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Geological Survey
Suirbhéireacht Gheolaíochta
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Cloonillan Sand and Gravel Aquifer Summary of Initial Characterisation



GW3D Project Report TR2023/61
July 2023

Cloonillan Sand and Gravel Aquifer Description July 2023

This sand and gravel report forms part of a series representing the output of a body of work undertaken to re-evaluate previously mapped sand and gravel aquifers and to identify new sand and gravel aquifers. This study resulted in the refinement of existing sand and gravel aquifer mapped extents, the modification of some sand and gravel aquifer categories, and the removal of some previously mapped sand and gravel aquifers, as well as identification of new aquifers. In addition to mapping the extent and depths of the sand and gravel aquifers, the investigations consider the hydraulic properties.

The study, undertaken as part of the GW3D project (2015-2019), comprised three parts:

1) Desk study and fieldwork preparation

Sand and gravel bodies above a minimum size criterion were extracted from the GSI Quaternary Sediments 1:50,000 map. Where it was known that the surface expression of the sands and gravels was only a small portion of the subsurface body, such areas were retained. This process left several hundred sand and gravel bodies remaining as a starting point for field work.

2) Fieldwork including mapping and data collection

Field work included a visit to each of the areas which had the potential to be (at least) a Locally Important Sand and Gravel Aquifer owing to its area. In such areas, gravel pits and sand pits were visited and depth and type of sediment recorded, other exposures into the subsurface were visited and logged, wells (whether Public Supply, Group Scheme or private farm or domestic) were dipped and any information on depths recorded, and data was collected where geological and hydrogeological data existed for the area.

3) Data collation, analysis and reporting.

All field data, and information from earlier reports and studies, were compiled and analysed. Where a sand and gravel body had qualifying aquifer properties (either 10 m depth sand and gravel, or 5 m depth saturated sediments), these areas were digitised in a GIS. The aquifer area was then ascertained and drawn up. Such areas formed the basic building blocks for the sand and gravel aquifer map, which included details on the aquifer name, area, aquifer resource value (Rg or Lg), confidence level, county, and any important aspects to note for each body.

The updated mapped sand and gravel aquifers are found on the Geological Survey Ireland site <https://www.gsi.ie/en-ie/data-and-maps/Pages/Groundwater.aspx#Aquifers>

The GW3D Mapping Team involved in the current revision of delineated sand and gravel aquifers were:

Geological Survey Ireland staff:

- Dr. Sophie O'Connor, Groundwater Programme / Land Mapping Unit
- Dr. Sarah Blake, Groundwater Programme

Consultant support:

- Dr. Robbie Meehan, Talamh Ireland
- Coran Kelly, Tobin Consulting Engineers
- Damien Doherty, independent Consultant Geologist/ Tobin Consulting Engineers
- Natalie Duncan, independent Consultant Geologist
- Sara Raymond, independent Consultant Geologist
- James McAteer, Gavin and Doherty Geosolutions



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Hydrometric Area Local Authority		Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
26 –Shannon Upper Roscommon County Council		Rivers: None Streams: Several unnamed, minor streams Lakes: None	None	4.24
Topography	The Cloonillan sand and gravel aquifer is located half way between Ballinasloe and Athlone, in County Roscommon, and is found at elevations between 63 m and 78 m AOD (Figure 1). The aquifer is comprised of hummocky sands and gravels and associated eskers which are in patches overlain by cutover raised peats. This hummocky landscape continues further north, encompassing a vast area to the west of Athlone Town, but the aquifer itself is surrounded by an extensive belt of cutover raised peat that is lowlying, flat and saturated.			
Geology and Aquifers	Aquifer categories	Based on its areal extent, inferred thickness, saturated thickness, groundwater throughput and position in the landscape the deposit is classified as Locally Important Sand and Gravel Aquifer (Lg) (DELG/EPA/GSI, 1999; GSI, 2017). Six borehole logs are available from within the body, and with these data it is inferred that a significant proportion of the deposit is greater than 10 m thick (Figures 2 and 3).		
	Main aquifer lithologies	The sand and gravel body is comprised of glaciofluvial sands and gravels derived chiefly from limestones (GLs), and eskers which are basic in chemical reaction (BasEsk).		
	Key structures	Exposure is poor within this sand and gravel body, and no stratigraphy or sedimentology of the sands and gravels could be noted during fieldwork.		
	Key properties	During fieldwork, there were a number of water levels recorded at specific localities within the aquifer extent. The water levels recorded range from 0.75 m to 6.25 m below ground level and, along with associated depth to bedrock data, this has allowed for inferences to be made on the degree of saturation within the body. It is estimated that approx. 41% of the aquifer area has a depth of saturated sands and gravels greater than 5 m (Figure 2). Sand and gravel aquifers generally consist of unconsolidated coarse grained material, usually containing less than 8% fines (Ó’Súilleabháin, 2000).		
	Thickness	Four of the six borehole logs show greater than 10 m depth of subsoil, with one of these indicating at least 20.7 m depth, in Cloonillan Townland (EMD, 2019). Bedrock is known to outcrop just south of the aquifer area, and nearby a borehole has a subsoil thickness of just 4.6 m (EMD, 2019). The thicknesses of sand and gravel sediments are interpreted to be greater than 10 m over the majority of the area of the aquifer.		
Overlying Strata	Lithologies	Approximately 46% of the aquifer area is overlain with cutover raised peat, with sand and gravel assumed beneath. There are two small pockets of till embedded in the main portion of the sand and gravel deposit, which are included as being part of the overall sand and gravel aquifer body.		
	Thickness	The cutover raised peat is expected to be less than 3 m thick. The thickness of the till, where present in localised areas, is unknown, but is not expected to be excessively deep.		
	% area aquifer near surface	Approximately 54% of the sand and gravel aquifer is at the surface, with the remainder beneath the peat, alluvial and glacial till deposits.		
	Vulnerability	The groundwater vulnerability of the sand and gravel is ‘Extreme’ where the water table is inferred to be < 3 m from the surface, this accounts for 69% of the aquifer area. In all other areas where the water table is at a depth > 3 m, the vulnerability is classed as ‘High’ (31% of the area, Figure 3).		
Recharge	Main recharge mechanisms	Diffuse recharge occurs <i>via</i> rainfall percolating through the unsaturated sand and gravel. Due to the high permeability of sand and gravel, a high proportion of the available recharge will percolate down to the water table. In the areas of the aquifer that is covered by overlying strata a much lower proportion of the available recharge will percolate down to the water table.		



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	Est. recharge rates	The annual average rainfall for the aquifer area is 972 mm (Walsh, 2012), thus providing an estimated diffuse groundwater recharge of 382 mm/year. The minimum groundwater throughput in the aquifer is consequently estimated to be 1,848 m ³ /d.
Discharge	Large springs and large known abstractions (m³/d)	There are no known large springs or abstractions from this aquifer body.
	Main discharge mechanisms	Groundwater discharges to a number of small, lowlying springs which are seen to be dotted throughout the aquifer on the OSI 6 inch raster map (1830s – 1930s) at, for example, Cuilfadda and Cloonillan Townlands. The streams that pass through and surround the aquifer are expected to accept discharged groundwater also.
	Hydrochemical Signature	There are no data readily available to assess the hydrochemistry of this aquifer, but the groundwater is likely to have a calcium bicarbonate (CaHCO ₃) signature.
Groundwater Flow Paths		The length of flow paths depend on the extent of the sand and gravel deposit. In general, locally important sand and gravel aquifers are expected to have relatively short flow paths <i>i.e.</i> up to several hundred metres. This is expected also to be the case at Cloonillan, given the geomorphology of the body and the stream pattern within it.
Groundwater & Surface water interactions		Owing to the presence of small springs throughout the aquifer, hydraulic connection between the groundwater and the surface streams is expected to be high.
Conceptual model	- The aquifer comprises hummocky sands and gravels and associated eskers which are overlain by cutover raised peat in places. - The aquifer surface is at elevations between 63 m and 78 m AOD (Figure 1). - Approximately 46% of the area of the aquifer is overlain with cutover raised peat, with sand and gravel assumed beneath. - There are two small pockets of till embedded in the main portion of the sand and gravel deposit, which are included as being part of the overall aquifer body. - It is inferred that approx. 41% of the aquifer area has a depth of saturated sand and gravel greater than 5 m (Figure 2), with the remainder inferred to have a saturated thickness less than this. - Four of the six borehole logs have greater than 10 m depth of subsoil, with one of these indicating at least 20.7 m depth of subsoil in Cloonillan Townland (EMD, 2019). - Diffuse groundwater recharge is estimated to be approx. 382 mm/yr. - The minimum groundwater throughput in the aquifer is estimated to be 1,848 m³/d.	
Attachments	Figure 1: Location and extent Figure 2: Cross section Figure 3: Groundwater vulnerability	
Instrumentation	Hydrometric gauges: National Water Monitoring Stations; Rivers: Groundwater:	None present None present None present
Information Sources	- DELG/EPA/GSI (1999). Groundwater Protection Schemes. Department of the Environment and Local Government, Environmental Protection Agency and Geological Survey Ireland. - EMD (2019). Exploration and Mining Division, OPALS Public Viewer. http://spatial.dcenr.gov.ie/ExplorationAndMining/SpatialViewer/ - EPA map viewer. https://gis.epa.ie/EPAMaps/ - GSI (2017). A description of Irish aquifer categories. 3 pp. Available from: https://www.gsi.ie/documents/GSI%20Aquifer%20Category%20Descriptions.pdf - NPWS viewer. http://webgis.npws.ie/npwsvviewer/ - Ó'Súilleabháin, C. (2000). Assessing the boundary between high and moderately permeable subsoils. Unpublished MSc., University of Dublin. Department of Civil, Structural and Environmental Engineering, Trinity College Dublin.	



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Information Sources (contd.)	Walsh, S. (2012). A Summary of Climate Averages 1981-2010 for Ireland, Climatological Note No.14, Met Éireann, Dublin.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations and assumptions based on the information sources described above and established hydrogeological formulae. Figures 1, 2 and 3 are used for illustrative purposes only.

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Cloonillan Sand and Gravel Aquifer

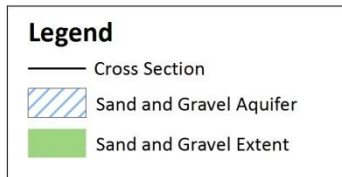
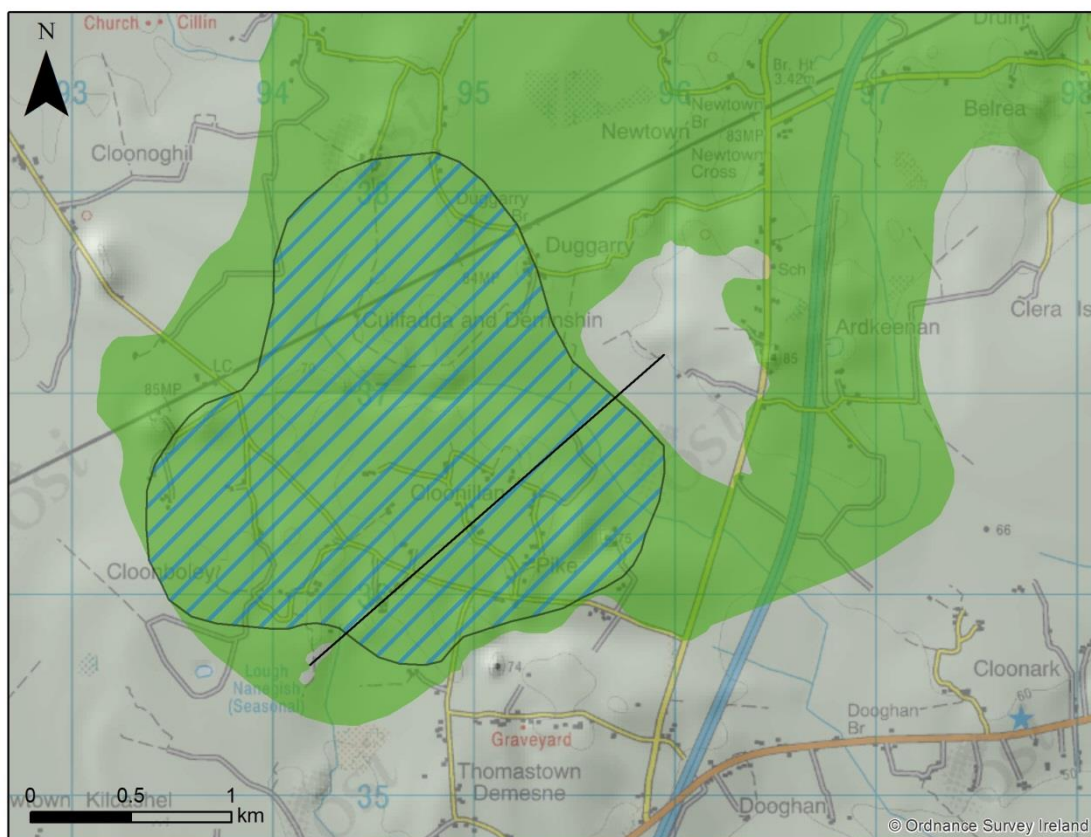


Figure 1: Cloonillan Sand and Gravel Aquifer extent with cross section location.

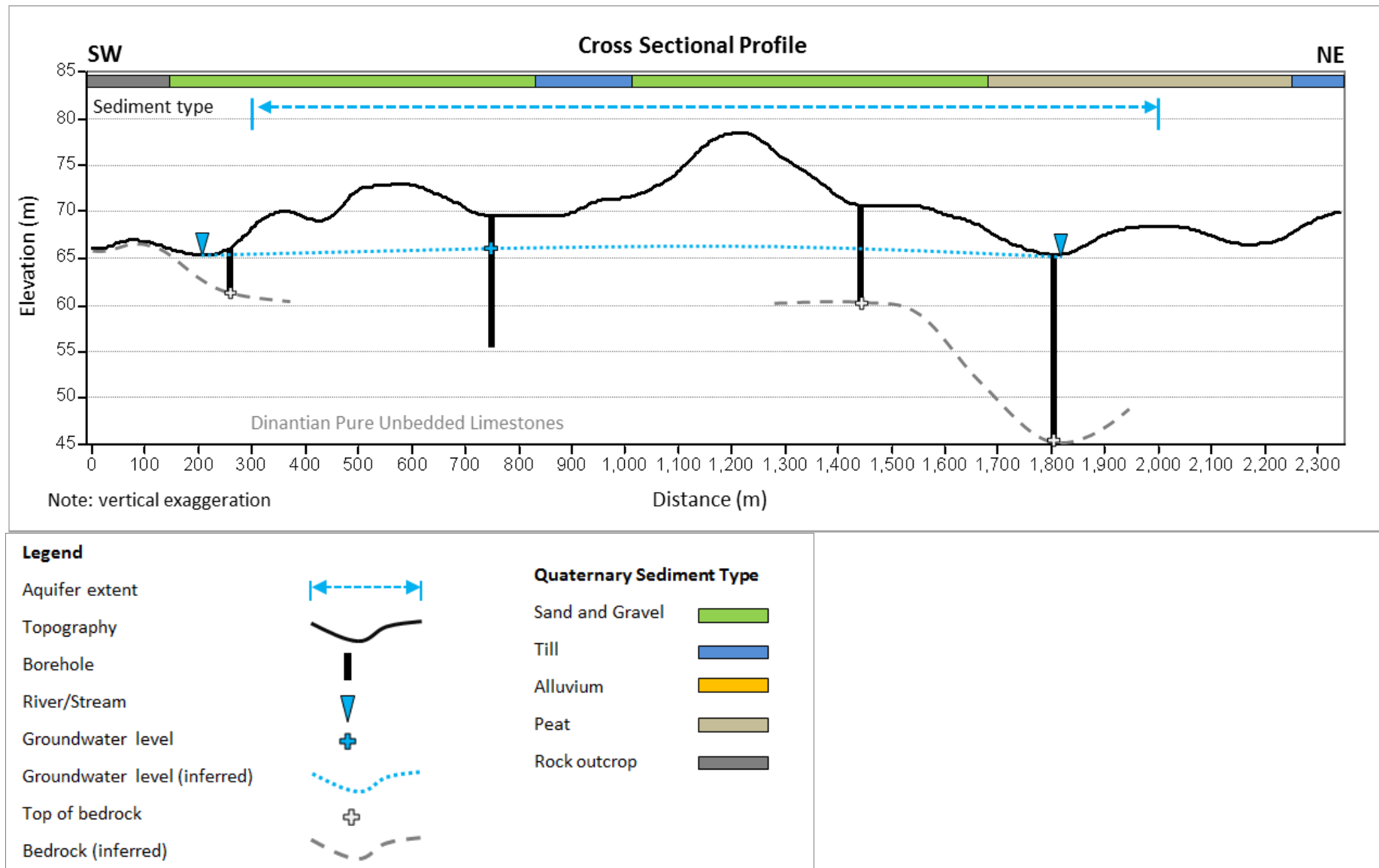


Figure 2: Cross section through the Cloonillan Sand and Gravel Aquifer body.

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Cloonillan Sand and Gravel Aquifer Vulnerability

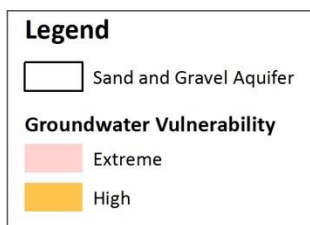
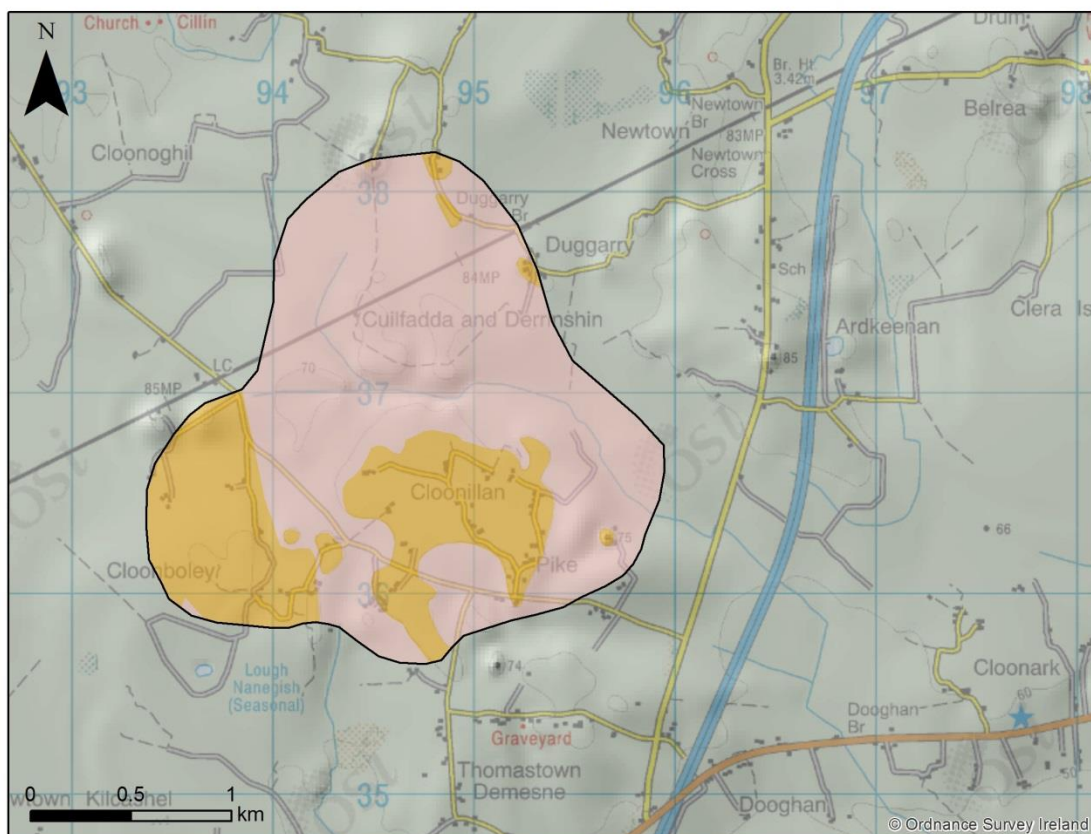


Figure 3: Groundwater vulnerability across the Cloonillan Sand and Gravel Aquifer.