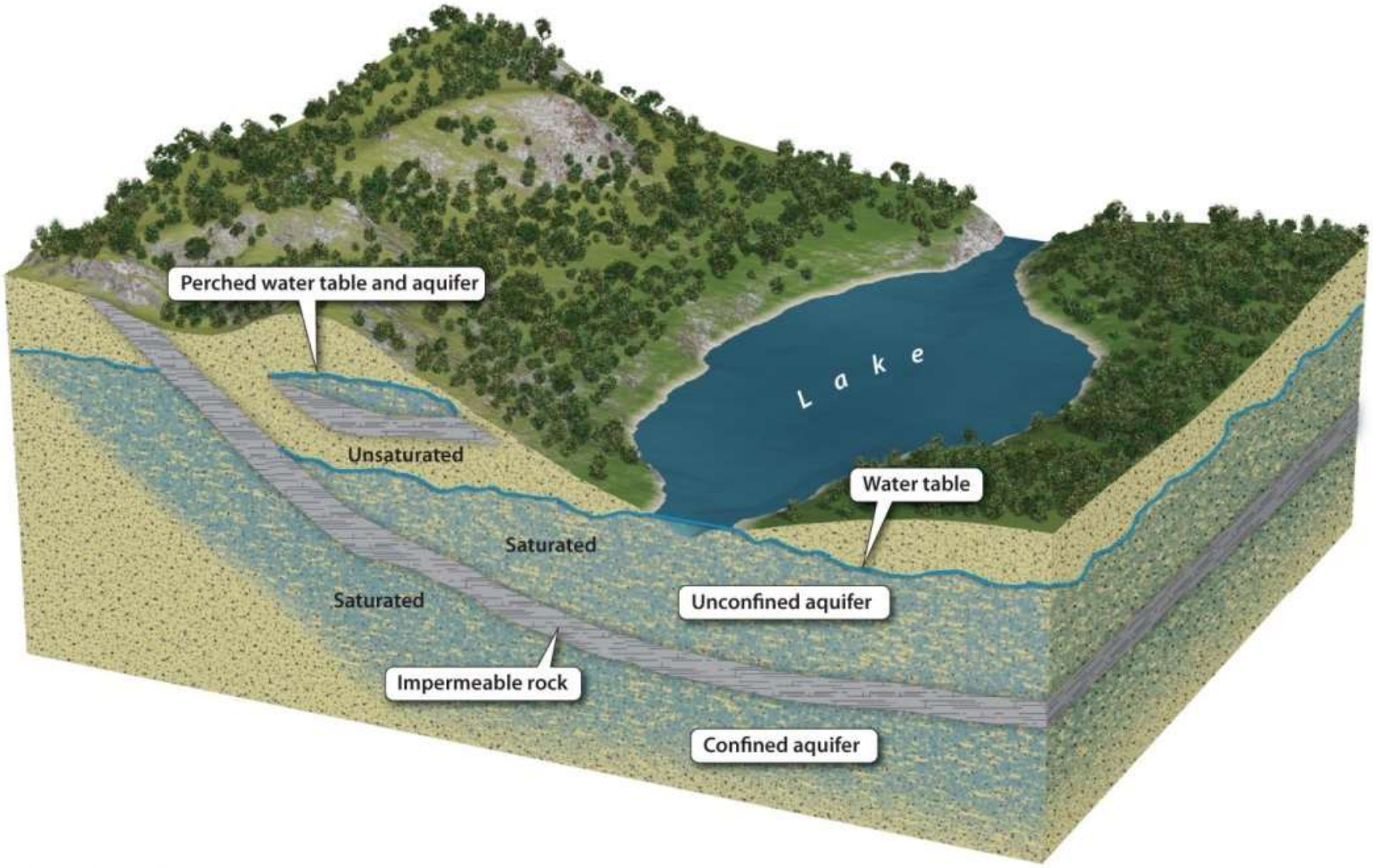
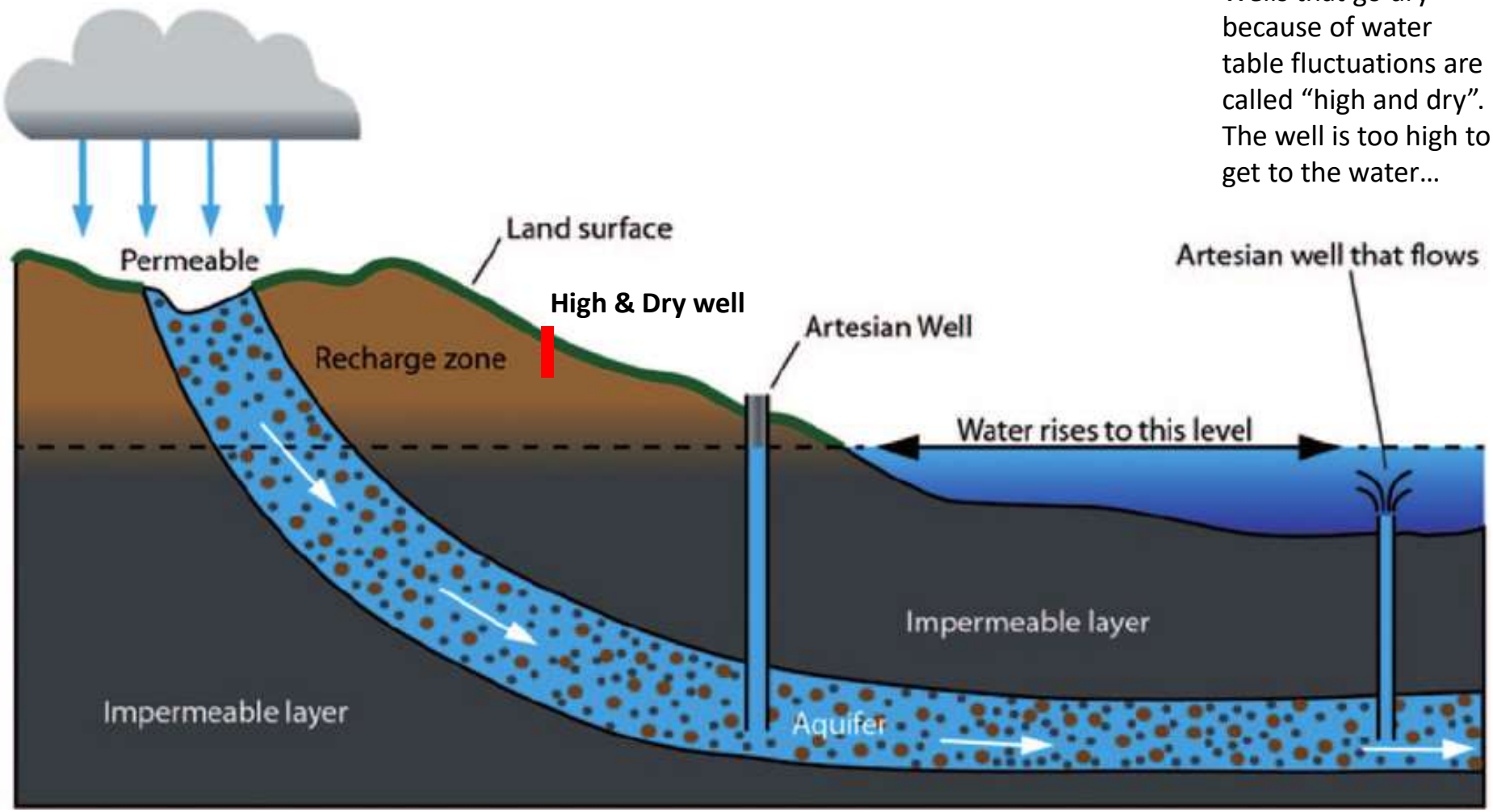


Figure 10-8 Aquifers

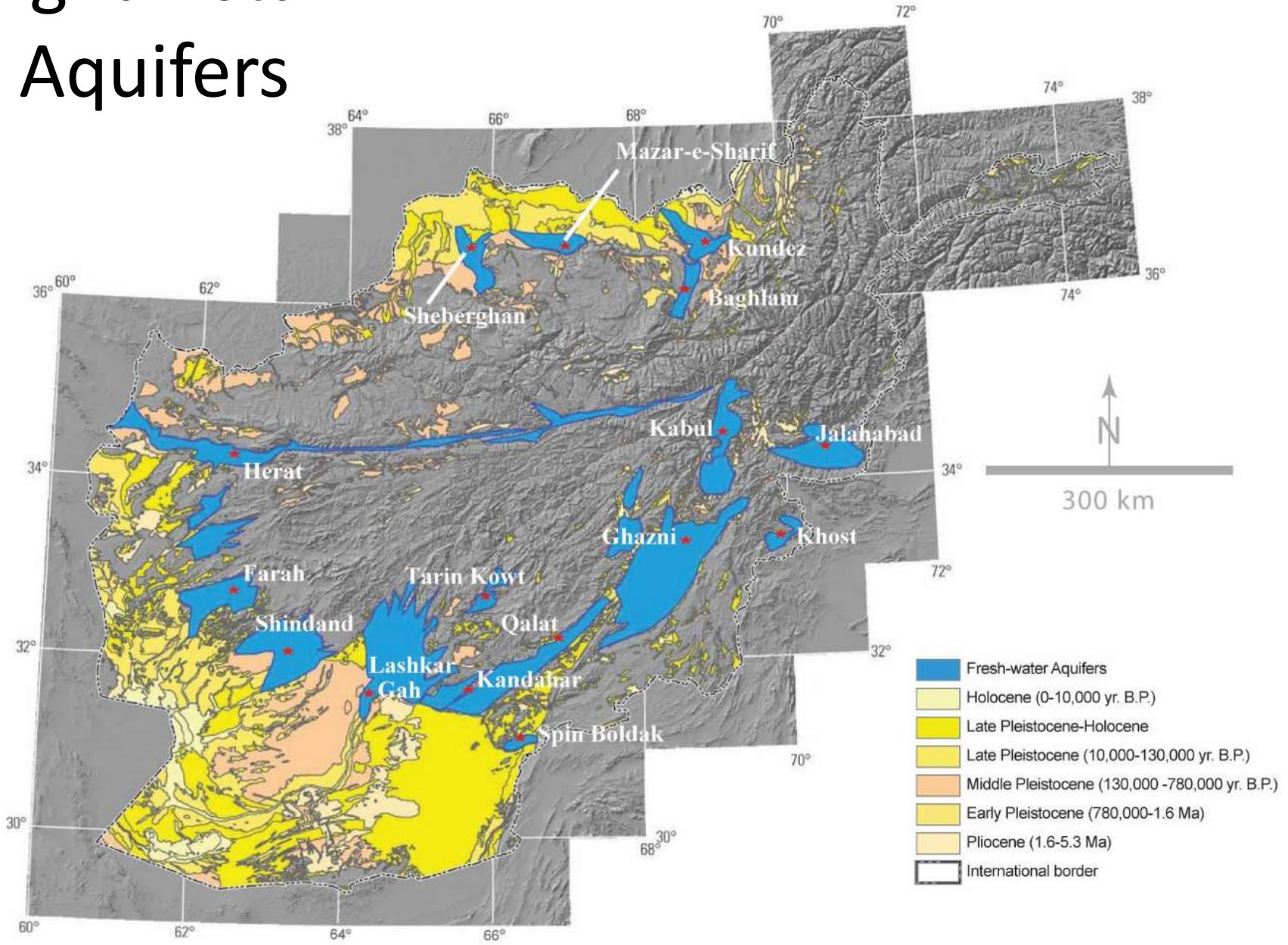


Artesian Wells

Wells that go dry because of water table fluctuations are called “high and dry”. The well is too high to get to the water…



Afghanistan Aquifers



Alluvial Aquifers

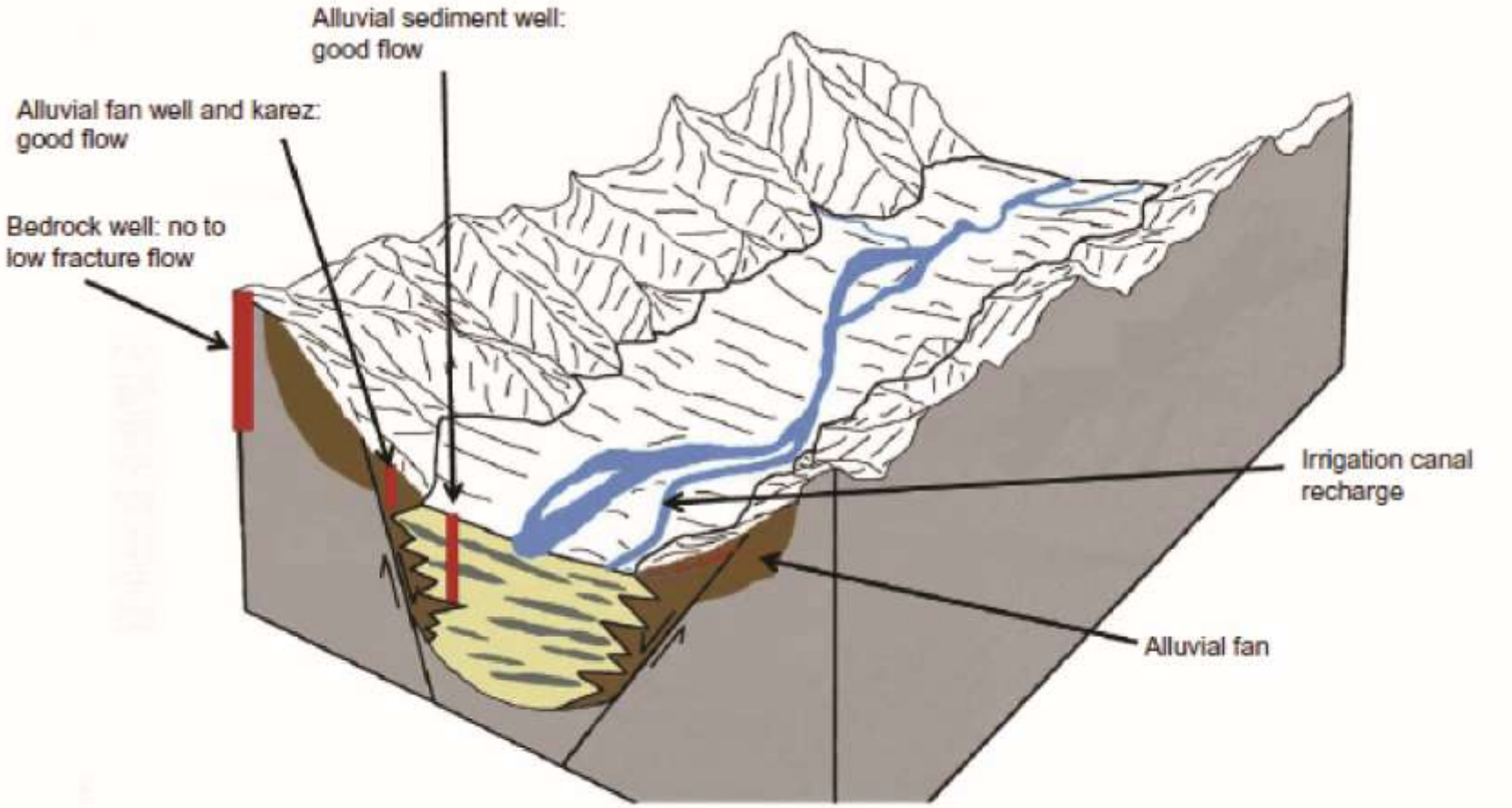


FIG. 3.14 Narrow alluvial aquifer in mountain valley underlain by a graben structure typical of Afghanistan. Note lenticular zones of water-bearing sands and gravels in basin center where ancient river channels sediments have been deposited.

Shroder and Ahmadzai, 2016