Clonaslee West GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water bodies	Associated terrestrial ecosystem(s)	Area (km^2)
25 - Brosna Catchment Laois, Offaly Co. Co.	Rivers: Clodiagh, Gorragh, Silver, County, Black, Ballynacarrig.	Clonaslee Eskers and Derry Bog (000859), Slieve Bloom Mountains (000412)	22

Topography	This groundwater body is located at the base of the northwestern slopes of Slieve Bloom. Where the rock unit is at or close to the ground surface, it is a narrow strip around the northwestern quarter of the uplands. The eastern and southern boundary are defined by surface water catchments. The northwestern and southeastern boundaries are formed by the contact with lower transmissivity bedrock. Elevations generally range from 100 to 200 mAOD. In the easternmost part of the GWB at the surface water catchment divide, elevations reach 208 mAOD. There is a break in slope located within the area of the body from the mountainous to lowland topography. Some of the rivers flowing off the uplands have incised deep valleys into the rocks. The GWB is the northwards continuation of the Bredagh GWB aquifer, and the westwards continuation of Clonaslee GWB aquifer in the Eastern RBD.	
Geology and Aquifers	Aquifer categories	**Rf:** Regionally important fissured aquifer.
	Main aquifer lithologies	Devonian Kiltorcan-type Sandstones.
	Key structures	The strata form the limbs of a large anticlinal fold, whose core forms Slieve Bloom. The rock layers dip north- and northwest-wards at 10–20°. North-south faults are frequent in the area. There are two sets of major vertical joints – NW-SE and NE-SW – and horizontal fractures can be recognised in most exposures. Microfractures are present in many exposures and are frequently closely spaced (≤0.2m). These fractures can give exposures a blocky appearance.
	Key properties	Transmissivity 20 to 90 m^2/d. Storativity = 8.4 x 10^{-4}. Gradients in the upland areas are as high as 0.09. In the lower-lying areas, gradients are approximately 0.02 (Daly, 1988). *(data sources: Rock Unit Group Aquifer Chapters, GWPS Reports, see references)*
	Thickness	The rock unit varies in maximum thickness from 70 to 105 m. Significant groundwater flux is likely to occur across the entire interval.
Overlying Strata	Lithologies	The lithology of the subsoil varies with the elevation. There is peat on the elevated slopes of the mountains, and Limestone Till lower down.
	Thickness	Subsoils are often less than 3 m thick, but are thicker lower down the slopes. The thickness of the subsoil is varied but is mostly below 10 m, but can attain greater thicknesses locally. Rock outcrops are scattered across the GWB.
	% area aquifer near surface	*[Information to be added at a later date]*
	Vulnerability	Vulnerability is variable over the area of this groundwater body. Between Coolagh Crossroads in the north and the southern boundary of the GWB, vulnerability is predominantly Extreme, but is High on the lower slopes. East of this, groundwater vulnerability has a more complex distribution; in the uplands it is generally Extreme, whilst along the Clodiagh River valley, vulnerability ranges from High to Low.
Recharge	Main recharge mechanisms	Most recharge takes place where the overburden is less than 5m thick or where sands and gravels exist.
	Est. recharge rates	*[Information to be added at a later date]*
Discharge	Important springs and high yielding wells (m^3/d)	The Clonaslee well field lies near the northeast limit of the groundwater body, with a large zone of contribution up gradient that also extends into the Eastern RBD. The combined abstraction of these wells is 1820m^3/d. *[More Information to be added at a later date]*
	Main discharge mechanisms	Groundwater will discharge to the rivers crossing the aquifer, where the subsoil is not too thick to prevent this. There is some evidence of springs within the lower section of the sandstones (e.g. St. Brigit's Well, Rosenallis), implying that recharge is being rejected by the lower permeability layers (Barber 1979).
	Hydrochemical Signature	Samples taken during the pumping tests on the production wells in this GWB, at Clonaslee, indicate hard groundwater. Alkalinity is moderate to moderately high (180–270 mg/l $CaCO_3$). Groundwater conductivity generally ranges from 500–600 μS/cm. Laboratory pH is neutral (7.2-7.4); one field sample measured pH 6.7. The Hydrochemical signature is calcium-bicarbonate. The hydrogeological setting would imply that softer water would be more typical of these strata. However, the subsoil comprises limestone till which would supply the calcium carbonate in the system.
Groundwater Flow Paths		The fissuring associated with faults results in higher transmissivities, specific capacities and yields for some wells. However the degree of fracturing and consequently development of permeability can vary over relatively short distances. In certain areas the rock cement has been dissolved and so the rock is crumbly and easily weathered. Here it may have intergranular permeability - a feature that is unusual in Irish bedrock. The general groundwater flow direction is naturally downhill (north and northwest) radiating from the peak of the Slieve Bloom Mountains. The groundwater flow is initially unconfined but, as it travels below thickening subsoils and then underneath the Lower Limestone Shales, it becomes confined. The hydrogeology of the Clonaslee Sandstone has been studied and described by E.P. Daly (Daly 1985; Daly, 1988). He suggests a subdivision into four zones, with different hydraulic and flow characteristics. This is summarised on Figure 1.

Groundwater & Surface water interactions	Springs in the lower parts of the rock unit discharge groundwater to surface. The rivers crossing the aquifer in areas where the subsoil is not too thick are gaining. There is the possibility of leakage through the Till or Lower Limestone shale were there to be excessive pumping of the Clonaslee well field. Derry Bog fens located at the foot of the gravel ridges (eskers) at are fed by springs coming from the base of the esker.
Conceptual model	• The groundwater body is bounded on the uphill and downhill sides by lower transmissivity rocks and to the east and south by the River Brosna catchment boundaries. The topography is hilly, with a generally consistent slope from the uplands to lower ground. • The groundwater body is comprised of high transmissivity fissured bedrock. • Flow occurs along fractures, joints and major faults. In certain areas the rock cement has been dissolved and so the rock is crumbly and easily weathered. Here it may have intergranular permeability. The major faults may compartmentalise the aquifer in certain situations. • Recharge occurs particularly in the upland areas where rock outcrops, or subsoils are thin. • Depending upon topography, the water table can vary between a few metres up to 20 m below ground surface. The aquifer becomes confined where it passes under the Lower Limestone Shales rock unit, or under thick low permeability tills, and wells are artesian. Groundwater flow follows topography, radiating north and northwestwards outwards from Slieve Bloom. Flow path lengths in the upland areas are short (≤ 300 m). Confined flow path lengths are considerably longer, and flow will be slow. • Groundwater discharges to the small springs, streams emerging mid-way down the slopes, and near the contact with the overlying impure limestones. Groundwater may also discharge from depth, by flowing upwards along fault zones. • The zone of contribution to the Clonaslee well field lies near the northeast limit of the groundwater body and extends into the Eastern RBD. • Derry Bog fens, located at the foot of the gravel ridges (eskers), are fed by springs fed from groundwater in the esker.
Attachments	Schematic representation of groundwater movement (Figure 1), Hydrochemical signature (Figure 2).
Instrumentation	Stream gauges: 25128. EPA Representative Monitoring boreholes: Clonaslee (LAO12), Clonaslee (OFF28).
Information Sources	Barber, W. (1979) *Evaluation of Groundwater Resources of the Clonaslee Area Co. Offaly.* Geoex Limited. Daly, D., Cronin, C., Coxon, C. and Burns, S-J (1998) *County Offaly Groundwater Protection Scheme.* Geological Survey of Ireland Report to Offaly Co. Co., 54 pp. Daly, E.P. (1985*). Hydrogeology of the Kiltorcan Aquifer System.* Groundwater Section, GSI Internal Report. Aquifer chapter: Devonian Kiltocan-type Sandstone. Daly, E.P. (1988) The Kiltorcan Sandstone Aquifer. Proceedings of *Eighth Annual International Association of Hydrogeologists (Irish Branch) Seminar, Portlaoise.* Deakin, J., Fitzsimons, V., Gately, C. and Wright, G.R. (revised 2002) *County Laois Groundwater Protection Scheme (draft).* Geological Survey of Ireland Report to Laois Co. Co., 44 pp.
Disclaimer	Note that all calculations and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

Figure 1: Schematic representation of groundwater movement in the Clonaslee Sandstone aquifer system (after E.P. Daly, 1988)

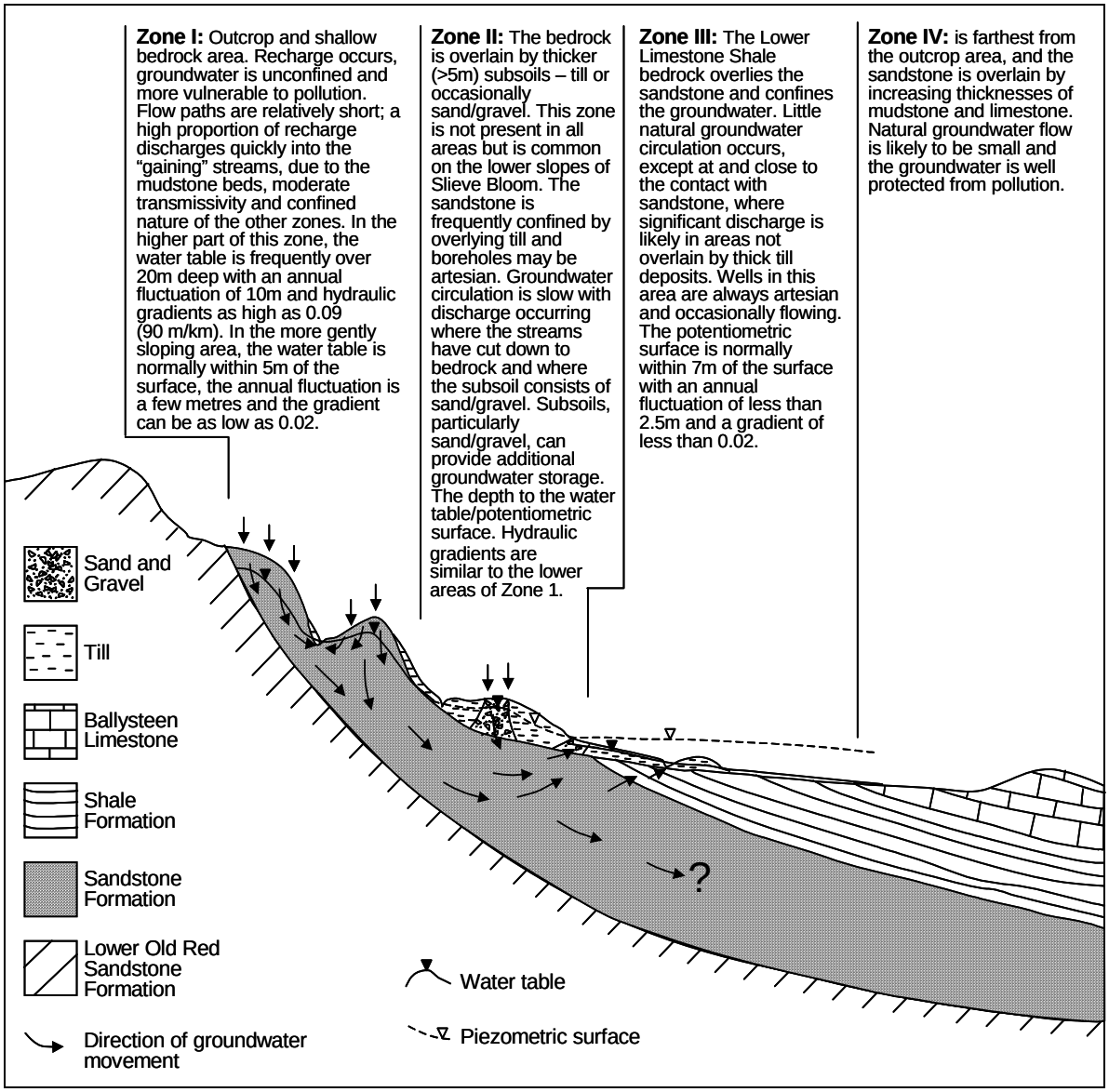
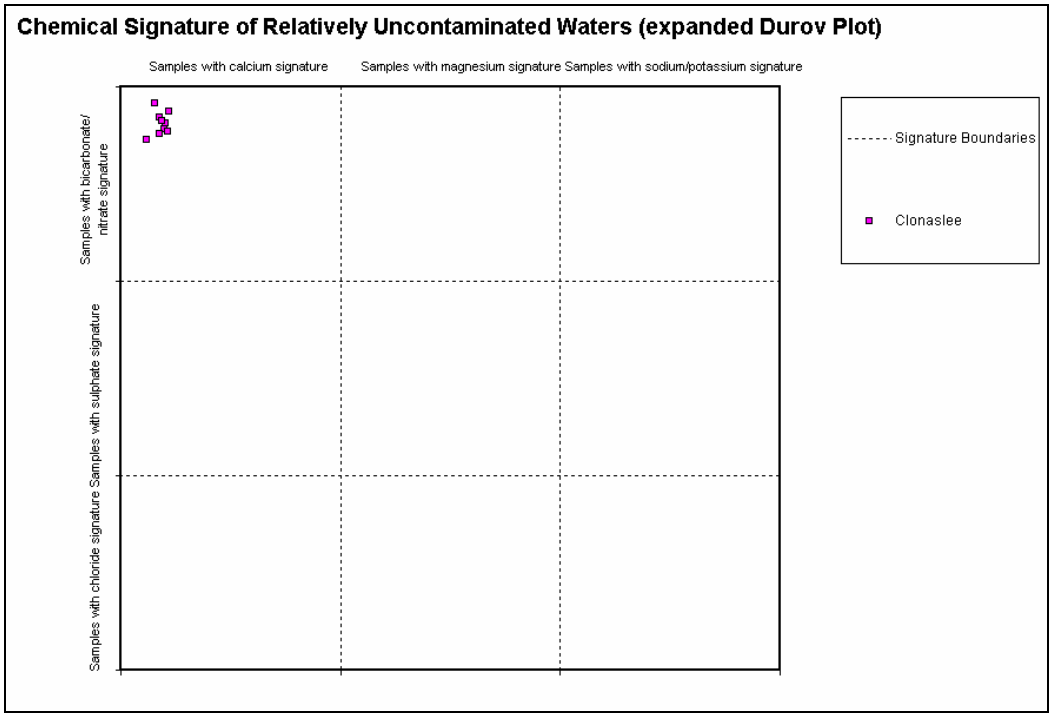
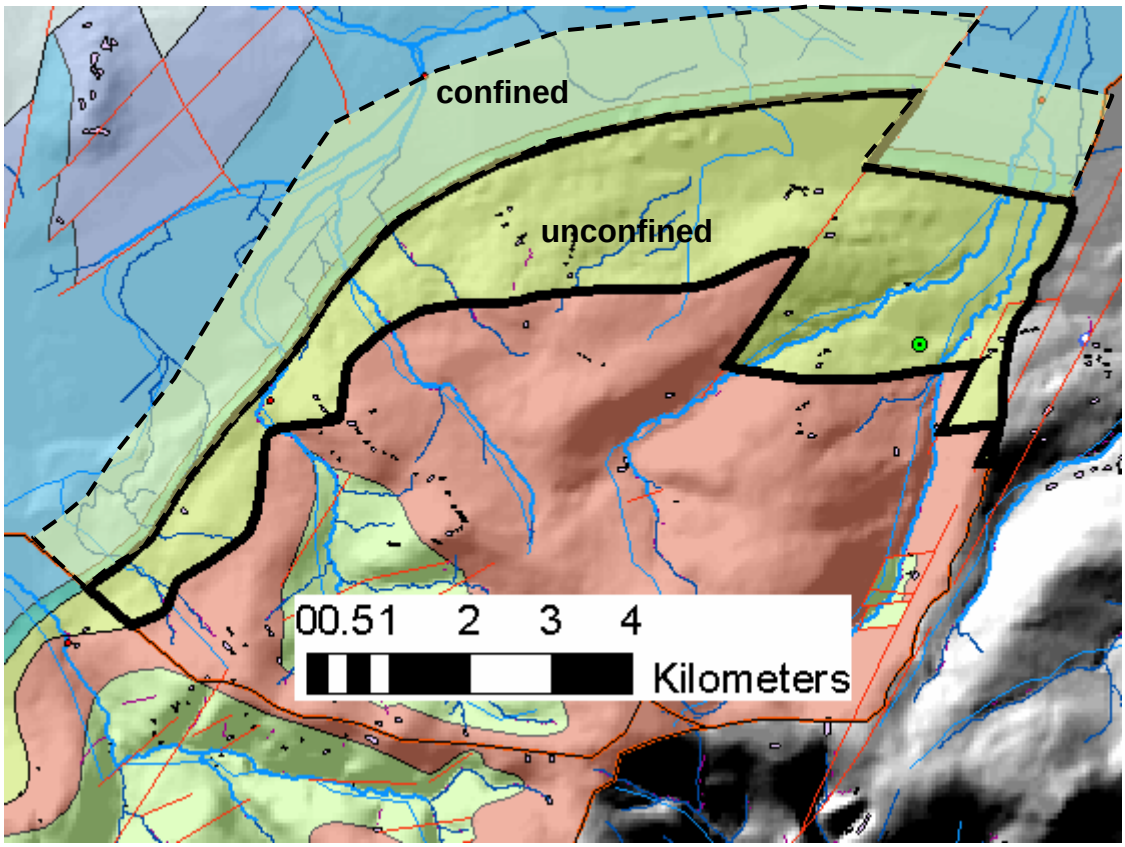


Figure 2: Hydrochemical signature





Rock units in GWB

Rock unit name and code	Description	Rock unit group	Aquifer Classification
Clonaslee Sandstone Member (CWcl)	Thick, flaggy sandstone, thin siltstone	Kiltorcan-type Sandstones	Rf