Chapter 9
Water Resources

Usable Water is Rare

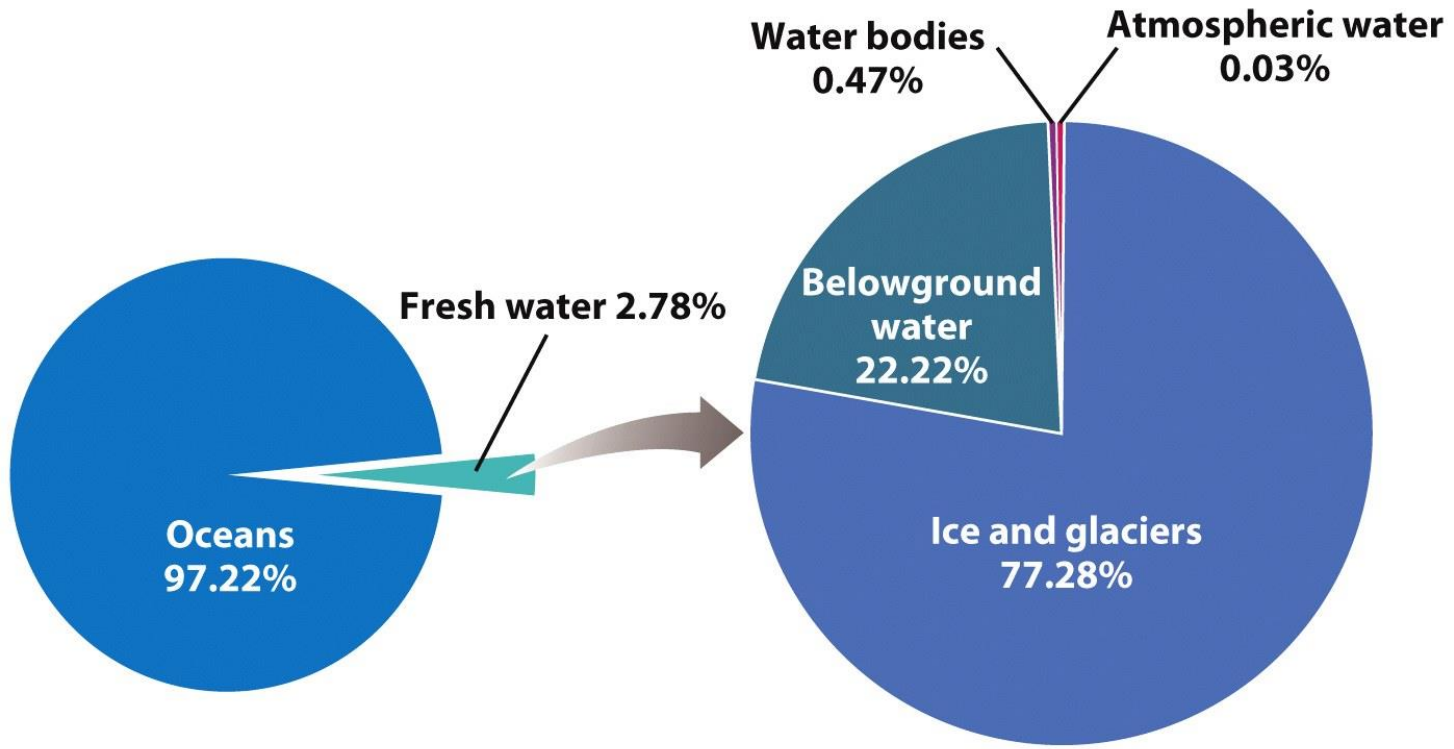


Figure 9.1
Environmental Science

Groundwater

- Aquifers- small spaces found within permeable layers of rock and sediment where water is found.
- Unconfined aquifers- an aquifer that is simply porous rock covered by soil.
- Confined aquifers- an aquifer surrounded by a layer of impermeable rock or clay.

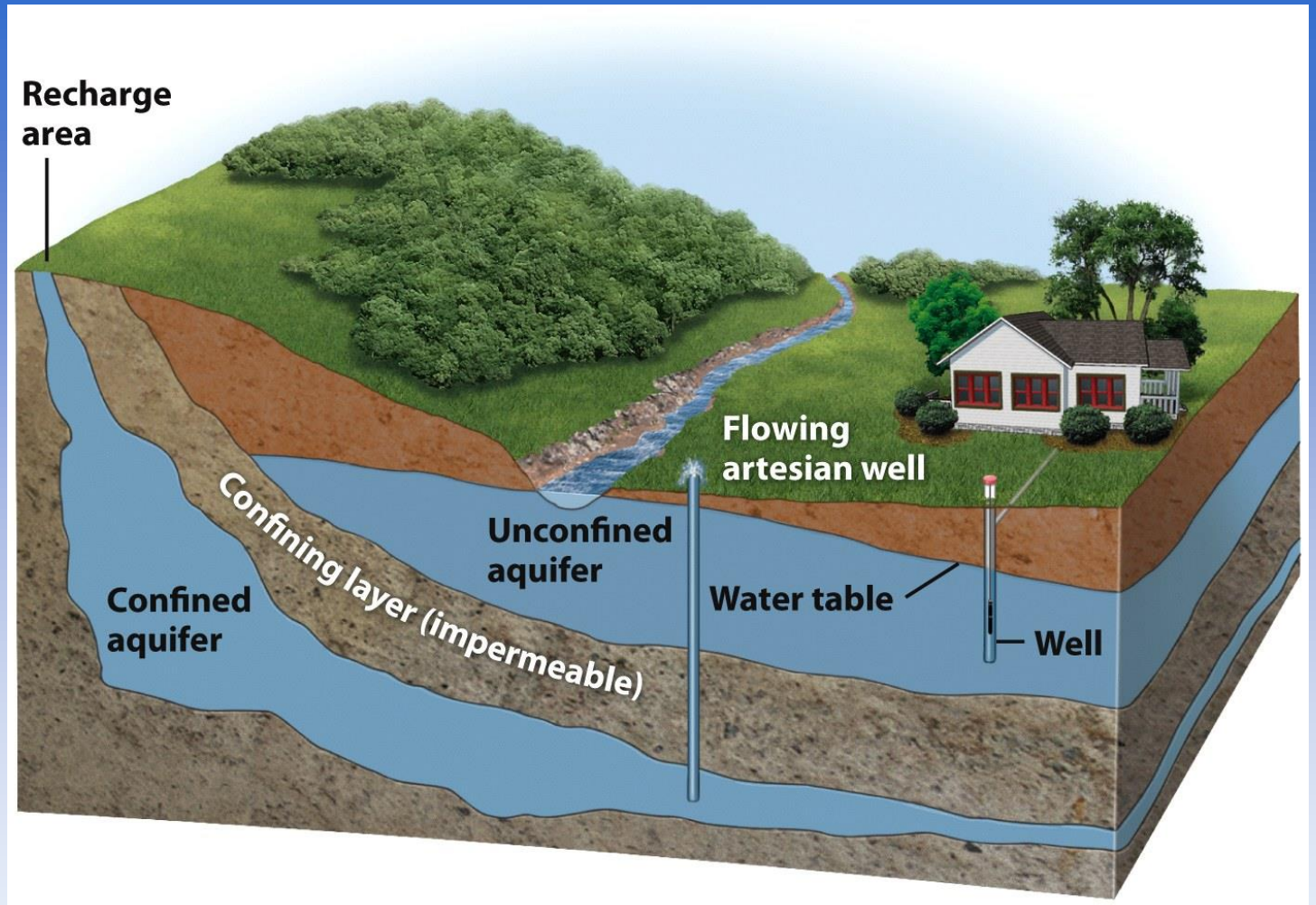


Figure 9.2
Environmental Science

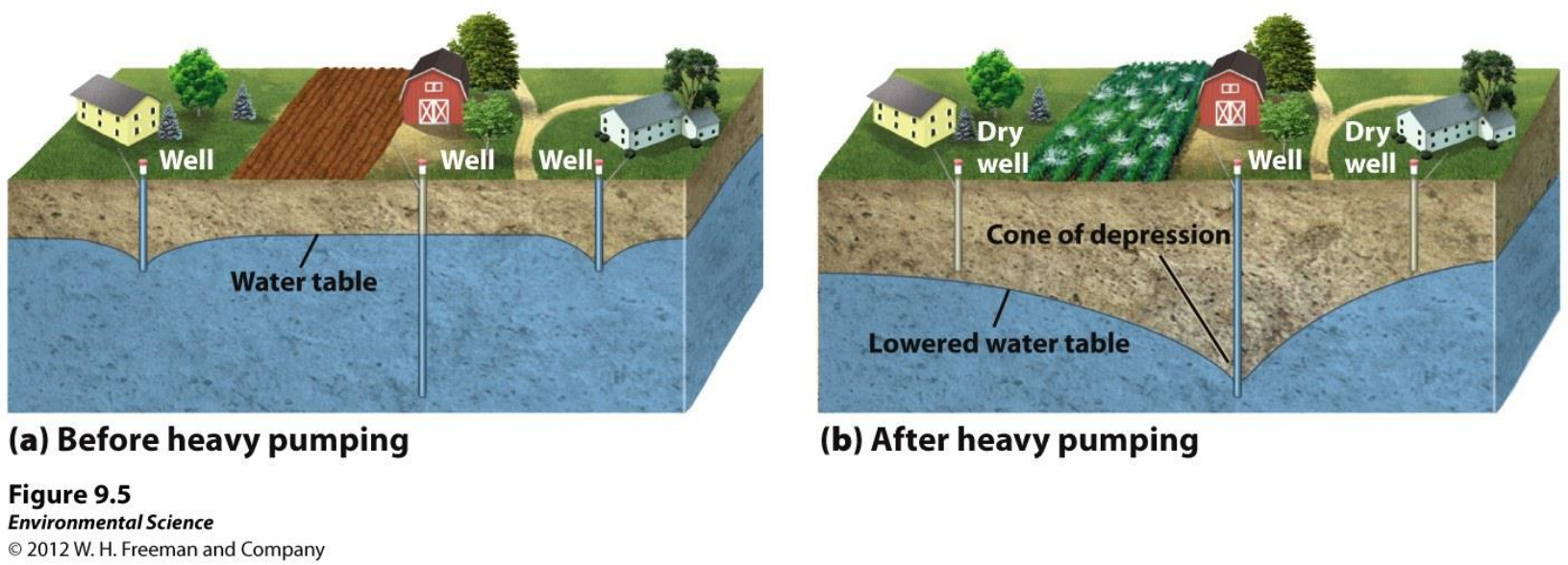
Groundwater

- Water table- the uppermost level at which the water in an area fully saturates the rock or soil.
- Recharge- the input process of water percolating into an aquifer.
- Springs- water from an aquifer that naturally percolates up to the surface.

Figure 9.3
Environmental Science

Groundwater

- Cone of depression- an area where there is no longer any groundwater.



(a) Before heavy pumping

(b) After heavy pumping

Figure 9.5
Environmental Science

Groundwater

- Saltwater intrusion- when the pumping of fresh water out of a well is faster than the recharge. Near coastal areas this can cause salt water to infiltrate the aquifer.

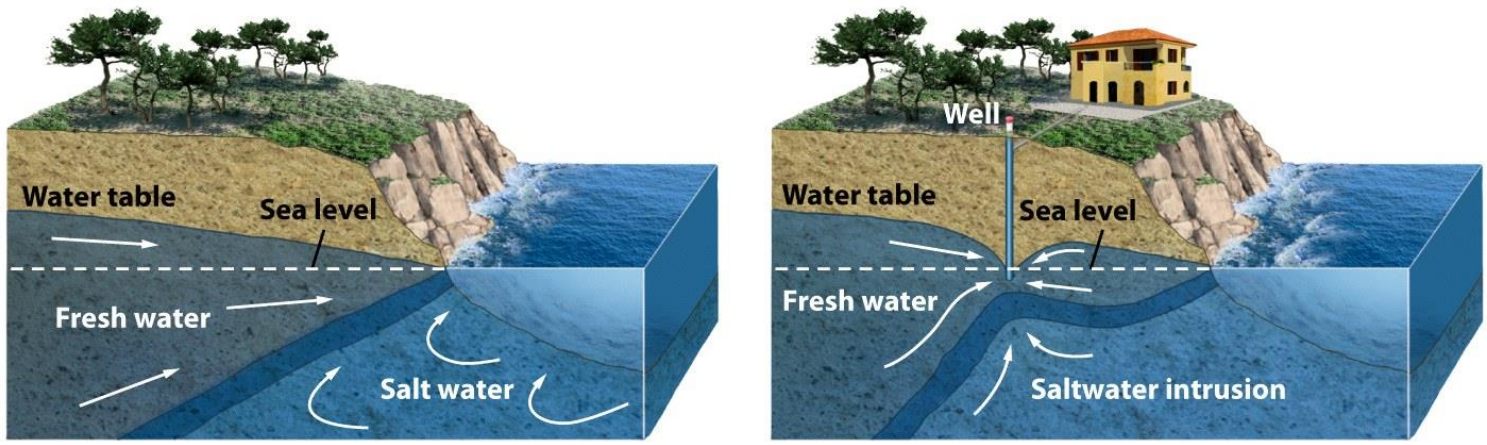


Figure 9.6
Environmental Science

Surface Water

- Streams, rivers, ponds, lakes and wetlands.

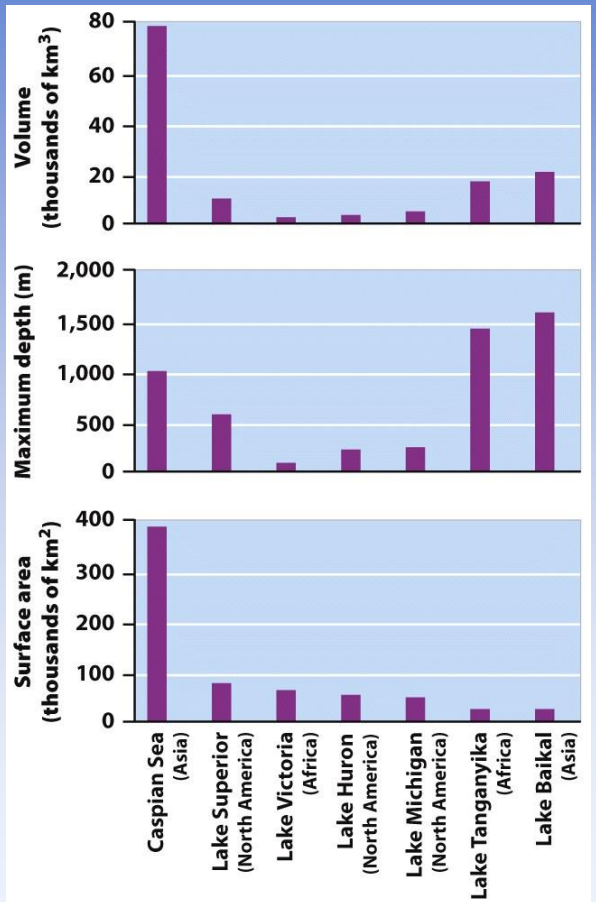


Figure 9.7
Environmental Science

Surface Water

- Productivity in a lake:
  - Oligotrophic- low amounts of nutrients such as phosphorous and nitrogen.
  - Mesotrophic- a moderate level of productivity
  - Eutrophic- high levels of productivity

Altering the Availability of Water

- Levees- an enlarged bank built up on each side of the river.
- Dikes- similar to a levee but built to prevent ocean waters from flooding adjacent land.

Figure 9.9
Environmental Science

Altering the Availability of Water

- Dams- a barrier that runs across a river or stream to control the flow of water.
- Reservoir- the area where water is stored behind the dam.

Figure 9.10
Environmental Science

Altering the Availability of Water

- Fish ladders- a set of stairs with water flowing over them that have been added to some dams to help migrating fish such as salmon get upstream.

Figure 9.11
Environmental Science

Altering the Availability of Water

- Aqueducts- canals or ditches used to carry water from one location to another.

Figure 9.12
Environmental Science

Altering the Availability of Water

- Desalination- removing the salt from salt water to obtain fresh water.

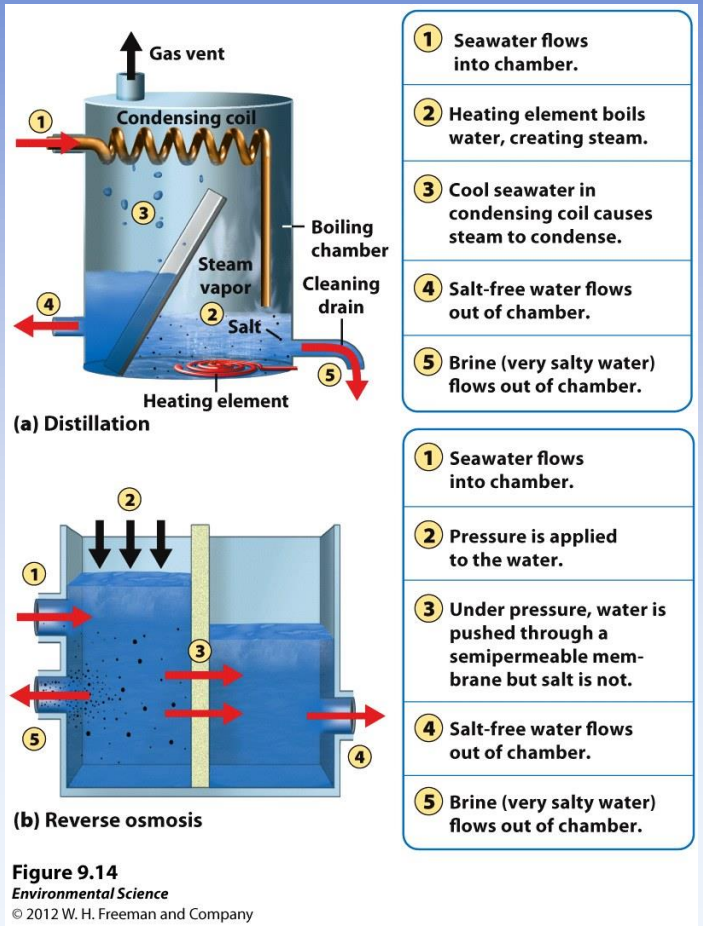


Figure 9.14
Environmental Science

Agriculture, Industry and Household Needs

- Agriculture- the largest user of water around the world.

Furrow irrigation

Figure 9.17a
Environmental Science

Flood irrigation

Figure 9.17b
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Spray irrigation

Figure 9.17c
Environmental Science
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Drip irrigation

Figure 9.17d
Environmental Science
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Agriculture, Industry and Household Needs

- Irrigation techniques-
  - Furrow irrigation- a trench that is flooded with water.
  - Flood irrigation- the entire field is flooded with water.
  - Spray irrigation- an apparatus that sprays water across a field.
  - Drip irrigation- using a slow dripping hose that is laid on or buried beneath the soil.
  - Hydroponic agriculture- crops grown in fertilized water and no soil.

Agriculture, Industry and Household Needs

- Industry- the second largest user of water worldwide.

Figure 9.19
Environmental Science

Agriculture, Industry and Household Needs

- Households- the third largest user of water worldwide .

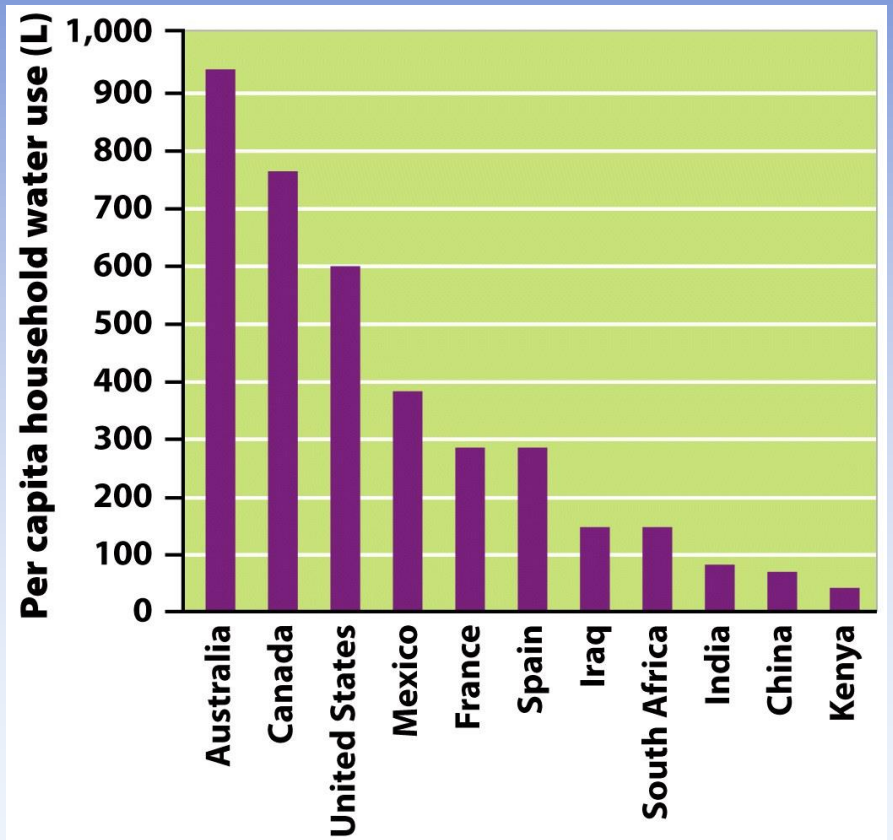

Figure 9.20
Environmental Science

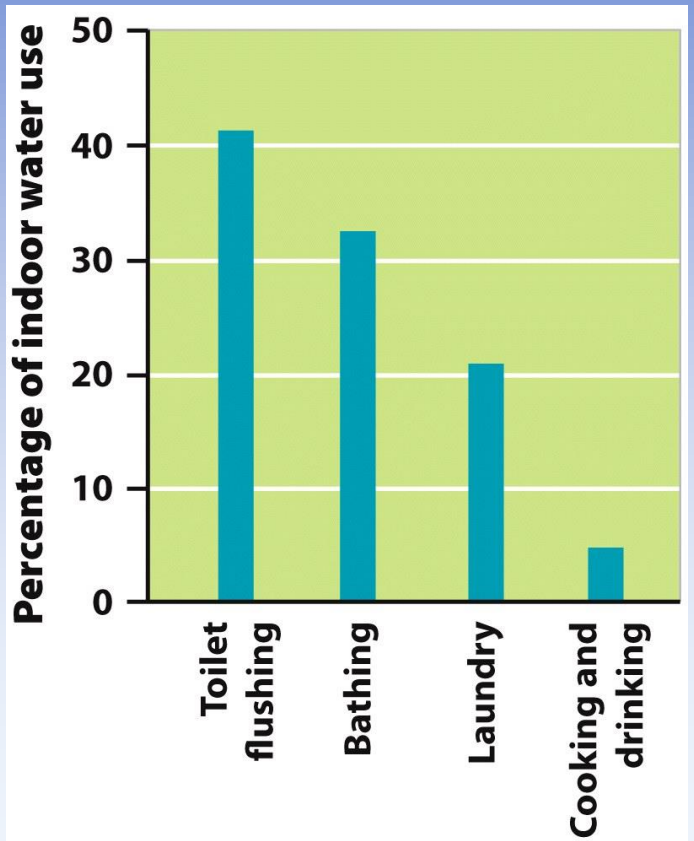

Figure 9.21
Environmental Science

The Future of Water Availability

- Water ownership- people can have rights to water use, but they do not own the water.
- Water conservation- using techniques such as more efficient water fixtures, faucets and washing machines.

Figure 9.23
Environmental Science