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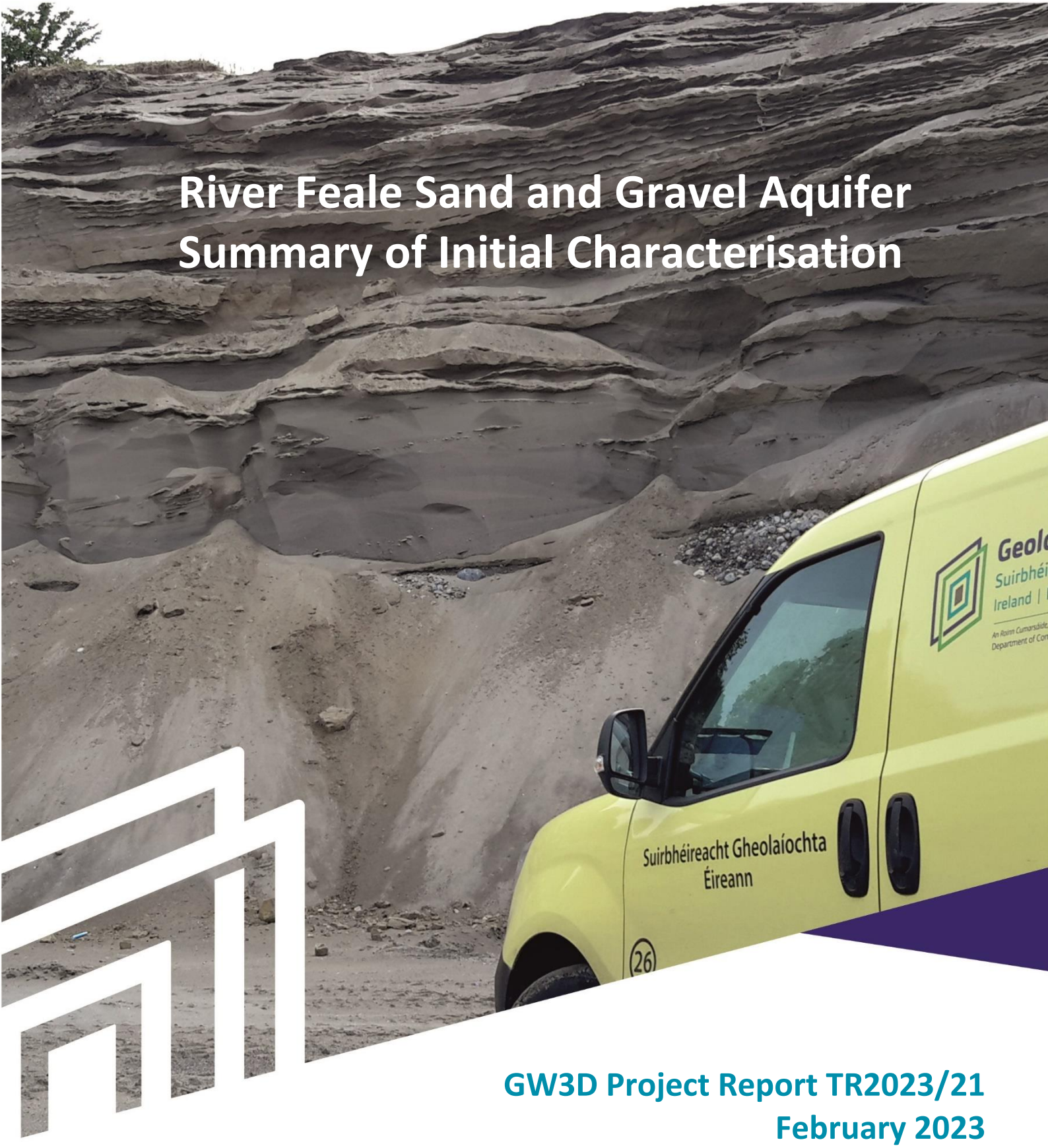

River Feale Sand and Gravel Aquifer
Summary of Initial Characterisation

GW3D Project Report TR2023/21
February 2023

Geological Survey Ireland is a division of the Department of the Environment, Climate and Communications

River Feale Sand and Gravel Aquifer Description February 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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River Feale Sand and Gravel Aquifer: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
23 – Tralee Bay - Feale, Kerry County Council Limerick County Council	**Rivers:** River Feale, Smearlagh River, Shanacoo River, Gortanimerisk River, Islandboy River, Sluicequarter River, Rathoran River, Moynsha River, Pollinbwee River, Oolagh River, Abbeyfeale River, Allaghaun River **Streams:** Several unnamed, minor streams **Lakes:** None	Lower River Shannon SAC	4.80

Topography	The River Feale sand and gravel aquifer stretches for 10 km along the floor of the Feale Valley in north County Kerry / west County Limerick, along a southeast-northwest orientation (Figure 1). The aquifers topography is flat to gently undulating, at elevations between 24 m and 52 m AOD, with a topographic gradient of 0.0028 from southeast to northwest. Steep hills rising to between 200 m to 260 m AOD bound the northeastern and southwestern sides of the aquifer, characterised as 'mountain streamlined plateaus' (GSI, 2023a).	
Geology and Aquifers	**Aquifer categories**	The sand and gravel body occupies an area of approx. 5 km^2, and is unconfined. There is one groundwater and geotechnical data point available from within the area of the aquifer. The aquifer exceeds the groundwater throughput threshold of 1,000 m^3/d, and the rejected recharge from the surrounding Locally Important Bedrock Aquifer **(Ll)** contributes significantly towards the throughput. The rejected recharge in the body would suggest characterising this body as Regionally Important Sand and Gravel Aquifer **(Rg)** but based on the 'good' yield from a Public Water Supply and the majority of the recharge in the aquifer expected as being rejected indirectly from the valley slopes the deposit is classified as **Locally Important Sand and Gravel Aquifer (Lg)** (DELG/EPA/GSI, 1999; GSI, 2017).
	Main aquifer lithologies	Alluvial sands and gravels, derived chiefly from Namurian sandstones and shales (Meehan, 2016).
	Key structures	Exposure into the alluvium is common within this sand and gravel body, with cuttings into well bedded and sorted, rounded and sub-rounded pebble and cobbles gravels, with sand interbeds, dominating (Meehan, 2016).
	Key properties	One desk study data point occurs in the area of the aquifer, with greater than 5 m depth of saturated sand and gravel present (GSI, 2023b). Specific capacity at the Duagh Bridge Public Water Supply, which extracts from the sands and gravels, has been estimated at 65.8 $m^3/d/m$ (GSI, 2019b). It is inferred that approx. 47% of the aquifer area has a depth of saturated sand and gravel greater than 5 m. In general, sand and gravel aquifers consist of unconsolidated coarse grained material, usually containing less than 8% fines (Ó'Súilleabháin, 2000).
	Thickness	Depth to bedrock has been measured at 9.1 m below ground level in the centre of the aquifer (GSI, 2023b), and the thicknesses of the deposits are expected to be approx. 10 m throughout the majority of the aquifer extent.
Overlying Strata	**Lithologies**	The aquifer comprises alluvial sands and gravels, which are inferred to be derived from soliflucted sediments and/or tills in the valley and on surrounding slopes, throughout the entire extent of the aquifer (Meehan, 2016). There are no sediments overlying any portion of the sand and gravel aquifer itself.
	Thickness	N/A
	% area aquifer near surface	All of the alluvial sand and gravel is at the surface.
	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 93% of the aquifer area. In all other areas where the water table is at a depth > 3 m, the vulnerability is classed as 'High' (7% of the aquifer area, Figure 3).

Recharge	**Main recharge mechanisms**	Diffuse recharge occurs *via* rainfall percolating down through the alluvial sands and gravels. Due to the relatively high permeability of the alluvium in the Feale Valley a significant proportion of the available recharge will percolate down to the water table. Rejected recharge is also conceptualised from the surrounding Locally Important Bedrock Aquifer **(LI)**, from higher slopes at both the northeast and southwest.
	Est. recharge rates	The annual average rainfall for the aquifer is 1,230 mm (Walsh, 2012), thus providing an estimated diffuse groundwater recharge of 225 mm/yr. The minimum direct groundwater throughput in the aquifer itself is estimated to be 1,421 m^3/d, which increases to a potential minimum of 16,809 m^3/d when rejected recharge from the surrounding slopes is included.
Discharge	**Large springs and large known abstractions (m^3/d)**	Groundwater is abstracted from a Public Water Supply borehole at Duagh Bridge; the yield is estimated to be 342 m^3/d (GSI, 2023b).
	Main discharge mechanisms	Groundwater is inferred to discharge into the streams and rivers which flow through the aquifer, in the majority the River Feale itself. Dry Weather Flow has been calculated for the Listowel (23002) hydrometric gauge, where a specific dry weather flow of 2.31 $l/s/km^2$ is estimated, which suggest sand and gravel aquifer input during periods of low flow.
	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 (Ca/HCO_3) to potassium bicarbonate ($Na/KHCO_3$) signature.
Groundwater Flow Paths		The length of flow paths depends on the extent of the sand and gravel deposit. In general, regionally important sand and gravel aquifers are expected to have relatively long flow paths *i.e.*, perhaps up to several kilometres. The geomorphology and pattern of streams and rivers within this sand and gravel aquifer would suggest groundwater flows paths are unlikely to exceed 500 m, again more in keeping with a Locally Important Aquifer.
Groundwater & Surface water interactions		Groundwater is expected to discharge *via* lowlying springs and rises as shown on the OSI 6 inch raster map (1830s – 1930s). Groundwater is also expected to discharge into the River Feale which flows through the full length of the aquifer body.
Conceptual model		• The aquifers topography is flat to gently undulating, found at elevations between 24 m and 52 m AOD, and gently sloping from the southeast to the northwest. The topographic gradient has been estimated at 0.0028. • The aquifer comprises alluvial sands and gravels. • Depth to bedrock data has been measured at 9.1 m below ground level, at one point locality in the central portion of the aquifer (GSI, 2023b). • Groundwater levels are expected to be less than 3 m below ground level in 93% of the aquifer area. • Groundwater is abstracted from a Public Water Supply borehole at Duagh Bridge; the yield has been estimated to be 342 m^3/d (GSI, 2023b). • An area of 10.12 $km^2$of rejected recharge from the surrounding Locally Important Bedrock Aquifer **(LI)** has been included in calculations of aquifer throughput. • The minimum direct groundwater throughput in the aquifer itself is estimated to be 1,421 m^3/d, which increases to a potential minimum of 16,809 m^3/d when rejected recharge from the surrounding slopes is included.

Attachments	Figure 1: Location and extent Figure 2: Cross section Figure 3: Groundwater vulnerability	
Instrumentation	**Hydrometric gauges:** **National Water Monitoring Stations;** **River:** **Groundwater:**	23010 (Abbeyfeale) RS23F010550 (Trieneragh) RS23F010500 (Bridge ENE of Duagh House) S23F010470 (Sluicequarter) RS23F010400 (Feale – 2.3 km d/s Abbeyfeale) RS23F010330 (Feale – 1 km d/s Abbeyfeale) RS23F010324 (WDLW 16) RS23F010322 (WDLW 15) RS23A010900 (Allaghaun Bridge) 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. • 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 • GSI (2023a). Geological Survey Ireland, Spatial Resources Viewer. https://www.gsi.ie/en-ie/data-and-maps/Pages • GSI (2023b). Geological Survey Ireland, Internal groundwater databases. • Meehan, R. (2016). Groundwater Programme Priority Groundwater Mapping Areas – River Feale Sands and Gravels. Report for the Geological Survey Ireland. • NPWS viewer. http://webgis.npws.ie/npwsviewer/ • 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. • 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.	

River Feale Sand and Gravel Aquifer

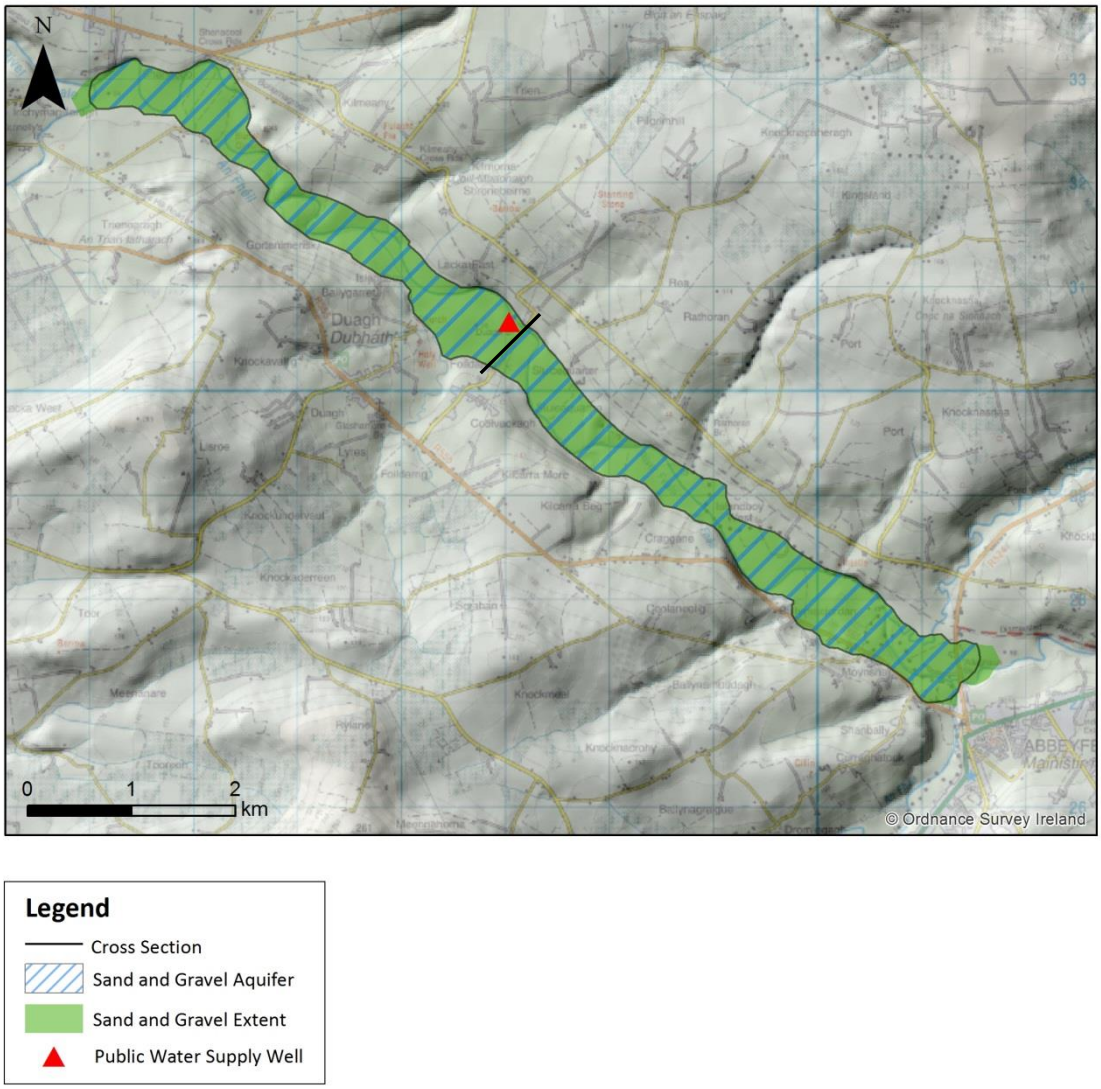

Figure 1: River Feale Sand and Gravel Aquifer extent with cross section location.

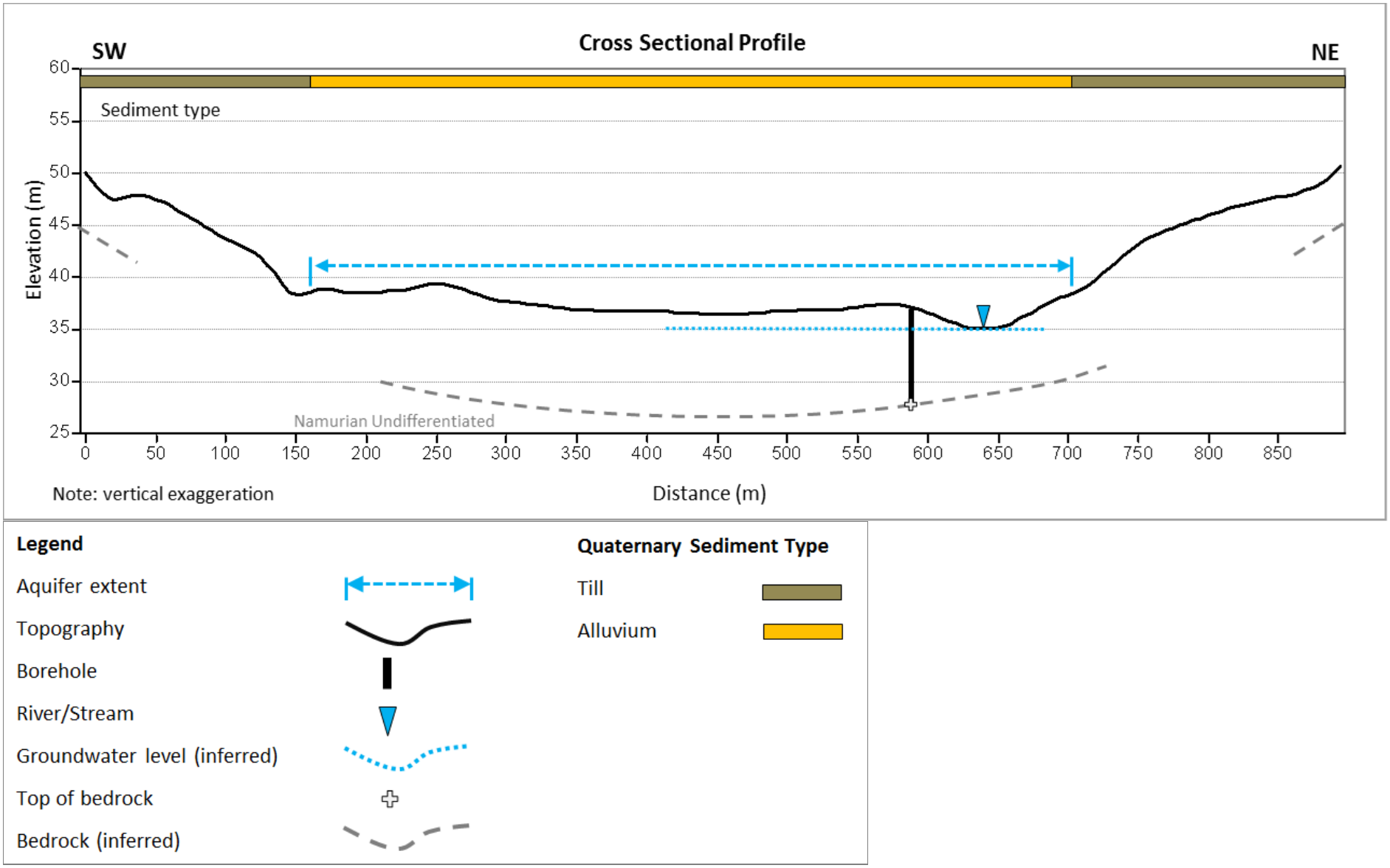

Figure 2: Cross section through the River Feale Sand and Gravel Aquifer body.

River Feale Sand and Gravel Aquifer Vulnerability

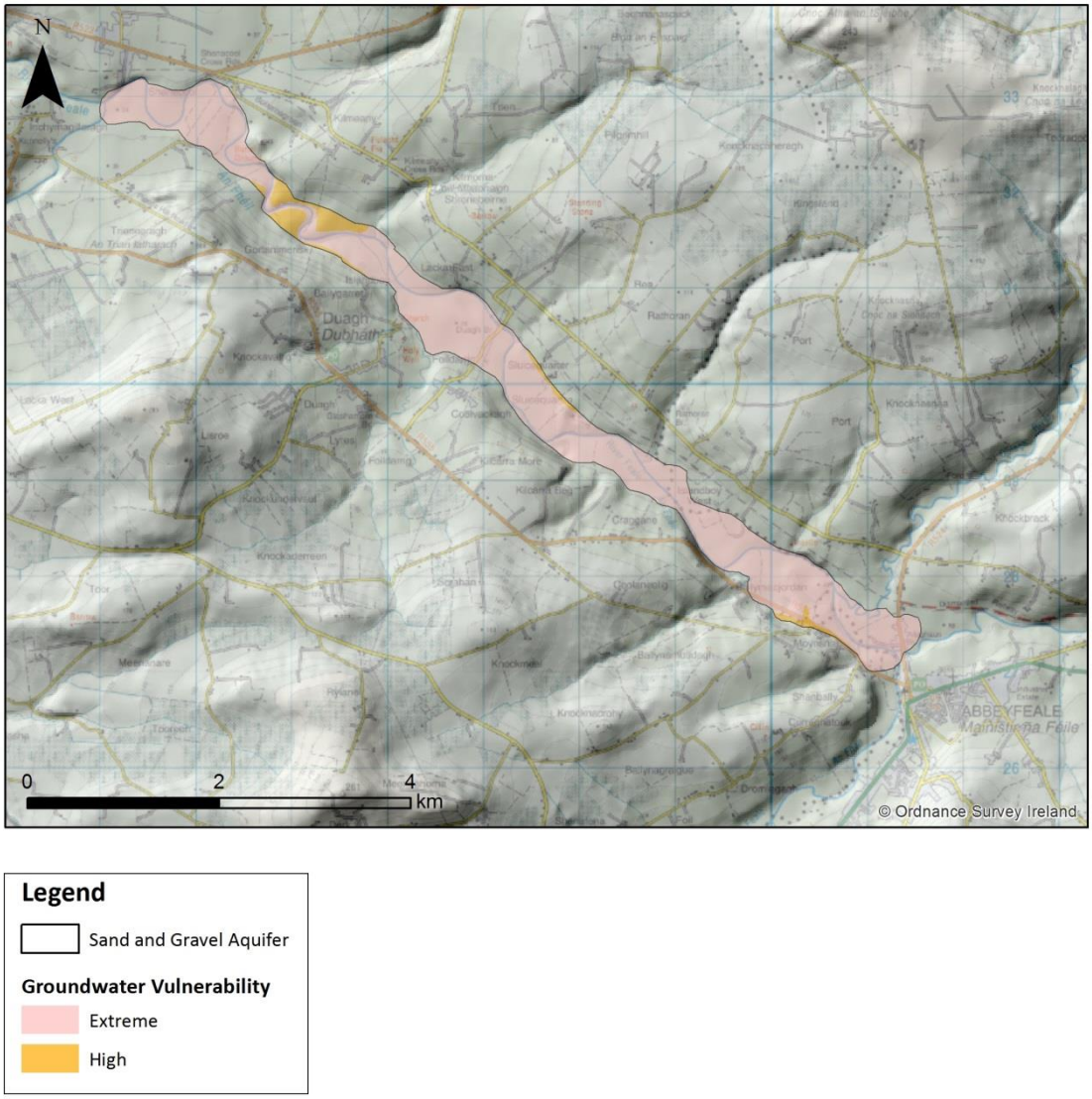

Figure 3: Groundwater vulnerability across the River Feale Sand and Gravel Aquifer.