

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

Hydrometric Area Local Authority	Associated surface water bodies	Associated terrestrial ecosystems	Area (km <sup>2</sup> )
Hydrometric Area 36  Cavan Co. Co. Leitrim Co. Co.	<b>Rivers:</b> Annalee, Cavan, Cullies, Erne. <b>Streams:</b> Laheen, 141 unnamed streams. <b>Lakes:</b> Aghabane, Ardan, Bawn, Black, Broompark, Burtbog, Carn, Carrs, Coalpit, Corglass, Corrala, Deerpark, Deraik, Derreskit, Derrindrehid, Derrybrick, Derrygid, Disert, Doo, Drumergoole, Drumlane, Drummany, Dumb, Farnham, Glasshouse, Kinaman, Kinkeel, Laheen, Atrain, Bane, Inchin, Oughter, Mullaghdoe, Pattersons, Peartree, Pleasure, Swan, Sweelan, Tawlaght, Town, Tully, Tullyguide.	Lough Oughter and Associated Loughs (O’Riain, 2004)	148
<b>Topography</b>	This ‘L’-shaped GWB is bounded by more productive rocks to the north and northeast, less productive rock to the south and southeast and a topographic divide to the west (Hydrometric Area 36). The entire GWB is dominated by drumlin topography, which have and approximately N-S alignment. Typical inter-drumlin elevations range from 50 mAOD around Lough Oughter to c.80 mAOD in the north and northwest. The drumlin peaks are generally an additional 40-60 m. The interconnected lakes of the Lough Oughter network in the central-eastern area are the predominant surface water feature in the GWB, with rivers and streams generally flowing eastwards into Lough Oughter.		
<b>Geology and Aquifers</b>	<b>Aquifer type(s)</b>	The vast majority of the GWB (c.97%) comprises <b>LI</b> : Locally important aquifer, moderately productive only in local zones although there is a thin band of <b>Lm</b> : Locally important aquifer, generally moderately productive along the southern boundary of the GWB.	
	<b>Main aquifer lithologies</b>	The GWB comprises rocks of Dinantian age: Lower Impure Limestones (40.80%); Shales and Limestones (30.07%); Early Sandstones, Shales and Limestones (22.38%) and Upper Impure Limestones (3.78%). Refer to Table 1 for details.	
	<b>Key structures.</b>	The rocks are approximately aligned NE-SE and generally dip to the NW by up to 50°. There are 4 major N-S trending faults across the body and more densely spaced NE-SW faults in the southeast.	
	<b>Key properties</b>	Of the 44 available yields ranging from 22-3273 m <sup>3</sup> /d, 33 have ‘good’ or ‘excellent’ (8) yields. Only 8 of these wells have available specific capacity values – 8.5-181 m <sup>3</sup> /d/m, averaging c.50 m <sup>3</sup> /d/m. The remaining 11 lower yielding wells have specific capacity values of 2.0-15.4 m <sup>3</sup> /d/m, averaging 5.7 m <sup>3</sup> /d/m. In total, the overall average specific capacity for the GWB is c.25 m <sup>3</sup> /d/m.  One transmissivity value is available for this GWB in the Early Sandstones, Shales and Limestones – 287 m <sup>2</sup> /d (NERDO Report, 1981). However, the groundwater monitored in this particular well a-typical of this GWB as the NERDO Report indicates that this well may be influenced by a ‘sulphate-rich’, lower confined aquifer’, and not be part of the general groundwater system of this GWB, which is related to the Erne and its tributaries.  Nationally, transmissivity values for these rocks are low (<20 m <sup>2</sup> /d in most rocks) although higher values may be achieved in the coarser-grained rocks and in faulted zones, which may reflect the conditions in this GWB. Storativity is generally expected to be relatively low to possibly moderate.  Just under 65% of 80 available groundwater levels are 0-10 m below ground level (35% are <5 m). The data are inadequate to calculate groundwater gradients however, they are expected to be relatively steep, given the lower permeability of the rock.  <i>(Dinantian Aquifer Chapters)</i>	
	<b>Thickness</b>	Most groundwater flux will be in the uppermost part of the aquifer comprising a broken and weathered zone typically less than 3 m thick, a zone of interconnected fissuring 10-15 m thick (c.50% of water levels between 5-15 m bgl), and a zone of isolated poorly connected fissuring typically less than 150 m. Water strikes in 2 boreholes are noted between 16-61 m bgl, suggesting that slightly deeper flows do exist.	
<b>Overlying Strata</b>	<b>Lithologies</b>	The GWB is predominantly covered by till subsoil (66%), with smaller proportions of peat (6%) and alluvium (4%). Subsoil has not been mapped in the west of the GWB (19% – Leitrim).	
	<b>Thickness</b>	Across the GWB, outcrop and borehole data suggest that the subsoil is generally thick (>3 m) with the drumlins representing very thick deposits (frequently >10 m thick). Thinner subsoil (<3 m) may occur in the inter-drumlin area, and potentially more so in the south-eastern portion of the GWB.	
	<b>% area aquifer near surface</b>	<i>[Information will be added at a later date]</i>	
	<b>Vulnerability</b>	Although maps are not available, the vulnerability is likely to be extreme where subsoil is thin or absent (possibly the inter-drumlin areas), with the drumlins representing probable areas of moderate or low vulnerability.	
<b>Recharge</b>	<b>Main recharge mechanisms</b>	Diffuse recharge occurs via rainfall percolating through the thinner/more permeable subsoil and via outcrops. Due to the low permeability and thickness of some of the subsoil (thicker tills and peat), and the aquifers in the GWB, a high proportion of the effective rainfall will discharge to the streams. In addition, the steep drumlin slopes will promote surface runoff. The relatively high stream density is likely to be influenced by the lower permeability rocks as well as the subsoil.	

**1<sup>st</sup> Draft Killashandra GWB Description – November 2004**

	<b>Est. recharge rates</b>	<i>[Information will be added at a later date]</i>
<b>Discharge</b>	<b>Important springs and high yielding wells</b>	<p>Springs: None identified.</p> <p>Sources: None identified.</p> <p>Excellent Wells: Milltown (3273 m<sup>3</sup>/d, 890 m<sup>3</sup>/d, 550 m<sup>3</sup>/d); Killashandra (2182 m<sup>3</sup>/d*2, 600 m<sup>3</sup>/d); Derrybrick (260 m<sup>3</sup>/d) Cavan (no yield).</p> <p>Good Wells: Killygorman (259 m<sup>3</sup>/d, 126 m<sup>3</sup>/d, 109 m<sup>3</sup>/d*2); Evalagh (196 m<sup>3</sup>/d); Coraspoint (164 m<sup>3</sup>/d), Aghnacreevy (152 m<sup>3</sup>/d, 104 m<sup>3</sup>/d), Latt (142 m<sup>3</sup>/d), Lisdaran (131 m<sup>3</sup>/d), Swellen (131 m<sup>3</sup>/d), Raleagh (131 m<sup>3</sup>/d), Drumshangore (109 m<sup>3</sup>/d), Derrinlester (109 m<sup>3</sup>/d), Tonaloy (109 m<sup>3</sup>/d), Drummany (109 m<sup>3</sup>/d*2), Laheen (190 m<sup>3</sup>/d), Drumgoohy (109 m<sup>3</sup>/d), Drumcanon (104 m<sup>3</sup>/d), Killygowan (104 m<sup>3</sup>/d), Croghan (104 m<sup>3</sup>/d).</p>
	<b>Main discharge mechanisms</b>	The main groundwater discharges are to the lakes and rivers and streams crossing the GWB, reflecting short groundwater flow paths. Small springs and seeps are likely to issue at the stream heads and along their course. Groundwater may also flow into the adjacent, higher permeability GWBs (Lm and Rk <sup>c</sup> ).
	<b>Hydrochemical Signature</b>	<p><b>National classification:</b> Dinantian Rocks (excluding Sandstones)</p> <p>Calcareous. Generally Ca- HCO<sub>3</sub> signature. However, influence of evaporates in Monaghan-Cavan-Leitrim area result in naturally occurring Na/K-HCO<sub>3</sub> or Mg-HCO<sub>3</sub> or Ca-SO<sub>4</sub> signatures.</p> <p>Alkalinity (mg/l as CaCO<sub>3</sub>): range of 10-990; mean of 283 (2454 data points)</p> <p>Total Hardness (mg/l): range of 10-1940; mean of 339 (2146 data points)</p> <p>Conductivity (μS/cm): range of 76-2999; mean of 691 (2663 data points)</p> <p><i>(Calcareous/Non calcareous classification of bedrock in the Republic of Ireland report)</i></p>
	<b>Groundwater Flow Paths</b>	In the absence of inter-granular permeability, groundwater flow is expected to be concentrated in fractured and weathered zones and in the vicinity of fault zones. Available groundwater levels are mainly 0-15 m below ground level. Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to nearby lakes, streams and small springs. There are observed deeper water strikes, indicating that there is a component of deep groundwater flow, however shallow groundwater flow is dominant. Groundwater flow directions are expected to follow topography – overall in a easterly direction.
	<b>Groundwater &amp; surface water interactions</b>	Groundwater will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low.
<b>Conceptual model</b>	<ul style="list-style-type: none"> <li>Northern, eastern and southern boundaries are different aquifer types. The western boundary is marked a topographic divide. The terrain is characterised by drumlins throughout and the interconnected lakes of Lough Oughter in the central-eastern area.</li> <li>The GWB is composed primarily of low transmissivity rocks. Most of the groundwater flux is in the uppermost part of the aquifer: comprising a broken and weathered zone typically less than 3m thick; a zone of interconnected fissuring typically less than 15m; and a zone of isolated fissuring typically less than 150m.</li> <li>Recharge occurs diffusely through the thin/permeable subsoil and via outcrops, although is limited by any thicker, low permeability subsoil and the lower permeability bedrock itself. Therefore, most of the effective rainfall is not expected to recharge the aquifer.</li> <li>Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to the lakes and streams crossing the aquifer, and to small springs and seeps. Overall, the flow direction is expected to be to the east, as determined by the topography.</li> </ul>	
	<b>Attachments</b>	Figure 1. Figure 2. Table 1.
	<b>Instrumentation</b>	<p><b>Stream gauges:</b> 36013, 36096, 36144, 36156.</p> <p><b>EPA Water Level Monitoring boreholes:</b> CAV126, CAV144</p> <p><b>EPA Representative Monitoring points:</b> CAV12, CAV15, CAV23, CAV24, CAV25, CAV33, CAV35, CAV41, CAV42, CAV49, CAV53, CAV54, CAV107, CAV108, CAV110.</p>
	<b>Information Sources</b>	<p>An Foras Forbartha and Geological Survey of Ireland (1981). <i>Groundwater Resources in the N.E. (R.D.O.) Region</i>; Main Report and Technical Appendices, Volumes 2, 3. 170pp.</p> <p>Geraghty, M., Farrelly, I., Claringbold, K., Jordan, C., Meehan, R., and Hudson, M., 1997. <i>Geology of Monaghan-Carlingford. A geological description to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 8/9, Monaghan-Carlingford</i>. Geraghty, M. (ed.). Geological Survey of Ireland. 60 p.</p> <p>Morris J.H., Somerville I.D. and MacDermot C.V. (2002). <i>Geology of Longford-Roscommon</i>. A Geological Description to Accompany the Bedrock Geology 1:100,000 Bedrock Series Sheet 12. With contributions by D.G. Smith, M. Geraghty, B. McConnell, K. Claringbold, W. Cox and M. Lee. Geological Survey of Ireland, 121pp.</p> <p>O' Riain, G. 2004. <i>Water Dependent Ecosystems and Subtypes (Draft)</i>. Compass Informatics in association with National Parks and Wildlife (DEHLG). WFD support projects.</p>
	<b>Disclaimer</b>	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

Figure 1. Location and boundaries of Killashandra GWB.

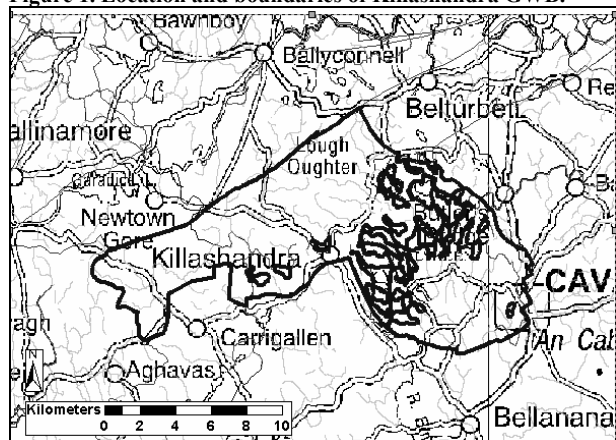


Table 1. List of Rock units in Killashandra GWB

Rock Unit Name	Code	Description	Rock Unit Group	Aquifer Class.	% Area
Ballysteen Formation	BA	Dark muddy limestone, shale	Dinantian Lower Impure Limestones	L1	40.80%
Drumgesh Shale Formation	DH	Dark shale, fine-grained limestone	Dinantian Shales and Limestones	L1	30.07%
Cooldaragh Formation	CH	Pale brown-grey flaggy, silty mudstone	Dinantian (early) Sandstones, Shales and Limestones	L1	17.52%
Ulster Canal Formation	UC	Calcareous sandstone, shale, micrite	Dinantian (early) Sandstones, Shales and Limestones	L1	3.93%
Fearnaght Formation	FT	Pale conglomerate & red sandstone	Dinantian Sandstones	Lm	2.96%
Calp	CP	Dark grey to black limestone & shale	Dinantian Upper Impure Limestones	L1	2.82%
Kilmore Slump Member	CPkm	Intraformational limestone turbidite	Dinantian Upper Impure Limestones	L1	0.96%
Cooldaragh Formation	CH	Pale brown-grey flaggy, silty mudstone	Dinantian (early) Sandstones, Shales and Limestones	L1	0.94%

Figure 2. Groundwater hydrographs (EPA Groundwater Level Monitoring)

