Abbeyfeale GWB: Summary of Initial Characterisation.

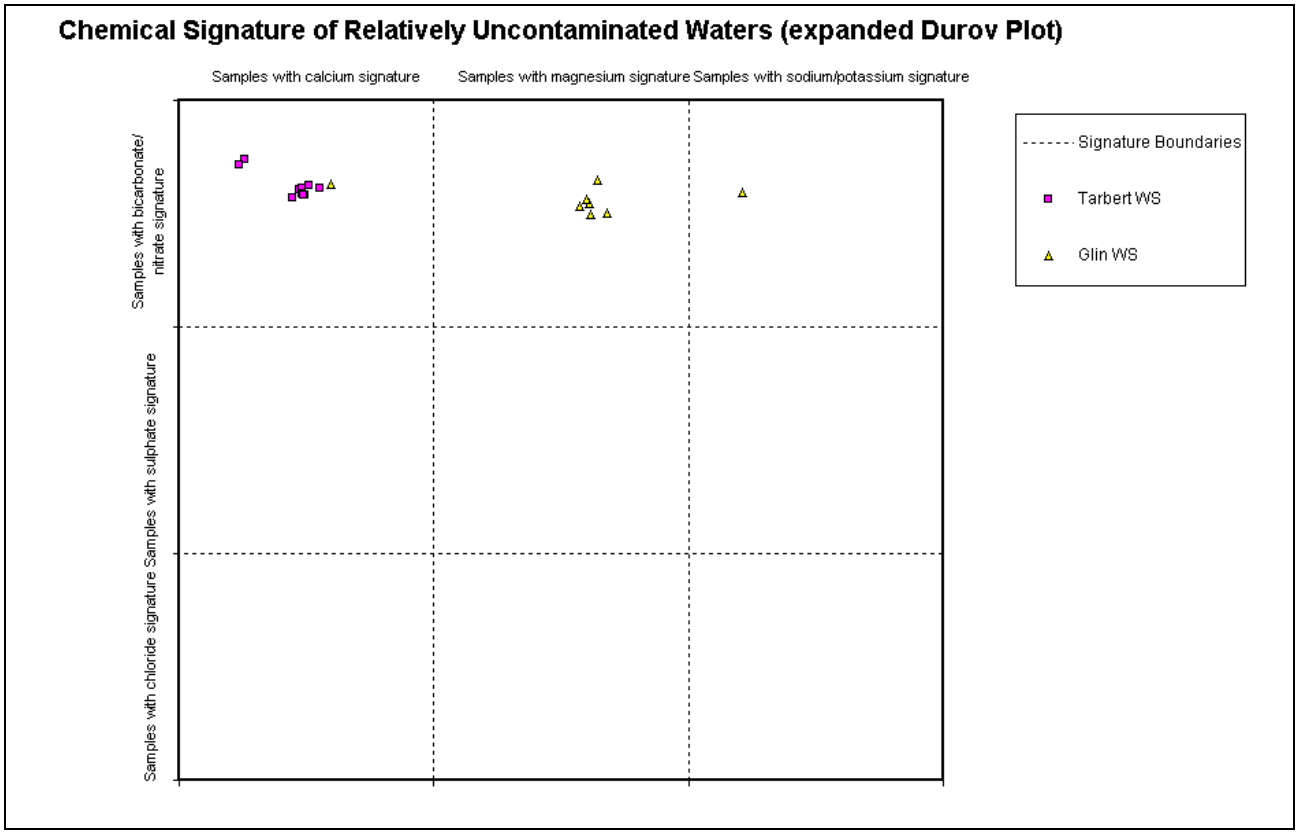
Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystems	Area (km^2)
23 - Feale catchment Kerry, Limerick and Cork Co. Co.'s	Rivers: Feale, Ahavanlummaun, Pound, Smearlagh, Galey, Brick, Clydagh, Oolagh, Allaghath, Owveg, Oolagh, Allaghaun, Glashoreag, Dromaddamore, Tullaleague, Breanagh, Knockfinnisk, Caher, Glenacarney, Glashacooncore, Breanagh, Lyracrumpane. Streams: Broghane, Tarmon, Milltown House Stream.	Moanveanlagh Bog (000374), Bunnaruddee Bog (001352).	949

Topography	The GWB is roughly triangular, with a thin spur running northwestwards towards the coast just north of Ballybunnion. South of an E-W line running through Abbeyfeale, ground elevation is generally more than 200mAOD. The uplands are dissected by numerous streams and rivers. The main mountains in the area are the Stack's, Glannaruddery and Mullaghareik ranges, and Mount Eagle and Knockfeha. Knockfeha is the highest, at 451 mAOD. North of the east-west line, except for the hills to the west of Newcastle West, the land is gently sloped and generally less than 100 mAOD. In the southern half of the GWB, the main river channels flow north- and northwestwards. In the northern half, river flows are to the west. Drainage is poor everywhere.	
Geology and Aquifers	Aquifer category(ies)	The vast majority of the GWB comprises an **Ll:** Locally important aquifer which is moderately productive only in local zones. There is a very small area of Clare Shales on the eastern boundary of the GWB which is a **Pl**: Poor aquifer which is generally unproductive except for local zones. A small area of Westphalian Shales in the eastern uplands, and a very thin strip of Clare Shales along the western boundary are **Pu**: Poor aquifers which are generally unproductive. There is less than 1 km^2 of karstified limestone (**Rk**) on the coast just north of Ballybunnion.
	Main aquifer lithologies	The main rock unit groups within the GWB are Namurian Undifferentiated, Namurian Sandstones and Namurian Shales. There are small areas of Westphalian Shales and Dinantian Pure Unbedded Limestones.
	Key structures	The rocks are the youngest strata in large anticlines and synclines, whose axes are orientated ENE-WSW. Bedding dips are about 30-55^o in both N/NE and S/SE directions due to smaller, parasitic folds on the larger structures. There are two sets of faults: NNW-SSE cross-cutting the fold and ENE-WSW parallel to the fold axes. Fractures may be more open on the fold axes.
	Key properties	Transmissivity is in the range 2–20 m^2/d. At Glin WS in the adjacent Ballylongford GWB, a pumping test gave transmissivity of 14 m^2/d [7-27 m^2/d], but this may have been affected by faulting. Transmissivities in the Westphalian strata and the Clare Shales will be significantly lower. Groundwater travel times in the karstified Pure Unbedded Limestones will be high. Aquifer storativities in all rock units are low. At Glin WS, estimated groundwater gradients are 0.04 - 0.05. Over the GWB, they are likely to be in the range 0.02 – 0.05. *(data sources: Rock Unit Group Aquifer Chapters, Source Reports, see references)*
	Thickness	In general, most groundwater flow occurs within the top 15 m of the aquifer, in the layer that comprises a weathered zone of a few metres and a connected fractured zone below this. However, deep water strikes (30-90 m) are noted in this aquifer, and are associated with slightly better yields (moderate to good, rather than poor) and better productivities (III and IV, rather than IV and V). Permeable zones are met at deeper levels than in other rocks. In a 3 km deep exploration borehole drilled by Ambassador Oil near Doonbeg (on the north side of the Shannon Estuary), for example, water was struck at 107 m and then intermittently until a depth of 610 m.
Overlying Strata	Lithologies	The major subsoil type covering the rocks in this GWB is Namurian Sandstone and Shale Till. In the uplands towards the southern and SE boundaries, Blanket Peat predominates. In some lower-lying areas in the northern part of the GWB, Cutover Peat occurs. Narrow zones of Undifferentiated Alluvium occur along some of the river courses. Along the Feale, around Duagh, the alluvial deposits are classified as a locally important gravel aquifer.
	Thickness	Subsoil thickness ranges from 1 m to over 30 m. The modal depths to rock are between 4 m and 6 m, with the majority of recorded subsoil thicknesses less than 12 m. Subsoil thicknesses generally increase north and west, to the lower-lying ground. Outcrop is mainly confined to river and stream valleys. Rock is also close to the surface in some parts of the uplands, between areas of blanket bog.
	% area aquifer near surface	*[Information to be added at a later date]*
	Vulnerability	*[Information to be added at a later date]*
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. Due to the generally low permeability of the aquifers within this GWB, a high proportion of the recharge will then 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]*

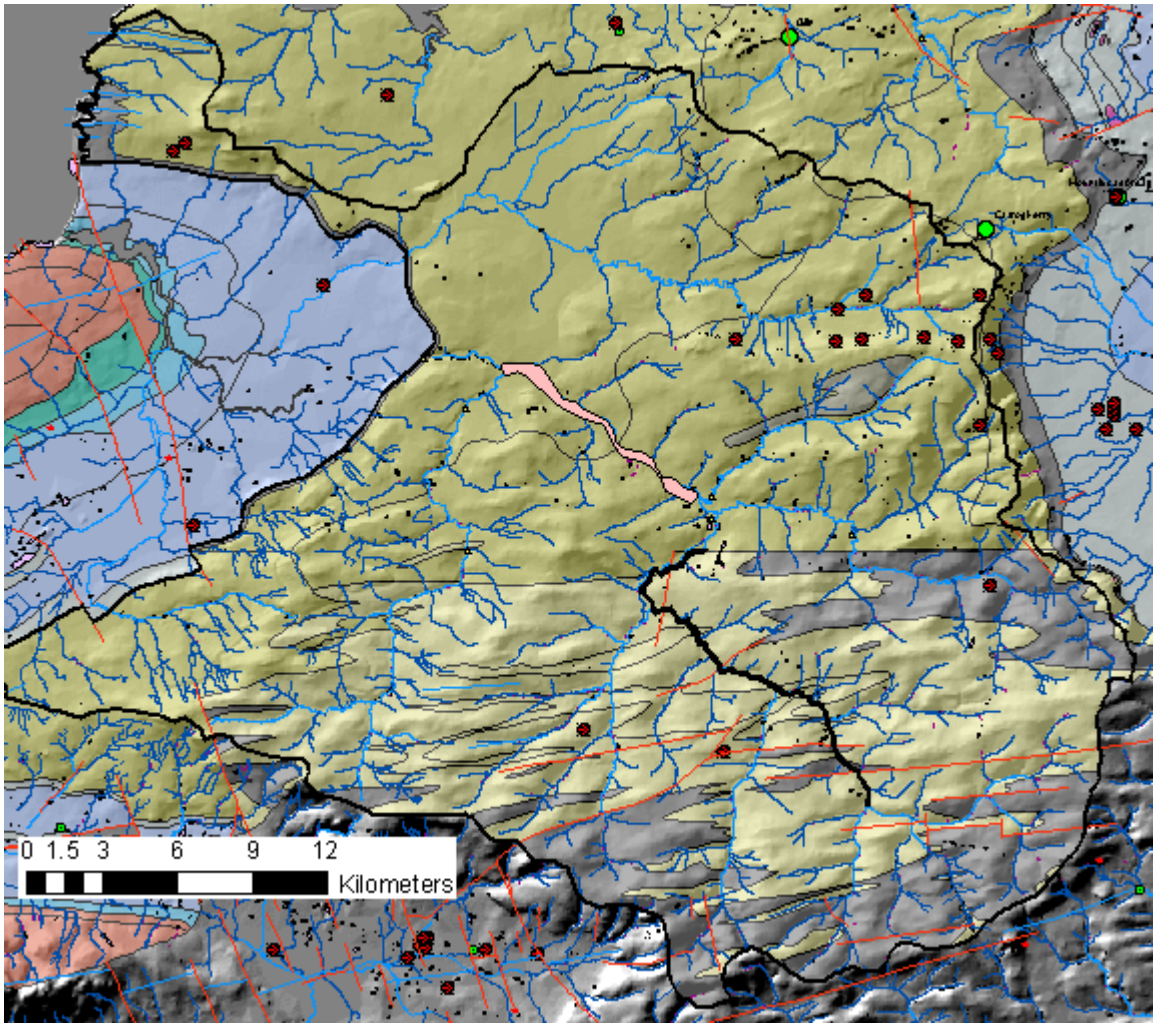
Discharge	Important springs and high yielding wells (m^3/d)	Athea WS (90 m^3/d – GSI database; 183 m^3/d – EPA database), Brosna (Knoppoge) WS (45 m^3/d – GSI database), Brosna WS (55 m^3/d – GSI database; 136 m^3/d – EPA database), Rockchapel WS (150 m^3/d – EPA database), Ballybunnion (Lahesheragh) WS (273 m^3/d – GSI database; unknown, EPA database), Ballydesmond WS (130 m^3/d – EPA database), Knocknagashel WS (unknown, EPA database), Scries/ Doon/ Rahavanig WS (180 m^3/d), Kerry Co-Op (Kilmorna Creamery) (5 m^3/d – EPA and GSI databases), Kerry Co-Op (Duagh Creamery) (27 m^3/d – EPA and GSI databases), Kerry Co-Op (Six Crosses) (5 m^3/d – EPA database), Kerry Co-Op (Coolaclarig Cross) (45 m^3/d – EPA and GSI databases), Lyrecrompane Creamery (27 m^3/d – EPA database), Tobermaing Creamery (137 m^3/d – EPA database), Ballaghbehy GWS (34 m^3/d – EPA database), Ballinloughan GWS (5 m^3/d – EPA database), Barnagh GWS (22 m^3/d – EPA and GSI databases), Cratloe West GWS (5 m^3/d – EPA database; 55 m^3/d – GSI database), Mountcollins GWS (118 m^3/d – EPA database; 174 m^3/d – GSI database), Templeathea GWS (10 m^3/d – EPA database, 55 m^3/d – GSI database), Templeglantane GWS (14 m^3/d – EPA database), Toornafulla WS (19 m^3/d – EPA database; 66 m^3/d (Village), 7 m^3/d (Doherty's) – GSI database), Tulligoline North GWS (10 m^3/d – EPA database), Ballyclough Co-Op (Tournafulla) (72 m^3/d – EPA database), Ballyclough Co-Op (Meenaheela) (59 m^3/d – EPA database), Golden Vale Creameries (Mountcollins) (55 m^3/d – EPA database), Golden Vale Creameries (Devonroad) (50 m^3/d – EPA database), Ballinloughane GWS (unknown – EPA database), Dromtransa GWS (unknown – EPA database), Tulligolane GWS (unknown – EPA database), Coolewest GWS (165 m^3/d – GSI database; unknown – EPA database), Glenediagh (Ballycastle) (unknown – EPA database). Duagh WS (204 m^3/d – infiltration gallery, EPA database; 342 m^3/d – borehole, GSI database– in Duagh gravels?), Duagh Bridge WS (342 m^3/d – borehole, GSI database, abstracting from 'black shales'). *[More information may be added at a later date]*
	Main discharge mechanisms	The main discharges are to the streams crossing and incising into the sandstone and shale rock units. Small springs and seeps issue at the stream heads or along their course.
Discharge	Hydrochemical Signature	No data are currently available for this GWB. Groundwaters sampled in the adjacent Ballylongford GWB are moderately hard (120-270 mg/l $CaCO_3$) and have moderate alkalinities (170-240 mg/l $CaCO_3$). Measured electrical conductivity ranges from ~440-560 µS/cm. Spring waters (Tarbert WS) have a calcium bicarbonate signature. Groundwater sampled from borehole (Glin WS) has a signature varying from Ca-HCO_3 to Na/K-HCO_3 and alkalinities greater than total hardness. This is typical of confined waters where ion exchange has occurred. Reducing conditions may also occur. Both iron and manganese can exceed allowable concentrations, these components coming from the shales. Background chloride concentrations will be higher than in the Midlands, due to proximity to the sea. The limestone bedrock aquifers have hard groundwaters with calcium-bicarbonate signatures.
Groundwater Flow Paths		These rocks are devoid of intergranular permeability; groundwater flow occurs in fractures and faults. Generally, groundwater levels are 0-6 m below ground level, and follow the topography. Deeper water levels, from 15-30 m are observed, however, which indicate that there are zones that are hydraulically isolated from the rest of the aquifer. 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 10 m, below which is a generally poorly fractured zone. This zone will be unconfined in the main, except where blanket bog occurs. Shallow groundwater flow paths are short (30-300 m), with groundwater discharging to the streams and small springs. Artesian conditions and deep inflow levels indicate that there are lower parts of the aquifer that are confined by low permeability layers in the rock succession. Confined flow path lengths may be considerable. Local flow directions are determined by local topography and drainage patterns. Overall, groundwater flow is to the west.
Groundwater & Surface water interactions		Due to the shallow groundwater flow in this aquifer the groundwater and surface waters are closely linked. The streams crossing the aquifer are gaining. Dry weather flows are low (0.1 to 0.5 l/s/km^2 at 5 stations), indicating that the aquifers have low storage are therefore incapable of sustaining summer river flows. However, at Listowel station on the Feale River, the DWF is 2.3 l/s/km^2. This high value is probably caused by groundwater being stored in the alluvium along the river course. There are numerous small springs and seeps contributing to river flows. Water from the rivers flowing onto the adjacent Ballybunnion GWB will recharge the karstic aquifer.

Conceptual model	• The groundwater body is bounded to the south, east and north by topographic highs, and to the west by the contact with the karstified limestones of the Ballybunnion GWB. The terrain is hilly and dissected by rivers. • The groundwater body is composed primarily of low permeability rocks, although localized zones of enhanced permeability do occur along faults. Groundwater flows along fractures, joints and major faults. • Recharge occurs diffusely through the subsoils and via outcrops. • The aquifers within this GWB are both unconfined and confined. Most flow in this aquifer will occur near the surface; the effective thickness of this aquifer is likely to be ≤15 m, comprising a weathered zone of a few metres and a connected fractured zone below this. The water table is from 0-6 m below ground level and follows topography. Areas covered by blanket bog may be confined. Deep inflow levels and artesian wells indicate confined conditions in higher permeability strata confined by lower permeability layers, from which better yields can be obtained. Shallow flow path lengths are relatively short, and in general are between 30 and 300 m. Confined, deep, flow paths may be significantly longer. Low dry weather flows indicate that aquifer storage is low. • Groundwater discharges to the numerous small streams crossing the aquifer, and to the springs and seeps. Local flow directions are oblique to the surface water channels. Overall, the flow direction is to the west. • Due to the shallow groundwater flow in this aquifer the groundwater and surface waters are closely linked. This interaction is rapid and seasonal; due to low storage and the local nature of the flow paths, summer baseflows to the rivers are low. • This GWB is overlain by the Duagh Gravel GWB, which occurs along the River Feale.
Attachments	Hydrochemical signature (Figure 1).
Instrumentation	Stream gauges: 23002*, 23004, 23005*, 23006*, 23007*, 23008*, 23010, 23014, 23015, 23016, 23017*, 23018, 23019, 23020, 23024, 25308, 25309. *(* denotes specific dry weather flow calculated for these stations.)*
Information Sources	Conlon, V. and Wright, G. (1998) *County Kerry Aquifer Classification (draft).* Geological Survey of Ireland Report to Kerry Co. Co., 18 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. Hudson, M. (1995) *Glin WS: Groundwater Source Protection Zones.* Geological Survey of Ireland Report to Limerick Co. Co., 8 pp. Aquifer Chapters: Namurian, Dinantian Upper Impure Limestones, Westphalian.
Disclaimer	Note that all calculations and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

Figure 1: Hydrochemical signature



NB: these data are from the adjacent Ballylongford GWB.



Rock units in GWB

Rock unit name and code	Description	Rock unit group
Westphalian Undifferentiated (WES)		Westphalian Shales
Central Clare Group (CCG)		Namurian Undifferentiated
Namurian Undifferentiated (NAM)		Namurian Undifferentiated
Shannon Group (SHG)		Namurian Undifferentiated
Ballyhnahown Sandstone Formation (BW)		Namurian Sandstones
Cloone Sandstone Formation (CF)		Namurian Sandstones
Feale Sandstone Formation (FS)		Namurian Sandstones
Glenoween Shale Formation (GN)		Namurian Shales
Clare Shale Formation (CS)		Namurian Shales
Undifferentiated Visean Limestones (VIS)		Dinantian Pure Unbedded Limestones