

Knockadoon GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
19 Cork Co. Co.	Rivers: Womanagh, Lakes: None Streams: None	(001076) Rostellan Lough	86.9
Topography	This GWB consists of a ridge running east west from Great Island to Knockadoon Head. Ground elevations range from 10-100 mAOD. The ridge is relatively flat topped steeply sloping towards adjoining valleys to the north and south.		
Geology and Aquifers	Aquifer categories	L1: Locally important aquife, moderately productive only in local zones (99%) Rk^d*/Pending Classification: * This area may karstified but is unlikely to be regionally important due to its small size (<10km ²) – a new classification code to represent such areas is pending. (1%)	
	Main aquifer lithologies	Devonian Old Red Sandstones (84%); Dinantian Mudstones and Sandstones (Cork Group) (15%); Dinantian Pure Unbedded Limestones (1%).	
	Key structures	During the Variscan Orogeny, rocks in South Munster were compressed from the south into a series of folds on east west axes. Subsequent erosion stripped the more soluble Carboniferous Limestones from the fold crests or ridges (anticlines) exposing the harder, more resistant sandstones underneath. The Carboniferous Limestones were preserved in the fold troughs (synclines) which today line elongate east-west trending valleys separated by sandstone ridges. This GWB occurs on the eastern end of the Great Island Anticline. The widespread faulting and folding associated with the Variscan Orogeny in the south of Ireland has given rise to zones of enhanced permeability in the mudstones and sandstones. These can occur in the immediate vicinity of faults and near the axes of folds.	
	Key properties	The ORS rocks are generally considered to be a relatively low permeability rock except where zones of higher permeability have been created as a result of structural deformation by folding and faulting. Coarse grained rocks such as the sandstones and conglomerates have a greater tendency to contain a fissure permeability and will have higher permeabilities than fine grained rocks such as the mudstones and siltstones. There are few pumping tests carried out in boreholes that draw water from the from ORS rocks from which the aquifer properties transmissivity and permeability can be derived. Estimated transmissivities in the ORS in Counties Waterford and Cork are generally less than 50 m ² /d. Higher transmissivities are associated with areas that are in the vicinity of high permeability fault and fracture zones.	
	Thickness	The Dinantian Mudstones and Sandstones (Cork Group) and Devonian Old Red Sandstone units in this GWB have a maximum thickness of several hundreds of metres. Most groundwater flow in this GWB is expected to occur, 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.	
Overlying Strata	Lithologies	The GWB is primarily overlain by sandstone till. There are frequent areas of rock outcrop and shallow rock. A small sand and gravel deposit is also recorded in the south of the body. The town of Cobh occupies a large area of made ground in the south west of the body on Great Island. The sandstone till is generally of 'moderate' permeability although some smaller pockets of 'low' permeability till do occur on lower ground, in a valley south and southwest of Ladysbridge and along the eastern side of the southern boundary of the body. Sand and gravel deposits, where they occur, are of 'high' permeability. <i>Subsoil Types identified in Knockadoon GWB by Teagasc Parent Material Mapping (Draft): Alluvium (A); Sandstone sands and gravels (Devonian) (GDSs); Marine sands and gravels (MGs); Made Ground (Made); Estuarine sediments (silts/clays) (Mesc); Rock outcrop and rock close to surface (Rck); Till – Devonian Sandstone Till (TDSs).</i>	
	Thickness	Subsoil is generally < 10 m thick with large areas of < 3 m subsoil, particularly in the centre and west of the body and along the steeply sloping edge of the ridge. The thickest subsoils are likely to be encountered in the low-lying valley running southwest from Ladysbridge and in the low lying area on the eastern side of the southern boundary of the body.	
	% area aquifer near surface		
	Vulnerability	The South Cork Groundwater Protection Scheme includes this GWB. Most of the body will be of Extreme or High Vulnerability. There are two small areas of designated as Moderate Vulnerability, a small valley running southwest from Ladysbridge and an area of low ground on the eastern side of the southern boundary of the body.	

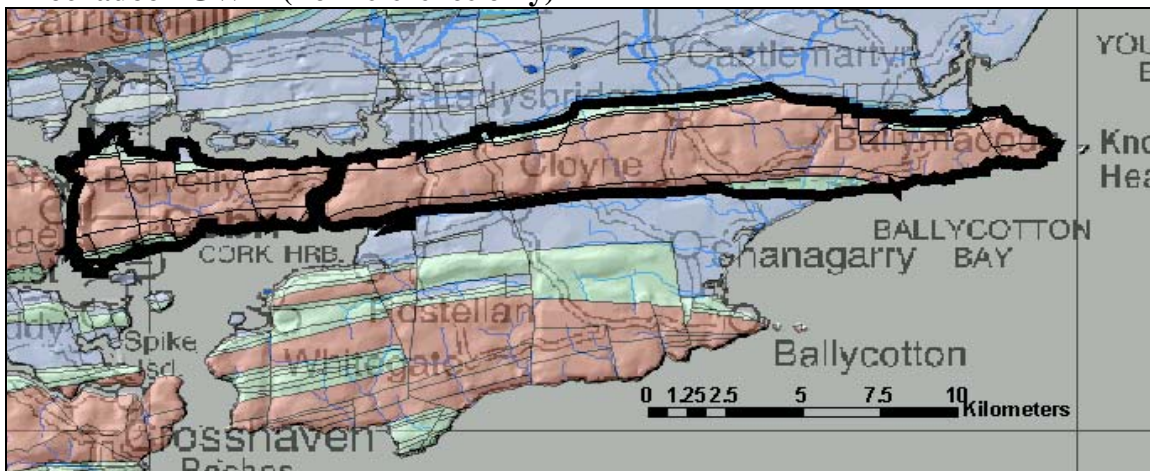
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Recharge	Main recharge mechanisms	Diffuse recharge will occur via rainfall percolating through the subsoil or areas of outcropping rock. The proportion of the effective rainfall that will recharge the aquifer is determined by the permeability of the soil and subsoil, and by the slope. The 'moderate' permeability till will not restrict percolation of recharge however the steeply sloping ridge margins will cause recharge to discharge rapidly to surface watercourses via the upper layers of the aquifer. There is a high density of surface drainage on the sandstone ridges indicating that the permeability of the sandstones is relatively low. Recharge to the ridges is expected predominantly to move as throughflow to streams with limited percolation to bedrock. Streams run off the sandstone ridges into the limestone valleys to the north and south.
	Est. recharge rates	
Discharge	Large springs and high yielding wells (m³/d)	<p><i>Note: The following data needs to be checked and updated by RBD Project Consultants.</i></p> <p>No large springs or high yielding wells.</p> <p>Data from EPA Groundwater Sources List: Ballymacoda Spring-WSS Knockadoon WS BH Ladybridge WS BH</p>
	Main discharge mechanisms	The main discharges are through flow to the streams flowing off the ridge, which recharge the limestone aquifer in the valleys to the north and south, and a small amount of flow from the sandstones to the limestones in the valleys at the GWB boundary.
	Hydrochemical Signature	The Old Red Sandstone rock units largely contain calcium bicarbonate type water. Alkalinity ranges approximately 14-200 mg/l (as CaCO ₃) and hardness ranges approximately 50-250 mg/l. Groundwater in the Old Red Sandstone rock units is considered to range from moderately soft to moderately hard water. Conductivities are relatively low, ranging approximately 150-450 µS/cm. High iron (Fe) and manganese (Mn) concentrations can occur in groundwater derived from sandstone and shale formations, due to the dissolution of Fe and Mn from the sandstone/shale where reducing conditions occur. It has been demonstrated that at low pumping rates water does not reside long enough in the well for oxidation to occur, thereby resulting in elevated Fe and Mn in small domestic supplies (Applin <i>et al.</i> , 1989). A typical pH in groundwater from the Old Red Sandstone rocks is 6 –7, but the pH of groundwater from Old Red Sandstone rocks of the Gortanimill, Ballytrasna and Caha Mountain formations can be as low as 5.4. Background chloride concentrations will be higher than in the Midlands, due to the proximity to the sea. Where the influence of sea water incursion is responsible for high chloride levels pumping rates may need to be reduced. There are currently no EPA representative monitoring in this GWB.
Groundwater Flow Paths		These rocks have no intergranular permeability; groundwater flow occurs in fractures and faults. Where there has been more intense faulting and folding these zones of high permeability will be more common, particularly in the coarser-grained rocks. 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. However, yields are not necessarily sustainable, as the fracture networks are generally not extensive or well connected but primarily concentrated in the vicinity of the fault zones. Springs are noted to occur in some instances on fault zones. Groundwater levels range 1.5-15 m below ground level, and will generally follow the topography. Close to rivers and streams, water levels will be near ground level. Groundwater flow will be of a local nature. Groundwater flow paths are generally short, typically 30-300 m, with groundwater discharging to small springs, or to the streams and rivers that traverse the aquifer. Flow directions are expected to approximately follow the local surface topography. Overall, groundwater flows to the north and south off the ridge towards the adjoining limestone valleys. Groundwater is generally unconfined.
Groundwater & Surface water interactions		Groundwater 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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Conceptual model	<ul style="list-style-type: none"> The groundwater body is bounded to the north and south by the contact with the limestones of the Cloyne and Midleton GWBs, to the east by the coast and in the west by the open water of Cork Harbour. The body topography consists of a relatively flat topped east west trending ridge steeply sloping towards adjoining valleys to the north and south. The groundwater body is comprised of rocks with low transmissivity and storativity, although localised zones of enhanced permeability occur along fault zones. Flow occurs along fractures, joints and major 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. Diffuse recharge occurs across the GWB through the subsoils and rock outcrops. The water table can vary between 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. Groundwater discharges as through flow to the streams flowing off the ridge, which recharge the limestone aquifer in the valleys to the north and south, and a small amount of flow from the sandstones to the limestones in the valleys at the GWB boundary.
Attachments	None
Instrumentation	Stream gauges: None EPA Water Level Monitoring boreholes: None EPA Representative Monitoring points: None
Information Sources	Kelly D, Leader U & Wright G (2002) <i>South Cork Groundwater Protection Scheme</i> . Report to Cork County Council (South). Geological Survey of Ireland. Sleeman A G & 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 Wright G (1979) Groundwater in the South Munster Synclines. In: <i>Hydrogeology in Ireland, Proceedings of a Hydrogeological Meeting and associated Field Trips held in the Republic of Ireland from 22 to 27 May, 1979</i> . Published by the Irish National Committee of the International Hydrological Programme.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

Knockadoon GWB (For reference only)



List of Rock units in Knockadoon GWB

Rock unit name and code	Description	Rock unit group	Aquifer Classification
Cuskinny Member (Kncu)	Flaser-bedded sandstone and mudstone	Dinantian Mudstones and Sandstones	L1
Castle Slate Member (KNcs)	Grey mudstone	Dinantian Mudstones and Sandstones	L1
Old Head Sandstone Formation (OH)	Flaser-bedded sandstone and minor mudstone	Dinantian Mudstones and Sandstones	L1
Waulsortian Limestone (WA)	Massive unbedded lime-mudstone	Dinantian Pure Unbedded Limestones	Rk ^{d*} /Pending Classification
Gyleen Formation (GY)	Sandstone with mudstone and siltstone	Devonian Old Red Sandstones	L1
Ballytrasna Formation (BA)	Purple mudstone with some siltstone	Devonian Old Red Sandstones	L1

