Cappoquin Kiltorcan GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
18 Cork and Waterford Co. Cos	**Rivers:**.Funshion, Douglas, Araglin, Owennashad, Glenshane, Finisk, Glennafallia, Blackwater. **Stream:** Glencorra. **Lakes:** Eelburn, Carra.	Blackwater River and Callows (000073), Blackwater River and Estuary (000072).	49

Topography		At ground surface the GWB forms a narrow strip (600-2000 m wide) around the southern, western and northwestern lower slopes of the Knockmealdown Mountains, between the mountains and the low lying Blackwater Valley and Mitchelstown Syncline. The change in topography reflects changes in the underlying geology. The topography is generally steeply sloping (particularly in the southern portion of the body) with some more gently sloping areas. Ground elevations range 10-200 m OD. The land surface is incised by gullies of streams flowing off the mountains.
Geology and Aquifers	**Aquifer categories**	**Rf:** Regionally important fissured aquifer
	Main aquifer lithologies	Devonian Kiltorcan-type Sandstones.
	Key structures	The regional structural deformation of the Variscan Orogeny created the characteristic South Munster sandstone ridge (anticline)-limestone valley (syncline) topography. The Devonian Kiltorcan-type Sandstones of this GWB are the uppermost unit of the Devonian Old Red Sandstone succession. They occur on the margins of the sandstone ridge that forms the Knockmealdown Mountains. The outcrop area of the Kiltorcan-type Sandstones is limited (approx. 300-1500 m wide) but the sandstones dip underneath the overlying shales and limestones of the Mitchelstown GWB (Figure 1). Down-dip towards the middle of the synclines, the aquifer becomes confined by increasingly thick overlying beds. Numerous north-south faults cross cut the GWB. As deformation is likely to be most intense along the fold axis of the anticline the sandstones are likely to be most productive in the west of the body at the "nose" of the anticline.
	Key properties	Results of aquifer testing in the sandstones are very variable. Generally transmissivity is expected to range from 40-100 m^2/d. Daly (1985) reports estimates of 5-1850 m^2/day, and suggests that highest values are likely to be associated with low-lying areas close to anticlines or faults. Daly suggests that sandstone permeabilities are in the order of 0.5 to 20 m/day, increasing up to 80 m/day in localised areas. Transmissivity will be reduced at depth, where the Kiltorcan Formation is thinner in the centre of synclines and permeability is reduced by deep burial. Borehole yields of 50-1300 m^3/d have been encountered (typical yield of 500 m^3/d) with specific capacities of 5 to 40 m^3/d/m. Storage values range from 0.01-0.1; the higher storage coefficients result from limited intergranular porosity (the sandstone is susceptible to weathering). A public supply borehole at Cappoquin in this GWB gave a transmissivity of 170 m^2/d from a 2 hour pumping test and 157 m^2/d from a 3.5 hour recovery test. Numerical modelling suggested groundwater gradients ranging from 0.03-0.08 (Hudson 1996).
	Thickness	Geophysical borehole logging suggests that significant water movement occurs at depths of over 60 m in the Kiltorcan Sandstones where the aquifer is unconfined. Where confined, active groundwater circulation is expected to be much more limited, but some deep flow has been inferred from mineral exploration boreholes at depths of over 200m (Daly 1985). Kiltorcan Formation is generally thinner in the centre of the synclines and permeability is reduced by the deep burial.
Overlying Strata	**Lithologies**	This GWB is primarily covered by glacial till, with a predominantly sandy matrix. Subsoil permeability has not been mapped in detail in North Cork, but similar subsoils in South Cork have been identified as having a generally 'moderate' permeability. Alluvial deposits occur along the River Blackwater and some of its large tributaries and some glacial sand and gravel deposits also occur. Rock outcrop and shallow rock is common, particularly in the southern portion of the body along the Blackwater valley. *Subsoil Types identified in Cappoquin Kiltorcan GWB by Teagasc Parent Material Mapping (Draft): Alluvium (A); Sandstone sands and gravels (Devonian) (GDSs); Lake Sediments Undifferentiated (L); Made Ground (Made); Rock outcrop and rock close to surface (Rck); Till – Devonian Sandstone Till (TDSs).*
	Thickness	Subsoils depths are variable, generally less than 10 m although depths of 11-16 m were encountered at Caherdrinny in the west of the body between Mitchelstown and Glanworth. Many areas of rock outcrop and shallow rock occur, particularly in the south of the body along the Blackwater valley.
	% area aquifer near surface	
	Vulnerability	A Groundwater Vulnerability Map is not available for North Cork. It is likely that most of this body will be of Extreme and High Vulnerability.

Recharge	**Main recharge mechanisms**	The Knockmealdown Mountains to the north and east of this GWB (Knockmealdown GWB) provide abundant runoff which augments recharge to this GWB. Groundwater may also cross as through-flow from the sandstones of the Knockmealdown GWB into this GWB. Diffuse recharge will occur over the entire GWB. Due to the steep topographic gradients that occur, particularly in the south of the body, recharge may be reduced due to rapid discharge to surface watercourses via the upper layers of the aquifer. The 'moderate' permeability subsoils will generally not restrict percolation of recharge.
	Est. recharge rates	*To be assessed.*
Discharge	**Large springs and high yielding wells (m^3/d)**	*Note: The following data need to be checked and updated by RBD Project Consultants.* Data from GSI Well Database: Cappoquin WS (687 m^3/d) Caherdrinny-Mitchelstown WSS, 2 BHs (436 m^3/d), (543 m^3/d) Kilphelan-Mitchelstown WSS (1637 m^3/d) Curraghoo Beg-Glanworth WSS (1200 m^3/d)
	Main discharge mechanisms	Groundwater will discharge as baseflow to the streams and rivers crossing the GWB. There is no obvious discharge zone for groundwater moving at depth in this aquifer, but it may flow via large faults and complex pathways into shallower groundwaters and from there to surface water bodies where outcrop areas are at the lowest elevations.
	Hydrochemical Signature	Groundwater from the Kiltorcan-type Sandstones is mainly a calcium/magnesium bicarbonate type water although the hydrochemistry can be variable. In the recharge areas where the Quaternary deposits are absent or derived from non-Carboniferous strata the water is quite soft (<150 $CaCO_3$ mg/l). Where the aquifer is overlain by limestone-derived drift the total hardness normally ranges 150–250 mg/l $CaCO_3$. Iron and manganese levels are low although occasional high levels are recorded. Chemical analyses of groundwater from the Cappoquin WS indicate **'moderately soft'** water (71-75 mg/l $CaCO_3$) with relatively low alkalinity (39-43 mg/l $CaCO_3$). Conductivities are also relatively low (155-195 µS/cm).
Groundwater Flow Paths		Groundwater flow generally occurs through faults and joints, but Kiltorcan-type Sandstones are sometimes slightly friable and may have a minor component of intergranular porosity. In general groundwater flow is concentrated in the upper 30 m of the aquifer, but deeper inflows can be encountered. The aquifer is unconfined at outcrop but becomes confined as it dips beneath the 'Lower Limestone Shale' and Ballysteen Formation at the margins of the synclinal valleys. Where confined, active groundwater circulation is expected to be much more limited, but some deep flow has been inferred from mineral exploration boreholes at depths of over 200 m (Daly 1985). Groundwater flow will be to the south and west away from the higher ground towards the valleys.
Groundwater & Surface water interactions		Based on data from other areas with similar rock type the aquifer is expected to contribute a relatively high baseflow to streams and rivers directly underlain by rock.
Conceptual model		• This GWB occurs as a narrow strip (600-2000 m wide) around the southern, western and northwestern lower slopes of the Knockmealdown Mountains, between the Knockmealdown Mountains and the low-lying Blackwater Valley and Mitchelstown Syncline. The topography is generally steeply sloping with some more gently sloping low lying areas to the south and west. Ground elevations range 10-200 m OD. • The GWB is bounded to the north and east by the contact with the low permeability sandstones of the Knockmealdown GWB. The Kiltorcan-type Sandstones of this GWB dip to the south and west and become confined beneath low permeability shales and impure limestones of the Lismore GWB, which forms the southern and western boundary of the body at ground level. At either end of this elongated GWB there is a groundwater divide that coincides with the SWRBD boundary. • The GWB is composed of productive fissured sandstone classed as a regionally important fissured aquifer. • The GWB is made up of an unconfined portion where the Kiltorcan-type Sandstones outcrop, and a confined portion where the sandstones become confined beneath overlying shales and impure limestones. • Groundwater flow generally occurs through faults and joints; however the Kiltorcan-type Sandstones are sometimes slightly friable and may have a minor component of intergranular porosity. • In general groundwater flow is concentrated in the upper 30 m of the aquifer, although deeper inflows can be encountered. Groundwater flow is influenced by topography and groundwater flow will be to the south and west away from the higher ground towards the valleys. • The GWB is recharged diffusely via rainfall percolating through the subsoil and by runoff from the Knockmealdown Mountains to the north and east. The generally 'moderate' permeability subsoils will not restrict percolation of recharge, but the steep gradients may reduce the amount of recharge effectively percolating to the aquifer due to rapid discharge to surface watercourses via the upper layers of the aquifer. • Based on data from other areas with similar rock type the aquifer is expected to contribute a relatively high baseflow to streams and rivers directly underlain by rock.
Attachments		Figure 1 Schematic Cross Section through the Mitchelstown Syncline and the Lismore Syncline
Instrumentation		**Stream gauges:** 18039, 18053. **EPA Water Level Monitoring boreholes:** Ballynacaheragh (CON 146), Kilphelan (CON 154) **EPA Representative Monitoring points:** none

Information Sources	Daly EP (1985) *Groundwater Resources of the Nore River Basin: Hydrogeology of the Kiltorcan Aquifer System*. Unpublished internal GSI report Daly EP (1988) *The Kiltorcan Sandstone Aquifer*. Paper presented at the 8th Annual Groundwater Seminar held in Portlaoise, on: The future of Groundwater Development in Ireland.. Published by: IAH (Irish Group). Daly EP (1994) *Groundwater Resources of the Nore River Basin* Internal Report Series, Geological Survey of Ireland. Duffy S (1994) *The Protection of Groundwater Resources in County Waterford* unpublished MSc Thesis, University College Galway. Hudson M (1996) Cappoquin Public Supply, Groundwater Source Protection Zones. Report to Waterford County Council. Geological Survey of Ireland. Hudson M, Daly D, Johnston P, Duffy S (1998) *County Waterford Groundwater Protection Scheme*. Report to Waterford County Council. Geological Survey of Ireland 87pp. Sleeman AG, McConnell B (1995) Geology of East Cork - Waterford. A geological description of East Cork, Waterford and adjoining parts of Tipperary and Limerick, to accompany the Bedrock Geology 1:100,000 scale map series, Sheet 22, East Cork - Waterford. Geological Survey of Ireland.
Disclaimer	*Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae.*

Cappoquin Kiltorcan GWB (For Reference)

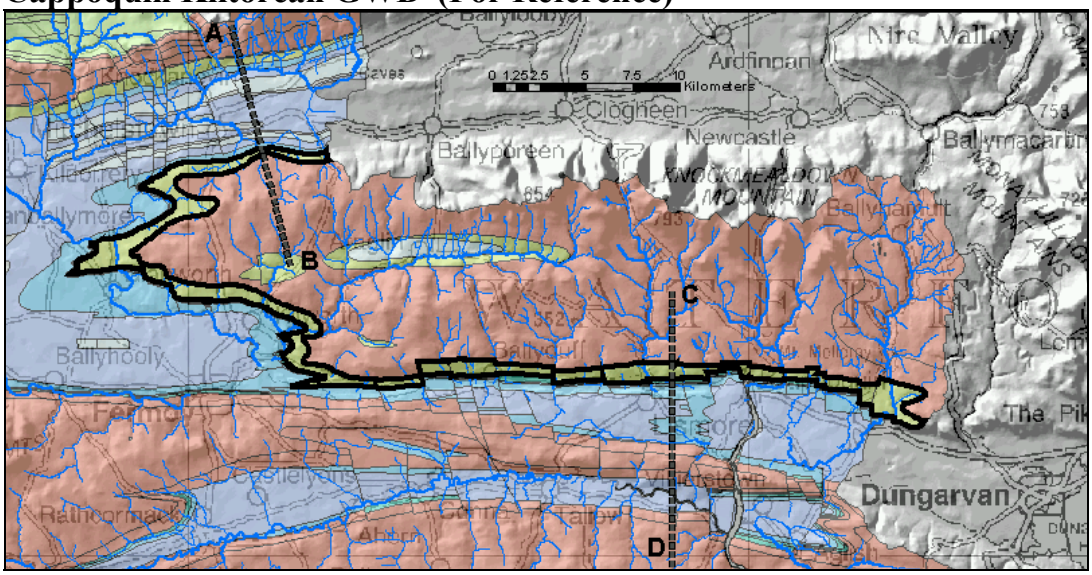
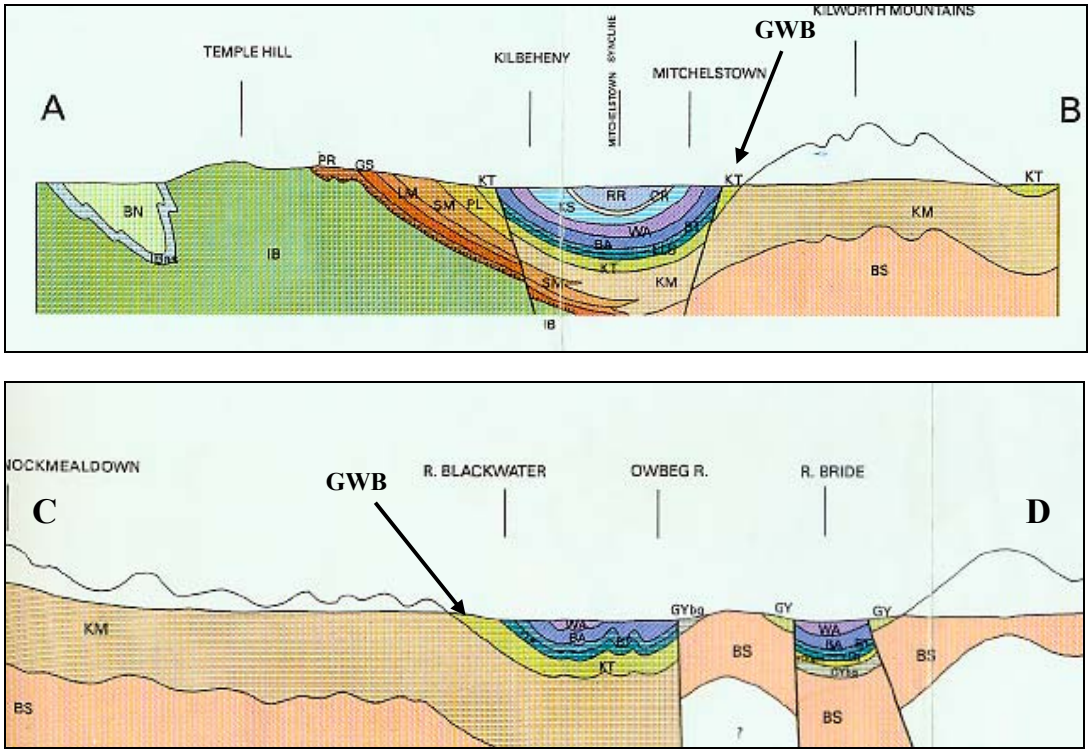


Figure 1: Schematic Cross Section through the Mitchelstown Syncline and the Lismore Syncline

(From Geology of East Cork – Waterford Sheet 22. 1:100,000 Bedrock Map Series)



List of Rock units in Capoquin Kiltorcan GWB

Rock unit name and code	Description	Rock unit group
Kiltorcan Formation (KT)	Yellow & red sandstone & green mudstone	Devonian Kiltorcan-type Sandstones