

Ballybofey GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water bodies	Associated terrestrial ecosystems	Area (km ²)
Hydrometric Area 01 Donegal Co. Co. (Northern Ireland)	Rivers: Burn Daurnett, Clogher(Finn), Cross Roads Stream, Cummirk, Elatagh, Finn (Donegal), Reelan, Rough Burn, Stranagoppoge Streams: 773-unnamed streams Lakes: Black Lough, Lough Nambraddan, Castle Lough, Lough Naroon, Croaghanard Lough Lough, Nastackagh, Croagherrib Lough, Lough Shivnagh, Cronloughan Lough Aduff, Illanicrooney Lough, Lough Assoge, Lough Arasy, Lough Doo, Lough Finn, Lough Gibbagh, Lough Glenaboghil, Lough Lilly, Lough Labia, Lough Nagarrionkagh, Lough Meenabrack, Lough Nagreal, Lough Muck, Lough Sallagh, Lough Nabastee, Meenlackdoe Lough.	Meentygrannagh Bog, Meenaguse Scragh (O' Riain, 2004)	468
Topography	Located in the southeast of County Donegal, this GWB (Figure 1) is bounded to the west, north and southwest by topographic divides (Hydrometric Areas 38, 39 and 37 respectively). The eastern and south-eastern boundaries are catchment divide for the R. Finn and the north-eastern boundary represent different aquifer types. The topography comprises higher areas cut by E-W aligned river valleys. Elevations range from c.10 mAOD along the lower reaches of the Finn valley to 680 mAOD along the southwest boundary (Bluestack Mountains). Surface water flows to the east.		
Geology and Aquifers	Aquifer type(s)	The GWB is dominated by Pl : Poor aquifer which is generally unproductive except for local zones (85%), with two main areas of Pu : Poor aquifer which is generally unproductive, in west of the GWB – roughly trending SW-NE – and in several small bands. One area of Li : Locally important aquifer, moderately productive only in local zones, is present in the body (7.5 km ²).	
	Main aquifer lithologies	Precambrian Quartzites, Gneisses & Schists is the main rock group (>90%) in this GWB, with two areas of Granites & Other Igneous Intrusive Rocks encompassing: 4.5% of the GWB underlying the Bluestack Mountains along the south-western boundary; 2.2% along the northwest boundary. There are also small areas/bands of Precambrian Marbles. Refer to Table 1 for more details.	
	Key structures	The rocks in this part of Donegal have been significantly deformed, resulting in a large number of approximately SW-NE faults (e.g. Belshade Fault). There are also a number of anticline and syncline folds in the GWB resulting in the rocks dipping in all directions between 25-85°.	
	Key properties	Well yields in the Precambrian Quartzites, Gneisses & Schists range from 10-218 m ³ /d with 3 of the 4 wells discharging <35 m ³ /d. Although there are no specific capacity or transmissivity data for the GWB, they are likely to be low, with the possibility of higher values in faulted zones, especially in the coarser-grained rocks (quartzites and gneisses). Typical specific dry weather flows for this rock group across Donegal are low (0.41-1.1 l/s/km ² at 5 stations), indicating that these aquifers have low storativity (expected to be <1%, possibly c.0.5%). All available groundwater levels (18) are 0-15 m below ground level, with 88% <3 mbgl. Although the data are inadequate to calculate groundwater gradients, these are expected to be greater than 0.01. <i>(Precambrian Aquifer Chapter; Donegal GWPS)</i>	
	Thickness	Most groundwater flux is expected to 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, and a zone of isolated poorly connected fissuring typically less than 150 m. Deeper water strikes are noted at 50 and 76 mbgl, although yields are low.	
Overlying Strata	Lithologies	The GWB is predominantly covered by peat (c.50%), with a lesser proportion of till (35%). Just under 10% is recorded as rock outcrop/shallow rock.	
	Thickness	From the Donegal GWPS, subsoil is absent or thin over the higher areas i.e. to the west of the GWB and between valleys. Deposits become thicker (>3 m) to the east, with the deepest deposits limited to the centre of river valleys (5-10 m).	
	% area aquifer near surface	<i>[Information will be added at a later date]</i>	
	Vulnerability	The majority of this GWB is classified as Extremely vulnerability, due to the high percentage of thinner subsoil and rock outcrops. Where subsoil is thicker, such as in the valleys, the vulnerability is mainly High, with occasional small areas of Moderate.	
Recharge	Main recharge mechanisms	Diffuse recharge occurs via rainfall percolating through the thinner/more permeable subsoil and rock outcrops. Due to the low permeability of the thicker peat deposits and the aquifers, a high proportion of the effective rainfall will quickly discharge to the streams in the GWB. In addition, the steep slopes in the upland areas promote surface runoff. The relatively high stream density is likely to be influenced by the lower permeability rocks.	

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	Est. recharge rates	<i>[Information will be added at a later date]</i>
Discharge	Springs and large known abstractions	Sources: None identified. Springs: None identified. Excellent wells: None identified. Good wells: 218 m ³ /d (Fintown).
	Main discharge mechanisms	The main groundwater discharges are to the 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.
	Hydrochemical Signature	No data are available within this particular GWB. <i>National classification:</i> Non-calcareous with bi-modal alkalinity distribution, although the higher range is possibly caused by thin bands of marble. Alkalinity (mg/l as CaCO ₃): range of 14-400; mean of 168 (41 'non limestone subsoils' data points) Total Hardness (mg/l): range of 46-412; mean of 200 (39 'non limestone subsoils' data points) Conductivity (μS/cm): range of 160-752; mean of 446 (45 'non limestone subsoils' data points) <i>(Calcareous/Non calcareous classification of bedrock in the Republic of Ireland report)</i>
	Groundwater Flow Paths	In the absence of inter-granular permeability, groundwater flow is expected to be concentrated in upper fractured and weathered zones and in the vicinity of fault zones. Of the 18 groundwater levels available, 88% <3 mbgl. Unconfined groundwater flow paths are short (30-300 m), with groundwater generally following the topography and then discharging rapidly to seeps, small springs and streams. Only 2 water strikes are recorded marginally deeper than the estimated interconnected fissure zone, suggesting a component of deep groundwater flow, however the yields of these wells are low and shallow flow is thought to be dominant. Overall, groundwater flow is eastwards, as determined by topography.
	Groundwater & surface water interactions	The predominantly shallow groundwater is likely to discharge rapidly to surface waters however, the baseflow proportion of total streamflow is expected to be small, as suggested by the regional specific dry weather flow data. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur.
Conceptual model	<ul style="list-style-type: none"> All GWB boundaries are topographic divides, except to the north-east, which is a change in aquifer type. The topography increases in elevation from east to west, and is generally hilly to mountainous. The areas is incised by large, parallel, W-E trending valleys. The GWB is composed primarily of low transmissivity rocks. Most of the groundwater flux is likely to be in the uppermost part of the aquifer comprising: a broken and weathered zone typically less than 3m thick; a zone of interconnected fissuring 10-15m thick; and a zone of isolated fissuring typically less than 150m. Recharge occurs diffusely through the subsoil and rock outcrops, although is limited by any thicker pockets of peat and the low permeability bedrock. Therefore, most of the effective rainfall is not expected to recharge the aquifers. Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to the streams crossing the aquifer, and to small springs and seeps. Overall, the flow direction is towards the east. 	
Attachments	Figure 1. Table 1.	
Instrumentation	Stream gauge: 01042, 01043, 01044, 01070. EPA Water Level Monitoring boreholes: None identified. EPA Representative Monitoring boreholes: None identified.	
Information Sources	Lee M. and Fitzsimons V. (2004). <i>County Donegal Groundwater Protection Scheme</i> . Main Report. Draft Report to Donegal County Council. Geological Survey of Ireland 58pp. Long, C.B. and McConnell (1999) <i>Geology of South Donegal: A geological description, to accompany bedrock geology 1:100,000 scale map, Sheet 3, South Donegal</i> . With contributions by G.I. Alsop, P. O'Connor, K. Carlingford and C. Cronin. Geological Survey of Ireland, 116pp. 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.	
Disclaimer	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 GWB.

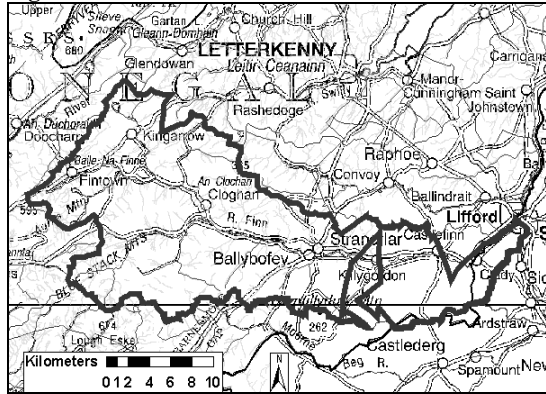


Table 1. List of Rock units in GWB

Rock Unit Name	Code	Description	Rock Unit Group	Aquifer Class.	% Area
Lough Eske Psammite Formation	LE	Feldspathic psammite; quartzite, marble	Precambrian Quartzites, Gneisses & Schists	PI	20.75%
Mullyfa and Deelee Formations	MF	Psammite, pebble beds, marble, schist	Precambrian Quartzites, Gneisses & Schists	PI	11.85%
Termon Formation	TE	Banded semi-pelitic & psammitic schist	Precambrian Quartzites, Gneisses & Schists	PI	11.13%
Boulytpatrick (Grit) Formation	BO	Psammite, graphitic clasts/beds, pebbles	Precambrian Quartzites, Gneisses & Schists	PI	9.08%
Croaghubrid Pelite Formation	CH	Graphitic pelite, thin psammite, marble	Precambrian Quartzites, Gneisses & Schists	Pu	8.49%
Lough Mourne Formation	LM	Quartz & feldspar pebbles, green matrix	Precambrian Quartzites, Gneisses & Schists	PI	7.46%
G2 variety	BaG2	main granite (adamellite)	Granites & other Igneous Intrusive rocks	PI	4.35%
Upper Falcarragh Pelite Formation	UF	Pelitic, semi-pelitic, psammitic schist	Precambrian Quartzites, Gneisses & Schists	Pu	2.98%
Upper Crana Quartzite Formation	UC	Psammitic schist with pebbly grit beds	Precambrian Quartzites, Gneisses & Schists	PI	2.76%
Slieve Tooye Quartzite Formation	ST	Whitish quartzite with pebble beds	Precambrian Quartzites, Gneisses & Schists	PI	2.51%
Gaugin Quartzite Formation	GA	Pale quartzite, pebble beds, rare schist	Precambrian Quartzites, Gneisses & Schists	PI	2.45%
Claudy Formation	CY	Psammite, pebbly grit, quartzite, marble	Precambrian Quartzites, Gneisses & Schists	PI	2.15%
Main Donegal Granite	MdGr	Coarse biotite granite & granodiorite	Granites & other Igneous Intrusive rocks	PI	2.08%
Knockletteragh Member	TEkg	Pebbly grits	Precambrian Quartzites, Gneisses & Schists	PI	1.61%
G3 varieties of sheet complex	BaG3	Leucogranite and porphyritic aplogranite	Granites & other Igneous Intrusive rocks	PI	1.44%
Glencolumbkille Pelite Formation	GP	Black graphitic pelitic schist	Precambrian Quartzites, Gneisses & Schists	Pu	1.33%
Reelan Formation	RE	Calc schist, pale marble and quartzite	Precambrian Quartzites, Gneisses & Schists	PI	1.25%
Sessiagh-Clonmass Formation	SC	Quartzite, dolomitic marble & schist	Precambrian Quartzites, Gneisses & Schists	PI	1.22%
Killeter Quartzite Formation	KT	Slightly impure quartzite	Precambrian Quartzites, Gneisses & Schists	PI	0.85%
Loughros Formation	LO	Quartzite with semi-pelitic schist	Precambrian Quartzites, Gneisses & Schists	Pu	0.82%
Lower Crana Quartzite Formation	LC	Psammitic schist, some marble beds	Precambrian Quartzites, Gneisses & Schists	PI	0.75%
Tectonic schist	ts	Mylonitic	Precambrian Quartzites, Gneisses & Schists	PI	0.74%
Aghyaran & Killygordon Limestone Formtns	DG	Marble, quartzite, psammite; graphitic	Precambrian Marbles	LI	0.67%
Metadolerite	Md	Hornblendic and sometimes schistose	Precambrian Quartzites, Gneisses & Schists	PI	0.37%
G1 variety - Cronamuck Granodiorite	BaG1	Medium/fine porphyritic granodiorite	Granites & other Igneous Intrusive rocks	PI	0.23%
Croveenananta Formation	CV	Schist, calc schist, quartzite & marble	Precambrian Quartzites, Gneisses & Schists	PI	0.22%
Microgranite and related rocks	mGr	Porphyritic & non-porphyritic sheets	Granites & other Igneous Intrusive rocks	PI	0.18%
Appinite suite	Ap	undifferentiated	Granites & other Igneous Intrusive rocks	PI	0.09%
Glencolumbkille Limestone Formation	GL	Dolomitic marble & semi-pelitic schist	Precambrian Marbles	PI	0.06%
Port Askaig Formation	PA	Diamictite, schist & quartzite	Precambrian Quartzites, Gneisses & Schists	Pu	0.05%
Falcarragh Limestone Formation	FL	Blue-grey banded marble, pelite partings	Precambrian Marbles	LI	0.03%
Cranford Limestone Formation	CR	Quartzite breccia & marble	Precambrian Marbles	PI	0.03%
Metavolcanic green bed	vg	Metavolcanic green bed	Precambrian Quartzites, Gneisses & Schists	PI	0.01%
Marble unit	DGmb	Marble-rich unit	Precambrian Marbles	LI	0.01%
Quartzite	qz	Quartzite	Precambrian Quartzites, Gneisses & Schists	PI	0.01%