

Hydrogeology of Wales: Quaternary aquifers - groundwater occurrences

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This page is part of a category of pages that provides an updated review of the occurrence of groundwater throughout Wales.

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Groundwater is present in most of the Quaternary and Holocene deposits and is stored and transported in useable quantities in many of the saturated sand and gravel deposits. These deposits receive direct rainfall recharge and may be in hydraulic continuity with rivers which can have identifiable gaining and losing reaches. However, persistent interbedded peat and clay horizons may inhibit the downward migration of recharge. For example, in the Vale of Clwyd in north Wales, the central valley floor is covered in thick weakly permeable till, but gravel deposits formed during the retreat of the ice along the margins of the valley enable direct rainfall recharge to access the underlying Carboniferous Limestone and Triassic sandstones, and put these aquifers into hydraulic continuity with the Afon Clwyd.

Widespread deposits of lodgement till are poorly permeable and tend to inhibit recharge to underlying aquifers. However, where they thin to less than 5 m thickness, postglacial weathering enhances the permeability of the shallow material such that it can transmit infiltrating water to lower horizons.

Alluvial deposits vary in water-bearing properties from weakly permeable silt and clay material to coarser sand and gravel, although the properties of the latter are inhibited wherever a fine-grained matrix is present. For example, the alluvium beneath the Cardiff Bay Barrage has a hydraulic conductivity of $5 \times 10^{-5} \text{ m d}^{-1}$ and a transmissivity of $250 \text{ m}^2 \text{ d}^{-1}$ in the subordinate gravel horizons, equivalent to a hydraulic conductivity of between 40 and 60 m d^{-1} ([Entec, 1996](#)).

Coastal dune-lands offer distinctive and delicate groundwater dependent ecosystems with wet dune-slacks that tend to become dryer as they mature. These deposits are characterised by a shallow lens of saturated sand fluctuating about the slack bottoms, typically by about 0.5 m above the slack in late winter to 1.5 m below the slack floor in late summer.



The Tregaron Bog in the upper Afon Teifi valley. P802432.

Blanket peat and domed peat deposits such as that at the Tregaron Bog in the Afon Teifi catchment

(**Plate P802432**) offer high groundwater storage potential but poor transmitting properties. However, where the peat has dried out it cracks so that the permeability significantly increases. As a consequence recovery of desiccated peat rarely occurs. A significant issue is the ingress of pesticides via surface waters into blanket peats which is selectively retarding peat development with a consequent risk of desiccation and loss of storage.

Resource potential in the granular superficial deposits is generally limited, but exceptionally in the Afon Rheidol, Afon Teifi, Afon Dyfi and Afon Tywi catchments in west Wales, higher yields have been developed for public supply. Lovesgrove Borehole No. 1 [SN 614 808] near Aberystwyth in the Afon Rheidol catchment has a licensed abstraction of 5 Ml d⁻¹ from a coarse-grained alluvial formation. There are three production boreholes and a number of observation boreholes in which the transmissivity has been found to range between 290 and 5500 m² d⁻¹ ([Entec, 2009](#)). There are numerous other smaller abstractions for public supply in valley bottoms which provide a relatively low-cost means of supplementing supply to the more isolated rural communities. In addition there are a large number of private boreholes, wells and springs that draw on the shallow Quaternary aquifers supplying isolated rural dwellings and farmsteads with potable domestic water, supply for stock watering and washing down. These supplies are critically important to the social and economic well-being of many small rural communities, notably in central and west Wales.

The Quaternary alluvial aquifers may provide additional storage to bedrock aquifers. In many of the valleys in west Wales drillers traditionally case off the sand and gravel cover and complete boreholes as open-hole within the underlying bedrock. This is a convenient construction design for percussion drillers and also some rotary drilling procedures. Abstraction from the completed borehole draws water from bedrock and is limited by its transmissive properties. The storativity is greatly enhanced, however, as the bedrock fractures draw on water in storage in the shallow gravels and sands, and they in turn may draw from the surface water course flowing down the valley ([Robins et al., 2000](#)). As a consequence borehole yields may be modest, typically 2 to 4 l s⁻¹, but are sustainable even through long periods of dry weather. These sources are, however, vulnerable to surface pollutants as rainfall recharge can penetrate rapidly to bedrock carrying with it contaminants spilled on the ground such as fuel and agricultural chemicals.

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