

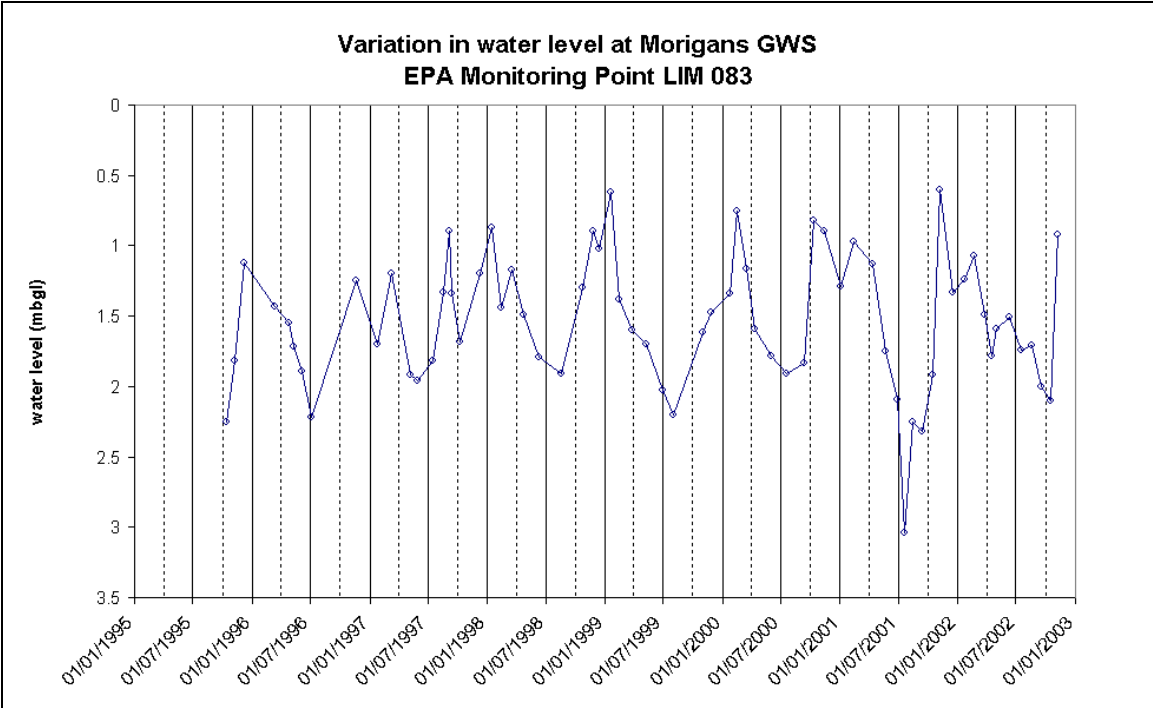
Askeaton GWB: Summary of Initial Characterisation.

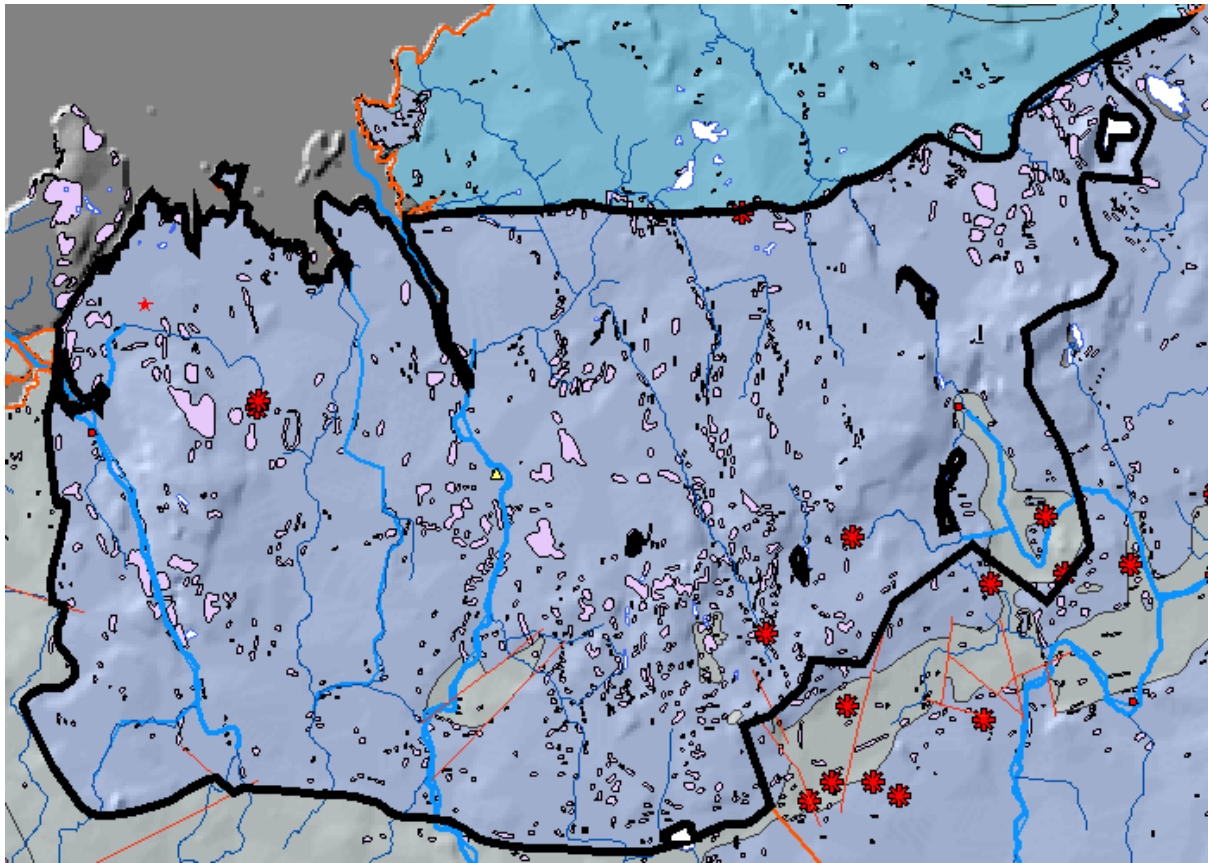
Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
24 - Deel/ Shannon Estuary South Limerick Co. Co.	Rivers: Ahacronane, Deel, Robertstown; Streams: Lismakeery; Loughs: Quayfield, Poulaweala, Mornane, Blue (two separate loughs), Ballymorrisheen, Dromore, Glenisca, Graigues, Doohyle.	Inner Shannon Estuary – South Shore (000435), Dromore and Bleach Loughs (001030), Gorteennamrock (Fen) (001433), Ballinvirick Marsh (001427), Ballymorrisheen Marsh (001425), Cappagh Fen (001429).	125 (this figure does not include Aughinish Island)
Topography	The groundwater body is roughly rectangular and is elongated east-west. The ground elevation decreases from around 100 maOD in the west and south to sea level along the Shannon Estuary. Much of the ground is gently undulating, and approximately 40 maOD. Some rivers (e.g. the Ahacronane) incise into the ground surface, but most are gently meandering across gently sloped ground.		
Geology and Aquifers	Aquifer categories	The majority of the GWB comprises Rk^c : Regionally important karstified aquifer dominated by conduit flow. There are small areas in the south and southeast where the bedrock is Li : Locally important aquifer which is moderately productive only in local zones.	
	Main aquifer lithologies	The dominant rock unit group in the GWB is the Dinantian Pure Unbedded Limestones. There are small areas of Dinantian Upper Impure Limestones in the south-centre of the GWB, and at the southeast corner.	
	Key structures	The rocks occur near the core of a WSW–ENE oriented syncline. Faults approximately parallel and at right angles to the fold axis are mapped near the edge of the groundwater body; they are likely to occur within the GWB also. North-easterly faults are noted at Aughinish; fault zones are up to 20 m wide and are associated with dolomitisation and solution. Bedding dips range between 15° and 50°, with the steepness probably reflecting the steep pre-folding bedding surfaces and not only deformation.	
	Key properties	Transmissivity in the karstified pure unbedded limestones will be in the range 200–2000 m ² /d. Due to the focussed nature of the flow, very high transmissivity zones will be close very low transmissivities zones. In the impure limestones, transmissivities will range from 2–30 m ² /d, and will tend to be towards the lower end of this range. Groundwater gradients are very low in the pure limestones (0.001-0.003); they may be slightly higher in the impure limestones, but not by much, since although the impure limestones are lower permeability, the ground underlain by them has very low relief. <i>(data sources: Rock Unit Group Aquifer Chapters, Limerick GWPS Report, see references; estimation from maps)</i>	
	Thickness	The Dinantian Pure Unbedded Limestones (Waulsortian Limestones) attain maximum thicknesses of more than 1200 m. However, the effective flowing thickness is likely to be about 30 m. An epikarstic layer of a couple of metres is likely to exist at the top of the aquifer; fieldwork is required to verify this. Deep karst conduits (60 mbsl) are known to exist, but the flux within the conduits is not known.	
Overlying Strata	Lithologies	<i>[Information to be added at a later date]</i>	
	Thickness	Subsoil thicknesses are typically in the range 0–10 m, with much rock exposed, especially in the west of the GWB.	
	% area aquifer near surface	<i>[Information to be added at a later date]</i>	
	Vulnerability	<i>[Information to be added at a later date]</i>	
Recharge	Main recharge mechanisms	Recharge will occur directly to the aquifer via outcrops, and by percolating through the shallow subsoil. There is likely to be an epikarst layer which will readily accept recharge, which will then redistribute the groundwater in the subsurface before it enters the main aquifer body. Point recharge to the aquifer may also occur via swallow holes. Where the water table intersects the surface and fen areas are formed, potential recharge may be rejected.	
	Est. recharge rates	<i>[Information to be added at a later date]</i>	
Discharge	Springs and large known abstractions (m ³ /d)	Aughinish WS (1200 m ³ /d – not sure if still in use); Morigans GWS (?); Cappagh GWS (Ballinarrane) (153 m ³ /d); Coolmin GWS (131 m ³ /d); Cappagh GWS (Cappagh) (50 m ³ /d); Ballyshonickbane GWS (218 m ³ /d); Ballyvogue GWS (?) (50 m ³ /d); Barrigone GWS (195 m ³ /d); Rintulla WS (not sure if in use) <i>[More information to be added at a later date]</i>	
	Main discharge mechanisms	The main discharge zones of the aquifer are the Shannon Estuary in the northwest, the Rivers Deel and Ahacronane, and the tributary of the Mague River. In winter, turloughs act as temporary discharge zones. There are numerous springs in the GWB. Some of these occur at the base of the hill that forms the catchment divide boundary at the south of the GWB. Others occur at the junction between the karst of this GWB and the low transmissivity rocks of the Ballysteen GWB.	

Hydrochemical Signature	No hydrochemical data are available for this GWB. The hydrochemistry of the Waulsortian limestone aquifer near Croom, 19 km southeast of Askeaton, shows a very hard (370–400 mg/l CaCO ₃), calcium bicarbonate type water with high alkalinity (330–350 mg/l CaCO ₃). Background chloride concentrations will be higher than in the Midlands, due to proximity to the sea. The bedrock strata of this aquifer are calcareous .
Groundwater Flow Paths	<p>Groundwater flow is concentrated in conduits. The intensity of karstification is thought to decrease eastwards. Site investigations in the Aughinish area have shown extensive karstification (solution) of the limestone and large variations in permeability (Ercon, 1974; Gutmanis, 1981; Clarke et al., 1981). There is evidence of permeability variations with depth: two unconnected sets of water bearing fissures were observed – one at sea level and one at approximately 60 m below present day sea level. Failed wells adjacent to productive ones, cavities recorded in boreholes, and the presence of turloughs indicate concentration of groundwater into conduits.</p> <p>Annual groundwater fluctuations at Aughinish are reported by Ercon (1974) to be about 6 m. The hydrograph at Morigan’s GWS shows an average annual fluctuation of about 1.5 m. Groundwater levels are typically 3–9 mbgl. However, some SWLs are significantly deeper (15 – 25 mbgl), and may be tapping a deeper conduit system – some of these water levels (if they are not affected by pumping) are below sea level. In this area of shallow rock, the water table is generally below the base of the subsoil.</p> <p>Groundwater flow paths in this aquifer are generally long, and can be up to km’s long. Groundwater may also discharge locally to surface water features or springs, however, if the topography is variable. In the western part of the GWB, groundwater flow is generally northwards to the Shannon Estuary, although more locally, groundwater flow will be more east-west to the nearest surface water course. In the southeast of the GWB, groundwater flow is to the southeast.</p>
Groundwater & Surface water interactions	The nature of the karstic system leads to rapid interchanges of water between surface and underground. Swallow holes and caves receive surface water, and groundwater is discharged to surface as springs or as baseflow to rivers crossing the groundwater body. The loughs act as groundwater stores – seasonal water levels can vary significantly. Data do not exist to assess the contribution by the aquifer to river flows, or vice versa. However, several groundwater-dependent ecosystems are known in the area: Ballinvirick marsh (NHA 001427) is a small wetland site with adjacent grassland and scattered scrub habitats. It is one of a network of small lakes and fens which include Cappagh (NHA 001429) and Ballymorrishen (NHA 001425) fens. Recent drainage schemes in particular to the east of the lake have greatly reduced the water level of the lake. Ballymorrishen Fen is a small to medium sized wetland site characterised by 3 small lakes surrounded by a fen vegetation. Cappagh Fen is a fen lake site with almost total dominance by reed beds. Gorteenamrock Fen (NHA 001433) is a small wetland site sheltered by higher scrub-covered ground. Dromore and Bleach Loughs (NHA 001030) are likely to be almost entirely groundwater fed, with their alkalinity determined by the nature of the bedrock. There are fens surrounding the loughs which are dependent on groundwater. The Shannon Estuary (000435) has fringing reedbeds, swamps, salt marsh and wet marsh habitats. Potential pollution could quickly enter the estuary via groundwater flow.
Conceptual model	<ul style="list-style-type: none"> • The groundwater body is elongated east-west and is roughly rectangular. The northwestern boundary is formed by the Shannon Estuary. The northern, western and western part of the southern boundaries are contacts with low transmissivity impure limestones (the Ballysteen and Patrickswell GWBs). The eastern boundary is a surface water catchment divide. The area is generally very low-lying, and topography is gently undulating. • Karstification is pervasive, especially around Aughinish. The degree of karstification is thought to decrease eastwards. These are highly transmissive and variable limestones, with low storativity. • Recharge occurs diffusely across the entire groundwater body, especially where there is rock outcrop or thin subsoil. An epikarst layer is likely to redistribute the recharge in the subsurface before it enters the aquifer proper. Point recharge is likely to occur, although, in this GWB, swallow holes are not recorded in the GSI database at present. Potential recharge may be rejected in the areas where the water table is very close to or intersects the surface. • The entire aquifer is unconfined. There can be large variations in well yields, indicating concentration of groundwater flow in karstified zones. There are two levels of conduits – one set is at sea level and one set is at around 40–60 m below sea level. The more active conduit system is likely to be the upper one, with the lower system reflecting ancient lower sea levels. Flow velocities within the conduits will be significant (10’s to 100’s m/h). • Groundwater discharges to the streams and rivers crossing the GWB (e.g., Deel and Ahacronane), and to the springs within the GWB. At the northwestern margin of the GWB, groundwater discharges to the Shannon Estuary. Near the southern edge of the GWB, groundwater in the karstic aquifer comes to the surface at the base of the slope forming the surface water catchment divide. • There are several important ecosystems within the GWB that are dependent on groundwater. Several of these (the system that includes Ballinvirick Marsh) are at risk from drainage that lowers the groundwater levels. Potential pollution could enter the Shannon estuary via groundwater flow.
Attachments	Groundwater hydrograph (Figure 1).
Instrumentation	Stream gauges: 24019, 24029*, 24081. (<i>Adjusted dry weather flow calculated for stations marked with *</i>) EPA Water Level Monitoring boreholes: Morigan’s GWS (LIM083).

Information Sources	<p>Clarke, R. G., <i>et al.</i> (1981). <i>Engineering geology for a major industrial complex at Aughinish Island, Limerick, Ireland</i>. <i>Quat. J. Eng. Geol.</i>, Vol. 14, pp. 231–39.</p> <p>Deakin, J., Daly, D. and Coxon, C. (1998) <i>County Limerick Groundwater Protection Scheme</i>. Geological Survey of Ireland Report to Limerick Co. Co., 72 pp.</p> <p>Ercon (1974) <i>Report on hydrogeological investigation, Bauxite beneficiation plant, Aughinish</i>. Report No. 6488, 19 pp.</p> <p>Gutmanis, J. C. (1981) <i>The geology of Aughinish Island and the preservation of probable Tertiary deposits in an ancient karst system</i>. Paper for submission to the <i>Journal of Earth Sciences</i>.</p> <p>Aquifer chapters: Dinantian Pure Unbedded Limestones, Dinantian Upper Impure Limestones.</p>
Disclaimer	<p>Note that all calculations and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae</p>

Figure 1: Groundwater hydrograph





Rock units in GWB

Rock unit name and code	Description	Rock unit group
Waulsortian Limestones (WA)	Massive unbedded lime-mudstone	Dinantian Pure Unbedded Limestones
Rathkeale Formation (RK)	Dark muddy limestone and shaley limestone	Dinantian Upper Impure Limestones