**Some notes on groundwater**

Ground water is important

• water supply for human consumption

• agricultural water

• clean air and water are the keys to a healthy ecosystem

• ground water can cause construction and foundation problems

• ground water can cause landslides

Ground water cycle includes surface phenomena in the soil layers, recharge, transport & discharge

Surface phenomena include **runoff** (water flowing on the surface), **evapo-transpiration** (water vapor passing into the atmosphere), and **infiltration** (water seeping down toward the water table)

**Porosity** is the percent of a given volume of rock that is empty or void space between grains.

**Permeability** is a measure of the ease with which a fluid can flow through a rock.

The **water table** is the surface between the unsaturated (aeration) zone and the saturated zone in which 100% of the pore space is filled with water.

The shape of the water table is generally a subdued replica of the shape of the ground surface. This is most valid for near-surface unconfined aquifers.

An **aquifer** is a rock layer from which water can be produced at a profit.

An **aquitard** is a rock layer through which water flows very slowly, due to very low permeability.

**Recharge** is the replenishing of an aquifer with water that has infiltrated from the surface or flowed from other water-bearing formations

An **unconfined aquifer** has uninterrupted fluid-air connection vertically to the ground surface. A bucket of sand could be used as a model of an unconfined aquifer.

A **confined aquifer** has a relatively impermeable layer between the aquifer and the ground surface. A bucket of sand with a layer of clay or plastic on top of the sand could be used as a model of a confined aquifer.

**Springs** occur when the water table intersects the ground surface, so that water flows out of the ground.

An **artesian spring** is associated with a confined aquifer from which water flows at the surface under its own pressure.

**Evaporites** are minerals that precipitate at/near the ground surface as the water in which the constituent ions were dissolved evaporates.

**Wells** may be pumping wells, injection wells or monitoring wells (aka *piezometers* or *manometers*). A pumping well in an unconfined aquifer will cause development of a cone of depression in the water table.

Dissolution of subsurface rock by acidic ground water might lead to the development of **caves**, **sinkholes**, solution cavities, or **karst** topography.

Precipitation of mineral material carried in solution by ground water can cause pores to be filled with new mineral material and cemented shut.

Groundwater problems that require engineered solutions: **ground water pollution**, **salt water intrusion**, **subsidence**.