

Groundwater

Groundwater is the generic term identifying water resources which are resident in soil or rock pores and matrices. By far the major proportion of groundwater resides under positive pore pressures within **aquifers**, but some water lies in the interstices between ground surface and the aquifer within the **capillary zone**. Aquifers are generally fully saturated, whereas the capillary zone contains a significant proportion of air as well as water.

Aquifers may be **confined** (pressurised between layers of relatively impermeable ground or aquicludes), or **unconfined** (a water table aquifer with a phreatic or 'free' surface). In both cases, the flow dynamics are similar in that flow is generated by differences in pressure from one point to another. A **perched** water table is a special type of unconfined aquifer which may exist within another unconfined aquifer, and is 'perched' on a thin impermeable lens such as clay.

Flow in aquifers is generally **laminar**, or seepage flow. In some cases where preferential flow paths may exist (eg. permeable faults and fractures in rock), turbulent flow may be generated. Flow in aquifers is always from a region of higher pressure or higher potential energy to a region of lower potential energy.

Most aquifers are interconnected, and it is very rare that a single aquifer will exist in isolation. Connections between aquifers may be weak or strong depending on the porous media and the geological stratification.

The single intrinsic soil or rock parameter that determines the characteristics of groundwater flow is the **hydraulic conductivity**. This is often (and strictly incorrectly) referred to as the permeability. The hydraulic conductivity is a quantitative measure of the velocity of seepage flow of water reached whilst being generated by a unit pressure gradient. Hydraulic conductivity may vary in space (**heterogeneous** porous media) as well as in the direction of flow (**anisotropic** porous media). A homogeneous and isotropic groundwater regime is an ideal saturation that rarely occurs in nature.

Groundwater, while recognised as a separate entity in the hydrologic cycle, is nevertheless strongly interactive with other components of the hydrologic cycle such as rain, rivers, lakes and oceans. Although the time scale of processes in groundwater is long because of the laminar nature of flow, its interaction with surface water components of the hydrologic cycle should always be considered.