Athlone West Groundwater Body: Summary of Initial Characterisation.

NB Note – the catchment boundary which forms part of the western and northern boundaries of this body needs to be adjusted in light or information available about specific catchment area – see page 5 for diagram of GWB location.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
26 – Hind/Lough Ree Roscommon Co. Co.	Rivers: Shannon, Cross, Mihanboy, Boor, Ballydangan. Streams: Cuileen. Loughs: Nanegish, Cranberry, Claffy's.	(001623) Carrickynaghtan Bog; (000216) River Shannon Callows; (001630) Cranberry Lough; (000222) Suck River Callows, Castlecoote-Shannonbridge	144

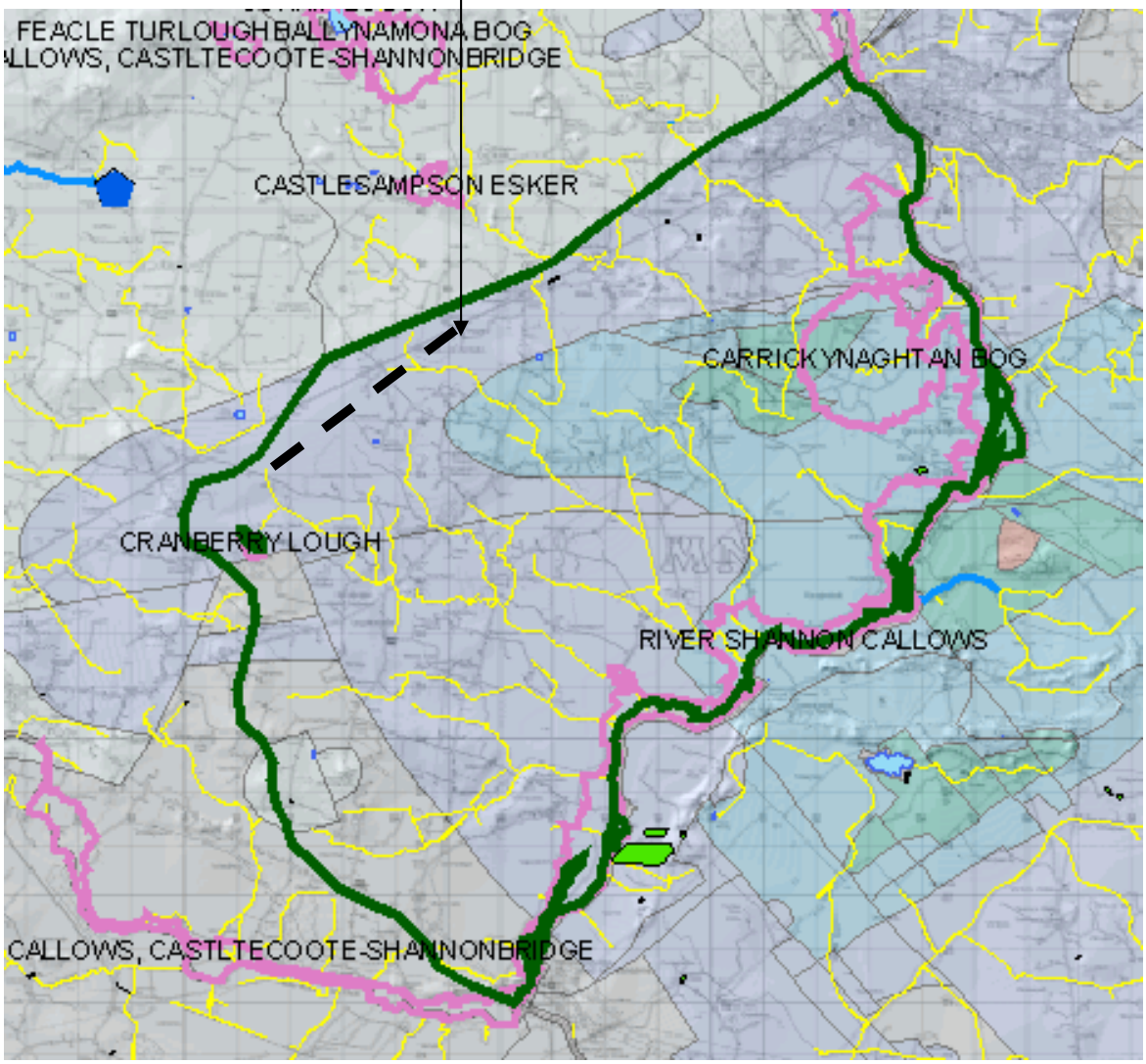
Topography	This groundwater body occupies a northeast southwest trending broadly rectangular area west and southwest of Athlone. It is bounded to the east and south by the River Shannon and to the north by contact with the Pure Bedded Limestones of the karstic Fuinshinagh GWB. The western boundary is formed by a groundwater divide and topographic high which coincides with a surface water catchment boundary. The area is flat and lowlying, with ground elevations ranging from 40-90 mAOD. The highest ground is in the north and west, with the highest point of 94 mAOD located on the western boundary of the body. Most of the body has a ground elevation of 40-60 mAOD. Land adjacent to the River Shannon rarely rises above 40 mAOD. The lowest point of 35 mAOD is located on the banks of the River Shannon. Much of the land area of this groundwater body, in particular lands in the vicinity of the River Shannon, is covered by raised bog, now being harvested for peat by Bord na Mona. As the peat is harvested for fuel the final surface level of the peat is in places lower than the winter water level in the River Shannon. The land is drained by several small streams flowing south and southeast and discharging to the River Shannon. The peat production bogs are currently drained by a series of large electrical pumps which pump water from the lowlying bogs into the adjacent River Shannon.	
Geology and Aquifers	Aquifer categories	**Ll:** Locally important aquifer which is moderately productive only in local zones
	Main aquifer lithologies	The main aquifer lithologies are Dinantian Pure Unbedded Limestones, Dinantian Lower Impure Limestones, and Dinantian Upper Impure Limestones (also referred to as 'Calp type' limestones). There are smaller areas within the body consisting of Dinantian (early) Sandstones ($6km^2$), Shales and Limestones and Dinantian Pure Bedded Limestones ($2km^2$).
	Key structures	A number of faults are mapped in the east and south of the body, however in this area due to the extensive covering of peat and glacial deposits the pattern of folds and faults are generally too poorly exposed to allow these structures to be closely mapped.
	Key properties	No data on hydrogeological properties specific to this groundwater body are available. Pumping tests in the Dinantian Pure Unbedded Limestones (Waulsortian Limestones), outside this groundwater body, in Tulla, Co. Clare and Shinrone, Co. Offaly indicated transmissivities of 13 m^2/d and 27 m^2/d respectively. These values are probably at the middle to higher end of the range for the Dinantian Pure Unbedded Limestones in this area. Within the Dinantian Lower Impure Limestones, transmissivities are likely to be in the range 2-20 m^2/d, with most values at the lower end of the range. Dinantian (early) Sandstones, Shales and Limestones aquifer properties are expected to be in a similarly low range. Aquifer properties of the Dinantian Upper Impure Limestones vary across Ireland influenced by lithological variations and variations in the extent of deformation. In this area transmissivities in the Dinantian Upper Impure Limestones are expected to be quite low. The rocks in this groundwater body can have local zones of enhanced permeability and it is to be expected that in the vicinity of fault zones where the rocks have undergone a higher degree of deformation higher transmissivity values can be encountered.
	Thickness	The Dinantian Pure Unbedded Limestones, Dinantian Lower Impure Limestones and Dinantian Upper Impure Limestones of this groundwater body are more than several hundreds of metres thick. However, the effective thickness of these aquifer is usually around 15 m, comprising a weathered zone of a few metres and a zone of interconnected fissures below this of about 10 m thick. Isolated deeper inflows occur where faults or significant fractures are intercepted by boreholes. The maximum thickness of Dinantian Sandstones, Shales and Limestones is less than 100 m.
Overlying Strata	Lithologies	Cut peat (Cut), Limestone Till (TLs), Limestone Gravel (GLs), Alluvium (A), Lake Sediment (L), Esker (BasEsk), and some shallow rock areas (Rck, KaRck.) Data source - Teagasc Parent Material mapping. Large areas of peat bog occur in a broad swathe along by the River Shannon. The peat is underlain by often quite thick deposits or marl and lacustrine clay ('blue clay'). Areas of gravel have been mapped in the north of the body. Large areas of Alluvium are mapped in the flood plain of the River Shannon which underlie the callow lands. *[Information to be added at a later date]*

	Thickness	Bedrock is less than 3 m below ground surface in areas in the west and northwest of this groundwater body, as well as in a small area in the east of the body. In the vicinity of the River Shannon, in areas covered by the vast expanses of raised bog, bedrock is generally greater than 10 m below ground surface, with the peat underlain by layers of marl and often quite thick lacustrine clay ('blue clay'). In areas where peat has been harvested, often less than 1 m of peat remains. *[Information to be added at a later date]*
	% area aquifer near surface	In just under 25% of this groundwater body the bedrock aquifer is less than 3 m below ground surface. *[Information to be added at a later date]*
	Vulnerability	Areas of Extreme vulnerability in the west, northwest and east of the body. Areas of high vulnerability in the north and west of the body. Areas of moderate and low vulnerability in the vicinity of the River Shannon. (This groundwater body occurs within the area of the Roscommon Groundwater Protection Scheme where groundwater vulnerability has been mapped.) *[Information will be added at a later date]*
Recharge	Main recharge mechanisms	Diffuse recharge will occur over the entire groundwater body via rainfall soaking through the subsoil. More recharge will occur where overlying strata are thinner. Karstification is rare in the type of limestones found in this groundwater body, however occasionally karst features are recorded. If present, karst features such as swallow holes or enclosed depressions would provide locations for point recharge to occur.
	Est. recharge rates	*[Information will be added at a later date]*
Discharge	Springs and large known abstractions (m^3/d)	None *[Information to be added at a later date]*
	Main discharge mechanisms	The main discharges will be local, to the streams crossing the body, where the subsoil thickness allows, and to the River Shannon in the east and south of the body. There may be some groundwater discharge at lagg zones at the margins of the bogs which skirt the River Shannon. There may also be the potential for emergence of groundwater in these bogs when the peat cover is completely removed by harvesting from areas where the underlying marl and clay deposits are thin.
	Hydrochemical Signature	No relevant hydrochemical data are available in this GWB for assessment. On the basis of data from other areas it can be assumed that groundwater from this groundwater body have a calcium-bicarbonate signature. Groundwaters will be Hard to Very Hard (typically ranging between 350-450 mg/l), and high electrical conductivities are also observed. Alkalinity will also be high, but less than hardness. In the Impure Limestones iron and manganese concentrations frequently fluctuate between zero and more than the EU Drinking Water Directive maximum admissible concentrations (MACs). Hydrogen sulphide can also be problematic in shaly limestones. These components come from the muddy parts of these rock units and reflect both the characteristics of the rock-forming materials and the relatively slow speed of groundwater movement through the fractures in the rock allowing low dissolved oxygen conditions to develop.
Groundwater Flow Paths		These rocks are devoid of intergranular permeability; groundwater flow occurs in fractures and faults. Permeability is highest in the upper few metres of bedrock, but decreases rapidly with depth. In general groundwater flow is concentrated in the upper 15 m of the aquifer. Local zones of high permeability can be encountered near fault zones and in areas of intensive fracturing. Groundwater flow in this body will be of a local nature. Groundwater flow paths are generally short, 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 water catchments. Overall, groundwater flow is to the east and south towards the River Shannon. In general groundwater is unconfined in this groundwater body, however groundwater can become confined beneath the clayey till and lacustrine clay deposits that underlie the large bogs along the River Shannon.
Groundwater & Surface water interactions		Groundwater provides an element of base flow to the River Shannon and to streams crossing the body. There are many areas of raised bogs within this groundwater body. Raised bogs are generally considered as ecosystems that are independent or only locally dependant on groundwater. However, lagg zones can develop at bog fringes, where mixing of upwelling groundwater flow and surface runoff from the bog provide added nutrients for the development of a diverse range of plant species. Groundwater is generally confined beneath low permeability clayey till and 2-3 m of lacustrine clay which underlie the peat in the large bogs. In areas where the underlying clays are thin or absent there is potential for upward movement of groundwater to the bog system. The complete removal of up to 10 m of peat from large areas of bog adjacent to the River Shannon, and the cessation of pumped drainage once harvesting is complete may have implications for future groundwater surface water interactions. Occasionally the post harvesting level of peat is lower that the winter water levels of the River Shannon. Karstification is rare in the limestones in this groundwater body however some features can occur. There are a small number of potential karst features currently recorded for the area - two swallow holes and an enclosed depression – these points require further investigation.

Conceptual model	• This groundwater body occupies a northeast southwest trending broadly rectangular area west and southwest of Athlone. It is bounded to the east and south by the River Shannon and to the north by contact with the Pure Bedded Limestones of the karstic Fuinshinagh GWB. The western boundary is formed by a groundwater divide and topographic high which coincides with a surface water catchment boundary. • The area is flat and lowlying with large areas of bog cover adjacent to the River Shannon. • This groundwater body is composed primarily of low permeability rocks which have localised zones of enhanced permeability. Groundwater flows along fractures joints and major faults. • Recharge occurs diffusely through the subsoils. Recharge is limited in areas where the aquifer in confined beneath clayey till and lacustrine clay which underlie the bogs. • In general groundwater is unconfined in this groundwater body, however groundwater can become confined beneath the clayey till and lacustrine clay deposits that underlie the large bogs along the River Shannon. Most groundwater flow occurs in the upper 15 m of the bedrock, comprising a weathered zone of a few metres and a connected fractured zone below this. Deep-water strikes in more isolated faults/fractures can be encountered. Groundwater flow in this body will be of a local nature. Groundwater flow paths will generally be short. • Groundwater will discharge to the streams crossing the body and to the River Shannon. Overall, the flow direction is east and south to the River Shannon. • Groundwater surface water interactions may be an issue in lagg zones on the margins of the raised bogs within this groundwater body. Removal of the peat cover and alterations to drainage patterns post harvesting may influence groundwater surface water interactions in these areas. • There may be a limited number of karst features, such as swallow holes and enclosed depressions, within the body. Where present these would act as a focus for point recharge and groundwater surface water interaction, however karstification is quite rare in the limestones found in this groundwater body.
Attachments	None
Instrumentation	Stream Gauges: 26027, 26212, 26221, 26316, 26317, 26318. (No dry weather flow data available). EPA Water Level Monitoring boreholes: None EPA Representative Monitoring boreholes: None
Information Sources	Lee, M. & Daly D. (2003) *County Roscommon Groundwater Protection Scheme.* Main Report. Roscommon County Council & Geological Survey of Ireland, 54pp. Morris J.H., Somerville I.D. and MacDermot C.V. (2002). *Geology of Longford-Roscommon.* A Geological Description to Accompany the Bedrock Geology 1:100,000 Bedrock Series Sheet 12. With contributions by D.G. Smith, M. Geraghty, B. McConnell, K. Carlingbold, W. Cox, D. Daly. Geological Survey of Ireland, 121pp. Publication Pending. Gately, S., Sommervill, I., Morris, J.H., Sleeman, A.G. and Emo, G. (2003) *Geology of Galway-Offaly. A Geological description of Galway-Offaly, and adjacent parts of Westmeath, Tipperary, Laois, Clare and Roscommon to accompany the bedrock geology 1:100,000 scale map series, Sheet 15.* With contributions from W. Cox (Minerals), T.Hunter-Williams (Groundwater) and R. van den Berg and E. Sweeney (Carboniferous Volcanics), edited by A.G. Sleeman.
Disclaimer	Note that all calculations and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

GROUNDWATER BODY (For Reference)

Potential catchement boundary adjustment



List of Rock units in Athlone West Groundwater Body

Rock unit name and code	Description	Rock unit group
Lucan Formation (LU)	Dark Limestone & shale (calp)	Dinantian Upper Impure Limestone
Waulsortian Limestone (WA)	Massive unbedded lime mudstone	Dinantian Pure Unbedded Limestone
Ballysteen Formation (BA)	Dark muddy limestone, shale	Dinantian Lower Impure Limestone
Navan Beds (NAV)	Dark limestone, mudstone, sandstone	Dinantian (early) Sandstones, Shales and Limestones
Oolitic Limestone (oo)		Dinantian Pure Bedded Limestones