

**Kilkenny GWB: Summary of Initial Characterisation.**

Hydrometric Area Local Authority		Associated surface water bodies	Associated terrestrial ecosystems	Area (km <sup>2</sup> )
15 – Nore Kilkenny Co Co S. Tipperary Co Co		King's, Ballintaggart Stream, Munster, Desart Stream, Bregagh, Ennisnag Stream, Nore, Brownstown Stream,	Newpark Marsh, Lough Macask, Dunmore Complex, Archersgrove.	152
<b>Topography</b>		The topography is dominated by the Slieveardagh Hills which border the northern area of the groundwater body. The topographic gradients are greatly reduced below 100m OD. Surface drainage is to the south off the hills and there is a low drainage density south of Kilkenny town.		
<b>Geology and Aquifers</b>	Aquifer type(s)	<b>Rk:</b> Regionally Important Karstified Aquifer.		
	Main aquifer lithologies	BM: Ballyadams Formation - Pale-grey thick-bedded pure fossiliferous limestone. CL: Clogrenan Formation - Thinly bedded bluish-grey pure limestones, regularly cherty. Both formations comprise thick-bedded pure limestones, with beds getting thinner and somewhat cherty in the Clogrenan.		
	Key structures.	The pure nature of the limestone means that the deformation brought about by the Variscan folding episode will have resulted in extensive brittle fracturing.		
	Key properties	As with most karstic systems, permeability and transmissivity data are very variable. Daly (1994) cites a range in permeability of 0.1 m/day to 100 m/day, and a range in transmissivity of 5 m <sup>2</sup> /day to 3000 m <sup>2</sup> /day. Groundwater gradients??		
	Thickness	Karstification is likely to concentrate within 20 m of the top of the rock in this formation (Cawley, 1990). Most groundwater flow is likely to be concentrated in this upper zone, and E.P. Daly (1994) has estimated that the maximum saturated and permeable part of the aquifer is 75 m thick.		
<b>Overlying Strata</b>	Lithologies	There are two significant sand and gravel deposits overlying this aquifer at Kilkenny and Kilmanagh. Both deposits are considered to be aquifers and groundwater bodies in their own right. The remainder of the aquifer is covered by glacial till.		
	Thickness	Depth to bedrock is substantial (over 10m) over the southern sections of this groundwater body. In the north the thickness is less than 5 metres, and towards the eastern boundary of the body <3m thick in places.		
	% area aquifer near surface	There is a low percentage of this aquifer close to the surface. The exceptions are towards the eastern boundary and also some isolated patches elsewhere.		
	Vulnerability	East of the Nore the vulnerability is Low in the southern band of the aquifer and Moderate elsewhere. To the east there are large areas of Extreme vulnerability.		
<b>Recharge</b>	Main recharge mechanisms	Significant amounts of recharge to the aquifer will enter via swallowholes. There is a cluster of such karst features located southwest of Kilkenny around Shellumsrath. This form of point recharge is typical of karstic aquifers. It is also important to note that it is derived from rain that has fallen outside this groundwater body. This makes the estimation of recharge values more complicated.		
	Est. recharge rates	[Recharge estimates will be added at a later date]		
<b>Discharge</b>	Springs and large known abstractions	A Full list of Groundwater abstractions greater than 10m <sup>3</sup> /d will be provided at a later date. Clarabricken GWS (7), Clara GWS, Clifden GWS (17), Rathcash GWS, Shellumsrath (17 & 12), St. Pat's School (38).		
	Main discharge mechanisms	The aquifer discharges via numerous large springs close to the main river channels or directly into the rivers. In a mathematical analysis of the spring and stream flows in the Nuenna Valley, Cawley (1990) describes a significant portion (??%) of the groundwater discharge from this karstic aquifer, particularly in winter, as "quickflow". This is essentially conduit flow and confirms the visual and other evidence of this type of flow in this aquifer.		
	Hydrochemical Signature	Waters are typically 'hard' to 'very hard', with a neutral pH and with calcium/bicarbonate as the dominant ions. This signature is thought to reflect the generally shallow nature of flows within the karst aquifer. Typical electrical conductivity is around 650 µs/cm.		
<b>Groundwater Flow Paths</b>		In karstic areas, groundwater flow velocities are typically tens of metres per hour. Though the groundwater flow system is karstic, Cawley, 1990's study of 43 wells in the aquifer showed that a continuous watertable does exist, indicating that flow in the aquifer may be through a diffuse network of conduits. Due to the predominance of conduit flow in karst systems, large fluctuations in watertable levels are expected, particularly in areas of elevated topography. These very high annual fluctuations are considered indicative of relatively low groundwater storage potential.		
<b>Groundwater &amp; surface water interactions.</b>		This aquifer makes a major contribution to the baseflow of the Nore River (Daly 1994). Where the aquifer occurs close to the surface, stream densities are low. In fact, surface water sinks underground in many areas where the aquifer is at surface. These occur where streams, flowing off areas of thicker subsoil to the west, meet an area where the karst aquifer comes very close to the surface.		

<b>Conceptual model</b>	<p>This body is defined to the east and west by the boundaries of the Nore Basin and hence stretches the width of the basin. The boundary between the Namurian shales and the Clogrenan Limestone defines the boundary to the north and the southern boundary is defined by the contact between the Ballyadams Limestone and the Calp-like formations.</p> <p>The pure nature of the limestone means that the rocks are susceptible to dissolution. Coupled with the probability of extensive fracturing, this means that the aquifer is likely to be karstified. This is supported by the presence of many recorded karst features. Some portions of the Ballyadams Limestone are dolomitised, which is likely to enhance the development of permeability. Where the aquifer is protected from dissolution by the presence of the Namurian shale above it, significant karstification and permeability is not believed to exist (Daly, E.P., 1994). Similarly, where the Namurian has been eroded away in only recent geological times, karstification and permeability are likely to be limited.</p>
<b>Attachments</b>	
<b>Instrumentation</b>	<p>Stream gauge: 15002, 15040  Borehole Hydrograph: none  EPA Representative Monitoring boreholes: Clara GWS (#41 - 577553), Clifden GWS (#13 - S583555) Rathcash GWS (#55 - 587551) Kilkenny Cattle Mart (#72 - S510565), Avonmore Dairy Kilkenny City (#49 – S508565)</p>
<b>Information Sources</b>	<p>Buckley, R. &amp; Fitzsimons, V. (2002) Kilkenny Co Co Groundwater Protection Scheme.  Cawley, A., (1990) The hydrological analysis of a karst aquifer system. Unpublished M.Eng.Sc. Dissertation University College Galway.  Daly, E.P. (1994) The Groundwater Resources of the Nore River Basin. Geol. Surv. Ire. Unpubl. Rep</p>
<b>Disclaimer</b>	<p>Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae</p>