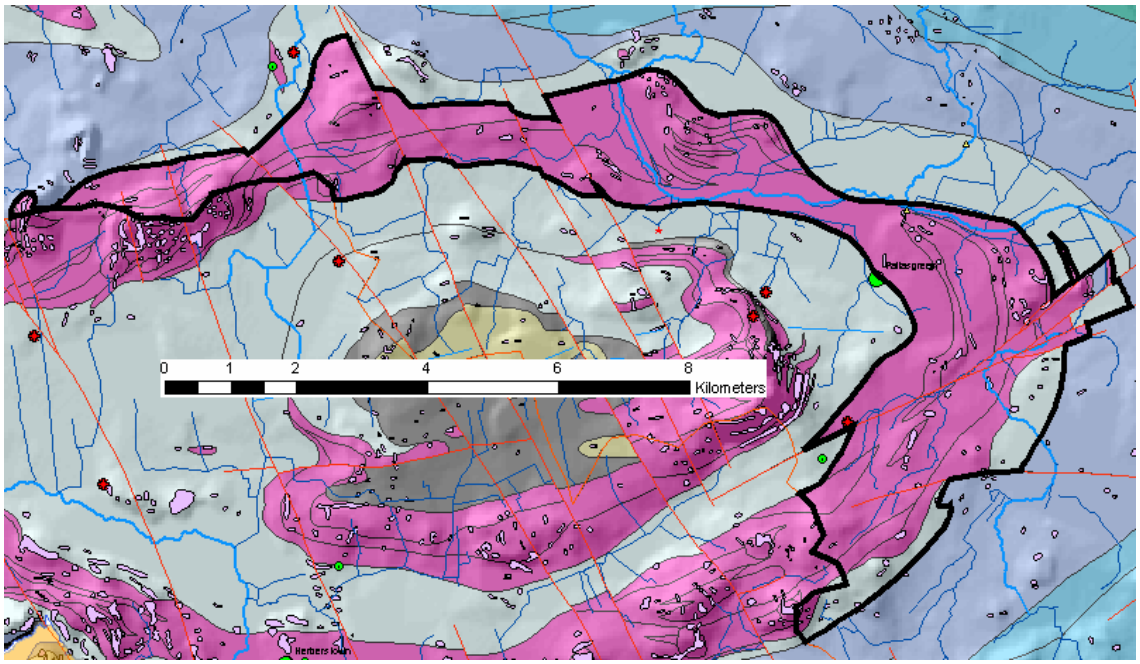
Knockroe East GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
25 - Mulkear Limerick Co. Co.	Rivers: Bilboa, Mulkear, Dead, Groody, Reask, Doolglasha.	None groundwater-dependent.	29

Topography	This body is narrow (~1-2 km) and arcuate, roughly like a backwards 'C'. The terrain is hilly and steep in the NW and SE, with ground elevations increasing rapidly from around 60 mAOD to more than 230 mAOD at Derk Hill on the SE boundary and more than 200 mAOD on the NW boundary. In the middle of the GWB, the ground is less hilly and apparently more eroded, with elevations in the range 50-70 mAOD. Drainage density within this generally flat-lying GWB is relatively high. In the SE and NW, drainage is to the north; in the middle sector of the GWB, surface water drains east and west.	
Geology and Aquifers	Aquifer categories	The majority of the rocks are currently classified as **Ll:** Locally important aquifers which are moderately productive only in local zones. The small volcanic plugs (Trachytes) are currently classified as **Lm:** Locally important aquifers which are generally moderately productive. In the SE, there are very small areas of **Lm** aquifer, and **Rk^d**: Regionally important karstified aquifer dominated by diffuse flow.
	Main aquifer lithologies	The GWB comprises Basalts and other Volcanic Rocks. There are small areas of Dinantian Pure Bedded Limestones in the SW, and a tiny area of Pure Unbedded Limestone on the eastern boundary of the GWB.
	Key structures	The main structures influencing groundwater flow are both primary (formed during deposition) and secondary (created by subsequent deformation). When the lavas solidified, cooling joints formed at right angles to the surface of the flow in some parts of the succession. The rocks are on the NE, E and SE limbs of a large boat-shaped syncline whose axis is orientated ENE-WSW. Strata are tilted at angles of 10-25^o to the inner (western) margin of the GWB. NNW-SSE trending major faults cross-cut the fold in the northern part; ENE-WSW major faults are dominant in the southern part. Movements during the folding would also have caused some fracturing and jointing of the rocks. Deakin (1995) considers that fracturing and jointing in the area may provide high transmissivity zones in a north-south direction.
	Key properties	Transmissivity in the Volcanic rocks in this area is thought to be variable: in some zones, columnar cooling joints provide a connected pathway for groundwater flow. In other parts, alteration of the rocks during their emplacement in shallow seas, or subsequent weathering during subaerial exposure in a tropical environment have clogged potential flow pathways (both cooling joints and tectonic fractures) with clays. At Herbertstown WS in the adjacent GWB, transmissivity is about 100 m^2/d. However, there are failed and poor yielding wells known in this rock unit group. In the cherty Pure Bedded Limestones, transmissivity is likely to be in the range 10-100 m^2/d, with most values probably in the lower half of the range. The karstified limestones will have higher transmissivities. Although the aquifers are generally moderate transmissivity, the high relief of the ground means that groundwater gradients will be quite high (up to 0.05) in the NW and SE parts, and lower (around 0.01) in the most extensive flatter areas in the middle. *(data sources: Rock Unit Group Aquifer Chapters, Source reports, see references)*
	Thickness	In general, the effective thickness of this aquifer is likely to be ≤ 15-20 m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, more isolated water-bearing joints or faults can be intercepted at greater depths.
Overlying Strata	Lithologies	*[Information to be added at a later date]*
	Thickness	There are no data for this GWB. Next to the boundaries of the GWB in the NW and SE, relief is high and there are outcrops, so subsoil is likely to be very shallow (< 2m). In the bulk of the GWB between these higher areas, subsoils are likely be thicker in this lower-lying area. At Pallasgrean WS, just west of this GWB, subsoil depths are between 3 m and 7 m.
	% area aquifer near surface	*[Information to be added at a later date]*
	Vulnerability	Groundwater vulnerability ranges between High and Extreme.
Recharge	Main recharge mechanisms	Diffuse recharge will occur via rainfall percolating through the subsoil. The proportion of the effective rainfall that recharges the aquifer is largely determined by the thickness and permeability of the soil and subsoil, and by the slope. In general, due to the generally low permeability of the aquifers within this GWB, a 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.
	Est. recharge rates	*[Information to be added at a later date]*
Discharge	Springs and large known abstractions (m^3/d)	There is one known Excellent yielding (> 400 m^3/d) borehole at Brackyle Creamery, which is capable of yielding 550 m3/d. This borehole is situated on a fault zone. Around Greenane GWS, there are two boreholes with Good yields (100 m^3/d < yield < 400 m^3/d), although Greenane GWS abstracts only 46 m^3/d.
	Main discharge mechanisms	The main discharges are to the streams and rivers crossing the aquifer and to small springs and seeps. There may be a small volume of cross-flow from this GWB to the Caherconlish GWB to the east.

	Hydrochemical Signature	No data are available to assess this GWB. In the adjacent Knockroe SW GWB, groundwaters have a calcium–bicarbonate signature. It is Moderately Hard (210-250 mg/l as $CaCO_3$) with corresponding alkalinities of 145-165 mg/l as $CaCO_3$ and neutral pHs of 7-7.5. Conductivities are relatively high, normally ranging between 480 and 550 μS/cm. These parameters indicate an influence by carbonate dissolution processes. This may be an influence of either the limestone dominated subsoil cover or perhaps limestones interbedded with the volcanic rocks at depth. Iron may be a problem due to the weathering of the rock forming minerals in the volcanic rocks. Due to the clayey weathering products, suspended solids can be a problem in some wells. Groundwater in the pure bedded limestone will be very hard with high alkalinities and electrical conductivities. Background chloride concentrations in the aquifers will be higher than in the Midlands, due to proximity to the sea.
Groundwater Flow Paths		These rocks are devoid of intergranular permeability; groundwater flow occurs in fractures, joints and faults. Where clayey weathering products or alteration minerals occur, this can block the flow conduits, unless they have been flushed from the system by high groundwater gradients in the hilly terrain. In the zones where the fractures and joints are not clogged with clays, transmissivities can be relatively high. Groundwater is unconfined; the water table is 1–12 m below ground level, and follows the topography, with deeper water levels being recorded in elevated areas. Relatively high drainage densities and low-lying ground indicate that the water table is close to ground surface over much of the GWB. In general, flows in the aquifer are likely to be concentrated in a thin zone at the top of the rock; the weathered zone may be up to 3 m thick, with a connected fractured zone a further 15-20 m, below which is a generally poorly fractured zone. However, there may be deeper inflows associated with zones of primary columnar jointing or tectonic fracturing and faulting. There may be limestones interbedded between the individual lava flows contributing to the flowing intervals. Groundwater flow paths are relatively short (up to 500 m), especially in the hilliest areas, with groundwater discharging locally to the streams and small springs. The general groundwater flow direction is southwards down-slope and westwards to the Camoge River.
Groundwater & Surface water interactions		The streams and rivers crossing the aquifer will be gaining and groundwater also discharges to small springs and seeps. Due to the shallow flow and high water table over much of the GWB, groundwater-surface water interaction will be significant. A specific dry weather flow along the Dead River of 0.9 l/s/km^2 includes baseflow from upstream, where the river crosses Pure Unbedded and Lower Impure Limestones. If this value is considered representative of the Volcanics, it indicates low-moderate aquifer storativity.
Conceptual model		• This body is thin (~1-2 km) and arcuate, like a backwards 'C'. It is bounded to north, east and southeast by the contact with the pure limestones of the Caherconlish and Ballyneety GWBs. The contact with the pure bedded limestones of the Pallas Grean GWB forms the western ('inner') margin, and the NW and SW boundaries coincide with surface water catchment divides. The ground is hilly at the catchment boundaries, but generally low-lying over most of the GWB. • The GWB comprises low-moderate transmissivity rocks. Localised zones of enhanced permeability occur in the Volcanics due to columnar jointing and tectonic fracturing. However, these zones may be clogged by weathering products, reducing permeability. The Dinantian limestones have low-moderate transmissivity. The pure unbedded limestones are diffusely karstified. Aquifer storativities are generally low. • Recharge occurs diffusely at outcrop and through the subsoils, particularly in the NW and SW corners, where subsoils are thin or absent. Potential recharge may be rejected where the water table is high. • The aquifers are generally unconfined. The water table is from 1-15 m below ground level and follows topography. The water table is close to ground surface over much of the GWB. Groundwater flows along fractures, joints and major faults. Most groundwater flow occurs near the surface in a narrow zone comprising a weathered zone of a few metres and a connected fractured zone below this. Deeper inflow levels will occur where isolated fractures/faults or jointed zones are intercepted. North-south fracturing and faulting in the northern part of the GWB, and ENE-WSW faulting in the southern part may cause anisotropy. Flow path lengths are relatively short, and in general are 30-300 m. • The rock units of this GWB may act as a confining layer to the limestones of the underlying GWBs. • Groundwater discharges to the streams and rivers crossing the aquifer and to small springs. Unconfined flow directions are controlled by local topography. Overall, flow directions are mainly east- and northwards, down-slope, to the Dead and Reask Rivers; groundwater flow is both east- and westwards to the Mulkear River. There may be some cross-flow from this GWB to the surrounding limestone GWBs.
Attachments		None.
Instrumentation		Stream gauges: 25005. *(Station has specific dry weather flow calculated)*
Information Sources		Deakin, J. (1995) *Herbertstown Public Supply, Groundwater Source Protection Zones*. Geological Survey of Ireland Report to Limerick Co. Co., 6 pp. Deakin, J. (1995) *Pallasgrean (New) Public Supply, Groundwater Source Protection Zones*. Geological Survey of Ireland Report to Limerick Co. Co., 6 pp. Deakin, J., Daly, D. and Coxon, C. (1998) *County Limerick Groundwater Protection Scheme*. Geological Survey of Ireland Report to Limerick Co. Co., 72 pp. Aquifer chapters: Basalts and other Volcanic rocks; Dinantian Pure Bedded Limestones.
Disclaimer		Note that all calculations and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae



Rock units in GWB

Rock unit name and code	Description	Rock unit group
Knockroe Basalt Lava Flow Member (KRb)	Basaltic lava flows	Basalts & other Volcanic rocks
Knockroe Lithic Tuff Member (KRl)	Lithic tuff & agglomerate	Basalts & other Volcanic rocks
Knockroe Trachyte Lava Flow Member (KRt)	Trachytic lava flows	Basalts & other Volcanic rocks
Knockroe Vitric-Lithic Tuff Member (KRv)	Vitric-lithic tuff & agglomerate	Basalts & other Volcanic rocks
Trachyte (T)		Basalts & other Volcanic rocks
Trachyte Breccias (Tb)		Basalts & other Volcanic rocks
Lough Gur Formation (LR)	Pale cherty crinoidal limestone	Dinantian Pure Bedded Limestones