

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

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km <sup>2</sup> )	
19 Cork Co. Co.	<p><b>Rivers:</b> Awboy, Blarney, Butterstown, Dissour, Dripsey, Dungourney, Foherish, Glashaboy, Glasheen, Kilha, Leamlara, Owenboy, Owennacurra, Owennagearagh, Bride, Laney, Lee, Martin, Shournagh, Sullane, Toon, Tramore, Womanagh, Aughnaboy, Butlerstown, Caha, Cummer, Cusloura, Douglas, Finnow, Garrane, Keel, Templebodan.</p> <p><b>Lakes:</b> Blarney, Cleanrath, Gouganebarra, Kilbanna, Allua, Beg, Carrignafurark, Carrignamork, Gal, Nambrackderg, Ovens, Quarry, River Lee Reservoirs</p>	<p>Mullaghanish Bog (001890), Blarney Bog (001857), Glashgarriff River (001055), Blarney Lake (001798), Douglas River Estuary (001046), Lough Allua (001065), Owenboy River (001990), Gouganebarra Lake (001057)</p> <p><i>To be re-checked</i></p>	1762	
Topography	<p>This GWB occupies the uplands of the Lee catchment and its tributaries in County Cork. The GWB is bounded to the north by the Glenville GWB, and to the south by the Bandon GWB. The Ballincollig and Midleton karstic GWBs intrude deep into this GWB. The topography is very rugged in the west, encompassing the Sheehy, Derrynasaggart and Boggeragh mountains. Ground elevations range from sea level to over 500 m OD.</p>			
	Geology and Aquifers	<p><b>Aquifer categories</b></p>	<p><b>LI:</b> Locally important aquifer which is moderately productive only in local zones (86%).  <b>PI:</b> Poor aquifer which is generally unproductive except for local zones (14%).</p> <p><i>There are also some very small areas with an aquifer category of:</i>  <b>Rk<sup>d</sup>*/Pending Classification:</b> *Where these rocks occur in other areas they are classified as Rk<sup>d</sup>. In this GWB they may be karstified but are unlikely to be regionally important due to their small size (&lt;10km<sup>2</sup>) – a new classification code to represent these areas is pending (&lt;1%)</p>	
		<p><b>Main aquifer lithologies</b></p>	<p>Devonian Old Red Sandstones (92%); Dinantian Mudstones and Sandstones (Cork Group) (6%); Namurian Sandstones (1%); Dinantian Pure Unbedded Limestones (0.5%); Dinantian Lower Impure Limestones (0.1%).</p>	
		<p><b>Key structures</b></p>	<p>The rocks have been folded into anticlines and synclines, with approximately East-West axes, by the Variscan Orogeny. The rocks are also broken by a strong system of steeply-dipping cross faults running approximately NNW-SSE, roughly at right angles to the fold axes. There are also other faults roughly parallel to the fold axes.</p> <p>The widespread faulting and folding has given rise to zones of enhanced permeability in the mudstones and sandstones. These can occur close to faults and fold axes, but such zones are generally local.</p>	
		<p><b>Key properties</b></p>	<p>Permeability generally decreases rapidly with depth in all aquifers. In general, transmissivities will be in the range 2-20 m<sup>2</sup>/d, with median values towards the lower end of the range. However, ‘Excellent’ yielding wells (&gt;400 m<sup>3</sup>/d) are known in some of the ORS units – these yields are usually associated with boreholes being situated on fault zones. Summer yields are sometimes unsustainable. Aquifer storativity will be low in all rock units. Groundwater gradients are likely to be in the range 0.01 to 0.04.</p> <p>Storativity is low, but may be enhanced by overlying sand and gravel deposits which are in continuity.</p>	
<p><b>Thickness</b></p>		<p>The Dinantian Mudstones and Sandstones (Cork Group) and Devonian Old Red Sandstone units form sequences which can be several kilometres thick (Sleeman &amp; Pracht, 1994). However, in all aquifers within this GWB, most groundwater flow occurs within the top 15-20 m of the aquifer, in the layer that comprises a weathered zone of a few metres and a connected fractured zone below this. Deeper flows occur along generally isolated faults or significant fractures.</p>		
Overlying Strata	<p><b>Lithologies</b></p> <p><i>Subsoil Types identified in Ballinhassig GWB by Teagasc Parent Material Mapping (Draft): Alluvium (A); Blanket Peat (BktPt); Cutover Peat (Cut); Sandstone sands and gravels (Devonian) (GDSs); Lake Sediments (Undifferentiated); Made Ground (Made); Rock outcrop and rock close to surface (Rck); Till – Devonian Sandstone Till (TDSs).</i></p> <p>Till is the most widespread subsoil in Cork. Tills found close to bedrock and where the deposits are relatively thin, comprise a coarse matrix with angular clasts and can be described as broken up bedrock or immature till.</p> <p>Sands and gravels occur in isolated areas along the Sullane River in western areas of South Cork at Ballyvourney and Carrigaphooca as well as at Dunisky on the River Lee.</p>			

	<p><b>Thickness</b></p>	<p>In general the subsoils are relatively shallow with about 50% of the total area estimated to have less than 3m of subsoil cover. The thinnest subsoils and areas of 'rock close to surface' occur in the smaller valleys where there are rock outcrops along the stream beds; along the east - west trending ridges, particularly in centre and east of the region; and in the mountains in West Cork (Derrynasaggart, Boggeragh). Depth to bedrock is also seen to be very shallow in a lot of coastal areas around the cliffs of South Cork. The thickest deposits are generally encountered in the major river valleys of the Lee, Bride and Bandon.</p> <p>The most frequent occurrences of outcrop and shallow rock are found in the west of the region near Macroom and the Derrynasaggart and Boggeragh Mountains. Subsoil depths of 10-15m are occasionally recorded in this region. In the south of the region there are also frequent occurrences of outcrop and shallow rock particularly in coastal areas and along river valleys. Outside areas of outcrop and shallow rock, subsoils are generally &lt;10m deep, although depths of &gt;10m are occasionally recorded.</p> <p>In general sand and gravel deposits are usually more than 10 m thick, in particular where they have been laid down with tills as morainic deposits. Thicknesses of lake, alluvial and estuarine deposits are usually unknown but it is unlikely that they are more than 10 m thick. Peat on higher ground is typically 3 m thick or less.</p>
	<p><b>% area aquifer near surface</b></p>	<p>High</p>
	<p><b>Vulnerability</b></p>	<p>A large proportion of the county is classed as having either extreme or high vulnerability while areas of moderate and low vulnerability are much less common. The 3 m contour, which influences the extreme and high vulnerability categories, is based on outcrop information, Quaternary mapping and borehole data. There may be more areas of moderate and low vulnerability than currently depicted.</p>
<p><b>Recharge</b></p>	<p><b>Main recharge mechanisms</b></p>	<p>Diffuse recharge will occur via rainfall percolating through the subsoil or areas of outcropping rock. The generally 'moderate' permeability subsoils will generally not restrict percolation of recharge. However, due to the generally low permeability of the aquifers within this GWB, and the high slopes, a high proportion of the recharge will discharge rapidly to surface watercourses via the upper layers of the aquifer, effectively reducing further the available groundwater resource in the aquifer.</p>
	<p><b>Est. recharge rates</b></p>	<p><i>To be assessed.</i></p>
<p><b>Discharge</b></p>	<p><b>Large springs and high yielding wells (m<sup>3</sup>/d)</b></p>	<p><i>Note: The following data need to be checked and updated by RBD Project Consultants.</i></p> <p>Data from GSI Well Database:                      Additional data from EPA Groundwater Sources List:                      Excellent BH – Knockmonalea (436 m<sup>3</sup> /d), Courtbrack (873 m<sup>3</sup> /d), Gurteen (&gt;400 m<sup>3</sup> /d)                      Good BHs (general)– No. of BHs &gt; 300 m<sup>3</sup>/d = 1                        &gt; 200 m<sup>3</sup>/d = 12                        &gt; 100 m<sup>3</sup>/d = 44</p> <p>Water Schemes – Coachford WS (122 m<sup>3</sup> /d), Grenagh WS (147 m<sup>3</sup> /d), Macroom U.D. WS, infil Gallery (1700 m<sup>3</sup> /d), Rylane WS (150 m<sup>3</sup> /d). <i>(All WS listed above are BHs &gt; 100m<sup>3</sup>/d unless stated otherwise)</i></p>
	<p><b>Main discharge mechanisms</b></p>	<p>The main discharges are to the gaining rivers and streams crossing the sandstones, mudstones, shales and impure limestone rock units and to generally small springs and seeps. Groundwater will also discharge at the coast. Localised seepages may develop on the cliff faces. Cross-flow may occur from the aquifers in this GWB to the adjacent karstic GWBs.</p>
	<p><b>Hydrochemical Signature</b></p>	<p>This GWB is underlain by non-carbonate rock units, which include Old Red Sandstone rocks and the sandstones and mudstones of the Cork Group. Alkalinity ranges about 10-300 mg/l (as CaCO<sub>3</sub>) and hardness ranges about 40-220 mg/l (moderately soft to moderately hard). The Old Red Sandstone formations largely contain calcium bicarbonate type water. Conductivities in these units are relatively low, ranging 125-600 μS/cm, with an average of about 300 μS/cm. Conductivities in the Cork Group rocks are quite similar with an average of 380 μS/cm and a range from 160 to 430 μS/cm. In general, high iron (Fe) and manganese (Mn) concentrations can occur in groundwater derived from ORS, due to the dissolution of Fe and Mn from the sandstone/shale where reducing conditions occur. Background chloride concentrations in all aquifers will be higher than in the Midlands, due to the proximity to the sea.</p>
<p><b>Groundwater Flow Paths</b></p>	<p>The Devonian ORS and Dinantian Mudstones &amp; Sandstones of this GWB have no intergranular permeability; groundwater flow occurs in fractures and faults; in-filling of fractures is to be expected. The permeability of individual fractures and the degree of interconnection will be generally low, with fracturing confined to local zones. Permeability is highest in the upper few metres but generally decreases rapidly with depth. In general, groundwater flow is concentrated in the upper 15 m of the aquifer, although deeper inflows from along fault zones or connected fractures can be encountered. Significant yields can be obtained where boreholes are drilled into known fault zones. In these rocks groundwater flow paths are expected to be relatively short, typically from 30-300 m, with groundwater discharging to small springs, or to the streams that traverse the aquifer. Flow directions are expected to approximately follow the local surface water catchments. Groundwater is generally unconfined.</p>	

**1<sup>st</sup> Draft Ballinhassig GWB Description – .....2004**

<b>Groundwater &amp; Surface water interactions</b>	Groundwater in the Devonian ORS and Dinantian Mudstones & Sandstones (Cork Groups) 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.
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<b>Conceptual model</b>	<ul style="list-style-type: none"> <li>• The groundwater body is bounded to the south by the Bandon GWB, and to the north by the Glenville GWB</li> <li>• The topography of this body is rugged, especially in the west, and elevations range from sea level to over 500 metres.</li> <li>• The groundwater body primarily comprises Devonian ORS and Dinantian Mudstones &amp; Sandstones (Cork Group) which have low transmissivity and storativity, although localised zones of enhanced permeability occur along fault zones. Flow occurs along fractures, joints and faults. Flows in the aquifer are generally concentrated in a thin zone at the top of the rock, although deeper groundwater flows along faults and major fractures.</li> <li>• Diffuse recharge occurs across the GWB through the subsoils and rock outcrops.</li> <li>• The water table can vary from a few metres up to more than 10 m below ground surface, depending upon topography. Groundwater is generally unconfined. Flow path lengths are generally short, ranging from 30-300 m. Local groundwater flow directions are controlled by local topography.</li> </ul> <p>Groundwater discharges to the numerous streams and rivers crossing the aquifer and to small springs and seeps.</p>
<b>Attachments</b>	
<b>Instrumentation</b>	<p><b>Stream gauges:</b> 19001*, 19004, 19006*, 19007, 19008, 19009, 19010, 19011, 19013, 19015*, 19017*, 19018, 19020, 19021, 19023, 19024, 19027, 19028, 19030, 19031*, 19032, 19033, 19034, 19036, 19037, 19038, 19039, 19040, 19041, 19042, 19043, 19044, 19045, 19046, 19047, 19048, 19060, 19066, 19090, 19091.</p> <p>* Dry water Flow available</p> <p><b>EPA Water Level Monitoring boreholes:</b> Kilnamatra (COS 34)</p> <p><b>EPA Representative Monitoring points:</b> Ballincurrag (COS 4), Dungourney WS (COS 25), Rylane WS-south BH (COS 48), White Cross WS (COS 52), Rylane WS-north BH (COS 162)</p>
<b>Information Sources</b>	<p>Kelly D, Leader U, Wright G (2002) <i>South Cork Groundwater Protection Scheme</i>. Main Report. Final Report to South Cork County Council. Geological Survey of Ireland.</p> <p>Sleeman AG, Pracht M (1994) <i>Geology of South Cork. A geological description of South Cork to accompany the Bedrock Geology 1:100,000 Map Series, Sheet 25</i>. Geological Survey of Ireland, 59pp</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

**List of Rock units in Ballinhassig GWB**

<b>Rock unit name and code</b>	<b>Description</b>	<b>Rock unit group</b>	<b>Aquifer Classification</b>
White Strand Formation	Sandstone & interbedded pyritic mudstone	Namurian Sandstones	L1
Lispatrick Formation (LP)	Pyritic cherty mudstone with dolomite	Dinantian Mudstones and Sandstones (Cork Group)	L1
Courtmacsherry Formation (CY)	Calcareous mudstone with limestone	Dinantian Mudstones and Sandstones (Cork Group)	L1
Ardaturrish Member (KNat)	Black mudstone & silt-lensed mudstone	Dinantian Mudstones and Sandstones (Cork Group)	L1
Pigs Cove Member ((KNpc)	Sand-lensed mudstone	Dinantian Mudstones and Sandstones (Cork Group)	L1
Narrow Cove Member (KNnc)	Flaser-bedded sandstone & mudstone	Dinantian Mudstones and Sandstones (Cork Group)	L1
Cuskinny Member (Kncu)	Flaser-bedded sandstone & mudstone	Dinantian Mudstones and Sandstones (Cork Group)	L1
Old Head Sandstone Formation (OH)	Flaser-bedded sandstone & minor mudstone	Dinantian Mudstones and Sandstones (Cork Group)	L1
Old Red Sandstone (undifferentiated) ORS	Red conglomerate, sandstone & mudstone	Devonian Old Red Sandstones	L1
Little Island Formation (LI)	Massive and crinoidal fine limestone	Dinantian Pure Unbedded Limestones	<i>Rk<sup>d</sup>*/Pending Classification</i>
Waulsortian Limestones (WA)	Massive unbedded lime-mudstone	Dinantian Pure Unbedded Limestones	<i>Rk<sup>d</sup>*/Pending Classification</i>
Ballysteen Formation (BA)	Fossiliferous dark-grey muddy limestone	Dinantian Lower Impure Limestones	L1
Ringmoylan Formation (RM)	Calcareous shale & crinoidal limestone	Dinantian (early) Sandstones, Shales and Limestones	P1
Gyleen Formation (GY)	Sandstone with mudstone & siltstone	Devonian Old Red Sandstones	L1
Ballyknock Member (Gybn)	Green sandstone, siltstone & mudstone	Devonian Old Red Sandstones	L1
Ballytrasna Formation (BS)	Purple mudstone and sandstone	Devonian Old Red Sandstones	L1
Toe Head Formation (TH)	Cross-bedded sandstone & minor mudstone	Devonian Old Red Sandstones	L1
Castlehaven Formation (CE)	Purple mudstone and siltstone	Devonian Old Red Sandstones	P1
Gun Point Formation (GP)	Green-grey sandstone & purple siltstone	Devonian Old Red Sandstones	L1
Caha Mountain Formation (CH)	Purple & green sandstone & siltstone	Devonian Old Red Sandstones	P1
Gortanimill Formation (GM)	Sandstone and siltstone	Devonian Old Red Sandstones	L1
Slaheny Sandstone Formation (SL)	Cross-bedded sandstone & siltstone	Devonian Old Red Sandstones	L1
Bird Hill Formation	Purple siltstone & fine sandstone	Devonian Old Red Sandstones	P1
Glenflesk Chloritic Sandstone Formation	Green sandstone & purple siltstone	Devonian Old Red Sandstones	L1