7 Land, Soils and Geology

7.1 Introduction

This chapter comprises an assessment of the land, soils and geology within the vicinity of the site and the surrounding environs. The potential impacts posed by the construction and operational phases of the Proposed Development are investigated, and suitable mitigation measures are recommended to minimise impacts on the local soil and geological receptors.

The objectives of this chapter are:

- To provide a baseline assessment of the receiving environment in terms of land, soils and geology.
- To identify any potential negative impacts posed by the construction and operational phases of the Proposed Development.
- To propose suitable mitigation measures to prevent or reduce the significance of the negative effects identified.
- To consider any significant residual effects of cumulative impacts posed by the Proposed Development.

7.2 Consultation

ORS have been commissioned to assess the potential impacts of the Proposed Development in terms of Land, Soils, and Geology during the construction and operational phases.

The principal members of the ORS EIA team involved in this assessment include the following persons:

- **Project Scientist and Lead Author:**
  Alex Nascimento – B.Eng. (Environmental Engineering), MIEnvSc. Current Role: Senior Environmental Consultant. Experience *ca*. 14 years.

- **Project Scientist and Reviewer:**
  Austin Hynes – B.Sc (Geology), M.Res (Structural Geology), PGeo EuroGeol. Current Role: Environmental Consultant. Experience ca. 8 years

- **Project Coordinator and Reviewer:**
  Oisín Doherty – B.Sc. (Geography with Environmental Science), MSc. (Environmental Management), CEnv, MIEnvSc. Current Role: Chartered Environmental Consultant. Experience *ca.* 15 years.

Consultation between ORS and other members of the planning/design team was made in order to obtain information required to assess the potential construction and operational phase impacts on local Land, Soils, and Geology.

7.3 Assessment Methodology and Significance Criteria

The methodology used to produce this chapter included a review of relevant legislation and guidance, a desk study, a site walkover, an intrusive investigation (in the form of trial pits, and

laboratory tests), an evaluation of potential effects, an evaluation of significance of the effect and an identification of measures to avoid and mitigate effects.

This chapter was carried out in accordance with the following guidance documents:

- EPA, (2022). Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.
- EPA, (2004). Land spreading of Organic Waste – Guidance on Groundwater Vulnerability Assessment of Land.
- EPA, (2004). Guidance Note on Storage and Transfer of Materials for Scheduled Activities.
- EPA, (2012). Guidance to Licensees on Surrender, Cessation and Closure of Licensed Sites.
- European Commission, (2017). Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report.
- Institute of Geologists Ireland, (2013). Guidelines for Preparation of Soils, Geology and Hydrogeology Chapters in Environmental Impact Statements.
- National Road Authority, (2008). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- Transport Infrastructure Ireland, (2019). Cross Sections and Headroom, Design Standards (DN-GEO-03036)
- CIRIA, (2001). C532 - Control of Water Pollution from Construction Sites – Guidance for consultants and contractors.
- UK CIRIA Report C552 (2001). Contaminated Land Risk Assessment: A Guide to Good Practice
- IGI, (2002). Geology in Environmental Impact Statements – a Guide (Institute of Geologists of Ireland.
- Department Agriculture, Food and Marine, (2017). Nitrate Explanatory Handbook for Good Agricultural Practice For The Protection Of Waters Regulations 2018
- DAFM, (2022). Code of Good Practice for Poultry Litter Hauliers - Legal Obligations and Good Practice Guidelines for Poultry Litter Hauliers in Relation to the Use and Disposal of Poultry Litter.
- Nitrates Directive (91/676/EEC)
- Groundwater Directives (80/68/EEC) and (2006/118/EC).
- EU Soil Strategy 2030
- EU Common Agricultural Policy
- Waste Management Act 1996.
- Möller, K., and Müller, T. (2012). Effects of anaerobic digestion on digestate nutrient availability and crop growth: a review. Engineering in Life Sciences, 12(3), 242-257.
- Doyeni MO, Stulpinaite U, Baksinskaite A, Suproniene S, Tilvikiene V. (2021) The Effectiveness of Digestate Use for Fertilization in an Agricultural Cropping System. Plants (Basel). 2021 Aug 22;10(8):1734.
- C.H. and Sanders, I.S. (eds). (2009). The Geology of Ireland (2nd ed.). Dunedin Academic Press.
- Pracht, M. & Somerville, I.D. (2015). A revised Mississippian lithostratigraphy of County Galway (western Ireland). Irish Journal of Earth Sciences, 33, 1–32.
- Geological Survey of Ireland (GSI): 1:100,000 Bedrock Solid Geology Map and associated datasets.
- Drew, D. 2018. Karst of Ireland: Landscape Hydrogeology Methods. Published by Geological Survey Ireland.

- Gardiner, M. J., & Radford, T. (1980). Soil Associations of Ireland and Their Land Use Potential: Explanatory Bulletin to Soil Map of Ireland. An Foras Talúntais (The Agricultural Institute).
- Lewis, S. (1837) A Topographical Dictionary of Ireland, libraryireland.com (last accessed November 25)

7.3.1 Desktop Study

A desk study was undertaken in order to collate and review background information in advance of the site survey and to develop a baseline of the land, soil and geology. The following documents and sources were referenced:

- Geological Survey of Ireland (GSI) maps and datasets
- Environmental Protection Agency (EPA) maps and datasets
- National Parks and Wildlife Service (NPWS) maps and datasets
- Ordnance Survey of Ireland (OSI) maps and datasets
- Met Eireann meteorological data
- Office of Public Works (OPW) maps and datasets
- Galway County Development Plan (CDP) 2022-2028
- Strategic Environmental Assessment CDP 2022-2028
- Review of the County Geology of Ireland: Galway
- Aerial Photography from ESRI (ArcGIS).
- 1:50,000 Discovery Series Maps and 6" maps
- Western River Basin District River Basin Management Plan (DoEHLG)
- Teagasc ISIS GIS maps
- General Soil Map of Ireland 2nd Edition, (1980), The National Soil Survey, An Fóras Taluntais
- An Foras Talúntais (1980). Soil associations of Ireland and their land use potential.

7.3.2 Field Survey

Fieldwork commissioned in July 2025 consisted of the following elements:

- Trial Pit Excavations
- Percolation testing for Wastewater Treatment System (WWTS) (carried out by Coyle Environmental)

A site walk-over was conducted by ORS geotechnical consultants on the 14th of July 2025 to identify hydrological features on site including:

- Drainage patterns and distribution
- Exposures
- Drainage Infrastructure
- Wet ground

7.3.3 Impact Assessment Methodology

Chapter 1, **Section 1.7** and **1.8**, outline the impact assessment methodology and rationale applied to each chapter of the study. This section describes some further criteria applied to the

assessment of soil and geological receptors.

Risk Appraisal Methodology

The Conceptual Site Model (CSM) identifies potential contaminants, receptors and exposure pathways that may be present based on the construction and operational phase of the Proposed Development. The identification of potential "contaminant linkages" is a key aspect of the evaluation of potentially contaminated land and in quantifying the potential risk associated with Proposed Developments. As such this assessment has been undertaken in line with the Source - Pathway - Receptor Model as per the "Guidelines on the information to be contained in Environmental Impact Assessment Reports" 2022 and IGI 2013 guidance notes. At the impact assessment stage, any potential beneficial or adverse impacts associated with the development are identified and assessed with reference to the baseline environment. This requires consideration of:

- Quality of effects (sensitivity of receptor)
- Significance of effects (severity)
- Description of extent and context of effects (character/ magnitude)
- Probability of effects
- Duration and frequency of effects
- Type of effect (direct, indirect, residual, etc.)

Table 1.1 in **Chapter 1** presents the criteria for the description of effects, as outlined in the EPA guidance report 2022.

Evaluation of Geological Receptors

The 13-step approach to impact assessment proposed in the Institute for Geologists Ireland (IGI) guidelines (2013) is adopted for the evaluation of potential effects. The baseline environment is assessed by characterising the site topographical, geological and geomorphologic regimes from the data acquired. Following on from the identification of the baseline environment, the available data is utilised to identify and categorise potential effects on the soils and geological environment as a result of the Proposed Development.

These assessments include:

- Undertaking preliminary materials calculations in terms of volumetric soil and subsoil excavation and reuse associated with development design,
- Assessing ground stability risks,
- Assessing the combined data acquired and evaluating any likely effects on the soils, geology, and ground stability,
- Identifying effects and considering measures that would mitigate or reduce the identified effect.

The significance of effects of the Proposed Development has been assessed in accordance with the EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports, 2022. The effects associated with the Proposed Development are described with respect to the EPA guidance in the relevant sections of this chapter.

Magnitude and Significance of Impact

An impact rating has been developed for each of the phases of the Proposed Development based on the Institute for Geologists Ireland (IGI) Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements. In line with the IGI Guidance the receiving environment (Geological Features) was first identified. Using the National Road Authority (NRA) (2008) rating criteria the importance of the geological features is rated in **Table 7.1** followed by an estimation of the magnitude of the impact (**Table 7.2**). This determines the significance of the impact prior to application of mitigation measures as set out in **Table 7.3**.

Table 7.1 - Sensitivity/ Value of the Site's Geological Features (NRA, 2008)

Magnitude	Criteria	Example
Very High	Attribute has a high quality, significance, or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying the site is significant on a national or regional scale	Geological feature on a regional or national scale (NHA). • Large existing quarry or pit. • Proven economically extractable mineral resource
High	Attribute has a high quality, significance, or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying the site is significant on a local scale	Contaminated soil on site with previous heavy industrial usage • Large recent landfill site for mixed wastes • Geological feature of high value on a local scale (County Geological Site) • Well drained and/or high fertility soils • Moderately sized existing quarry or pit • Marginally economic extractable mineral resource
Medium	Attribute has a medium quality, significance, or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying the site is moderate on a local scale	Contaminated soil on site with previous light industrial usage • Small recent landfill site for mixed wastes • Moderately drained and/or moderate fertility soils • Small existing quarry or pit • Sub- economic extractable mineral resource
Low	Attribute has a low quality, significance, or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying the site is small on a local scale	Large historical and/or recent site for construction and demolition wastes • Small historical and/or recent landfill site for construction and demolition wastes • Poorly drained and/or low fertility soils • Uneconomic extractable mineral resource

The assessment of the severity/ magnitude of an impact incorporates the timing, scale, size, and duration of the potential effect. The magnitude criteria for geological effects are defined in **Table 7.2**.

Table 7.2 - Severity/ Magnitude of Impact on Geological Features (NRA, 2008)

Magnitude	Criteria	Description and Example
Large Adverse	Results in loss of attribute	• Loss of high proportion of future quarry or pit reserves • Irreversible loss of high proportion of local high fertility soils • Removal of entirety of geological heritage feature • Requirement to excavate / remediate entire waste site • Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Loss of moderate proportion of future quarry or pit reserves • Removal of part of geological heritage feature • Irreversible loss of moderate proportion of local high fertility soils • Requirement to excavate / remediate significant proportion of waste site • Requirement to excavate and replace moderate proportion of peat, organic soils
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Loss of small proportion of future quarry or pit reserves • Removal of small part of geological heritage feature • Irreversible loss of small proportion of local high fertility soils and/or • high proportion of local low fertility soils • Requirement to excavate / remediate small proportion of waste site • Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

Based on the determination of the findings from the above **Tables** (**7.1** and **7.2**) the following matrix is used to establish the significance of the impact.

Table 7.3 - Rating the Significance of the Impact in Geology (NRA, 2008

Importance of Attribute	Magnitude of Impact			
	Negligible	Small Adverse	Moderate Adverse	Large Adverse
Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Profound/ Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/ Moderate

7.4 Description of the Receiving Environment

7.4.1 Background

This section of the chapter provides the baseline information in terms of geomorphology (landscape and topography), superficial and solid geology. The regional review of geological and hydrogeological conditions covers a zone of at least 2 km from the Proposed Development site, as suggested in the IGI guideline.

The Proposed Development, spanning approximately 4.0 hectares, is designed to process up to 90,000 tonnes annually of locally sourced agricultural manures, slurries, dairy processing residues, and crop-based feedstocks. Its primary objective is to produce grid-quality biomethane (renewable natural gas), which will be exported via a dedicated buried pipeline for injection into the Gas Networks Ireland (GNI) distribution system. This renewable natural gas (RNG) will directly replace conventional natural gas, contributing to the Government's target of generating 5.7 TWh of domestic biomethane annually.

The facility will also produce a nutrient-rich, biobased fertiliser, offering a sustainable alternative to conventional, fossil fuel-derived fertilisers. Additionally, the facility is designed to capture and recover biogenic carbon dioxide (CO_2).

The underlying geology has a major influence on topographical, hydrogeological and hydrological features within the Proposed Development vicinity; hence this chapter is closely linked to **Chapter 8 – Hydrology and Hydrogeology**.

The receiving environment is described below for the Proposed Development under the following headings:

- Landscape and Topography
- Receptors
- Drift (Quaternary) Geology
- Bedrock Geology
- Soils and Subsoils

7.4.2 Landscape and Topography

County Galway is segmented by Lough Corrib into two distinct regions, each possessing unique characteristics.

The eastern portion of the county is predominantly fertile and relatively level, with the exception of the Slieve Aughty mountains, which delineate its boundary with County Clare. A notable fertile corridor, considered by some to be an extension of the southern Golden Vale, extends from Gort through Loughrea to Aughrim and Ballinasloe. In the northern area around Dunmore, the landscape features a varied topography of hills and dales, primarily supporting rich pasture or tillage. Conversely, the terrain between Oranmore and Monivae presents a sterile surface, characterised by short heath and fern, yet underlain by limestone gravel.

In contrast, the western portion is characterised by a rugged, mountainous, and largely barren landscape. The Benna Beola mountains, commonly known as the Twelve Pins, represent the most elevated features. These ranges are situated centrally between Lough Corrib and Aghris

Point (westward) and between Birtirbuy and Killary bays (northward). They comprise two distinct groups connected by the elevated Maméan pass, with Knockenhiggeen being the highest peak at *ca.* 730m. The cliff on the south side of Glen Ina is particularly striking, forming a sheer, perpendicular precipice of *ca.* 365m, over which a significant volume of water cascades. To the east of the same valley, a chain of hills extends along the boundary of the Barony of Ross, marked by passes known as Maam.

Despite its mountainous topography, the western district is not uniformly an upland region akin to Wicklow. Approximately three-quarters of Connemara proper lies less than 30m above sea level. A substantial part of West Connaught gently ascends from the shores of Galway Bay to an elevation of around 91m, beyond which lie hills reaching *ca.* 210m, leading into a low-lying limestone area adjacent to Lough Corrib, which is only slightly elevated above the lake's surface.

Joyces' Country (a special region in North Connemara stretching from Maam Cross in the south to Tourmakeady in the North), conversely, is an elevated expanse featuring flat-topped mountains ranging from *ca.* 274m to 610m, intersected by deep, narrow valleys. The entirety of the western county is widely considered one of Ireland's least cultivated areas, presenting a continuous expanse of bog and mountain, with arable land constituting less than one-fiftieth of the total.

Based on the descriptions of the county presented on the Landscape Character Assessment of the Galway County Development Plan 2022-2028, the landscape descriptions move from the highest level of broad Landscape Regions to distinctive Landscape Types, and down to individual Landscape Units.

- Landscape Regions – a broad area of land with a distinctive character due to large-scale natural factors – such as mountains, plains, coasts etc.
- Landscape Character Type – an area of land that has an appearance that is readily recognisable as being different and distinctive from other areas.
- Landscape Character Unit - the smallest area of distinctive local features within a Landscape Type that can be practicably identified to assist in policy formulation.

7.4.2.1 Landscape Regions

At the broadest level, the County of Galway can be considered to consist of three landscape regions and the coast. These are the foundations of the county's landscape character, that are determined by the underlying geology and glacial drifts that have given rise to the topography, soil, vegetation and patterns of human settlement from prehistory to today.

- The *West Galway Region* is a zone that is mostly underlain by bolder, harder geology that gives rise to large-scale rugged, complex landscapes of mountains, lakes, bogs, islands and coastal inlets.
- The *Eastern Plains Region* is underlain by younger, softer rocks. This derives most of its character from the covering blanket of glacial soils that give rise to extensive, level plains of grasslands, with many areas of bog in the north.
- The *South Galway Region* where the Slieve Aughty Mountain's older, harder rock meet the younger, yielding geology of the Burren in the west and the Shannon basin in the east. The result is a collection of small landscapes which vary considerably as one travels from west to east.

- The Coast is a separate region which covers the islands and coastal waters of Galway. Areas of coastal water derive their character from their proximity and interactions with terrestrial areas.

7.4.2.2 Landscape Character Types

Each part of the County has been classified according to the type of landscape that it is part of, as follows;

- Coastal Landscape - the Coasts of Galway are highly distinctive, but very complex and varied, types of landscape that vary considerably between low and high tide.
- Island Landscape - large, inhabited islands, unconnected to the shore - more than 3km from the coast.
- Uplands and Bog Landscape - an extensive area of very open landscapes with low levels of settlement, roads or agriculture. Upland and Bogs make up much of the centre of those western parts of the county that are nearest to the Atlantic.
- Lake Environs Landscape - this type covers Lough Corrib and Lough Derg, Ireland's second and third largest lakes respectively, both highly prized as recreational and scenic resources.
- North Galway Complex Landscape - an extensive grassland plain stretching from the Suck River in the east to the watershed of the River Clare in the west. It includes elevated areas such as Slieve Dart in the north, as well as lakes, turloughs, raised bogs, wetlands and winding rivers.
- Central Galway Complex Landscape - an extensive plain of grasslands comprising medium-to-large fields with low enclosures and many areas of low stone walls. This area contains the majority of the county's population with associated high levels of rural housing, roads and settlements.
- Urban Environs Landscape - around all major settlements, can establish extensive landscapes of urbanised appearance and character for a considerable distance around each centre.
- Shannon Environs Landscape - establishes an extensive area of distinctive character along much of the southeastern boundary of the county.
- Karst Landscape - distinctive localised landscape created where the northern-most extent of Burren exposed limestone forms a southern boundary of County Galway. The characters that define the Karst Landscape extend beyond the southern boundary of County Galway.
- Slieve Aughty Landscape - distinctive uplands of the Slieve Aughty Mountains define the much of Galway's southern boundary with County Clare.

The Landscape Character Types as described in the GCDP 2022-2028 – LCA is shown in the **Figure 7.1**

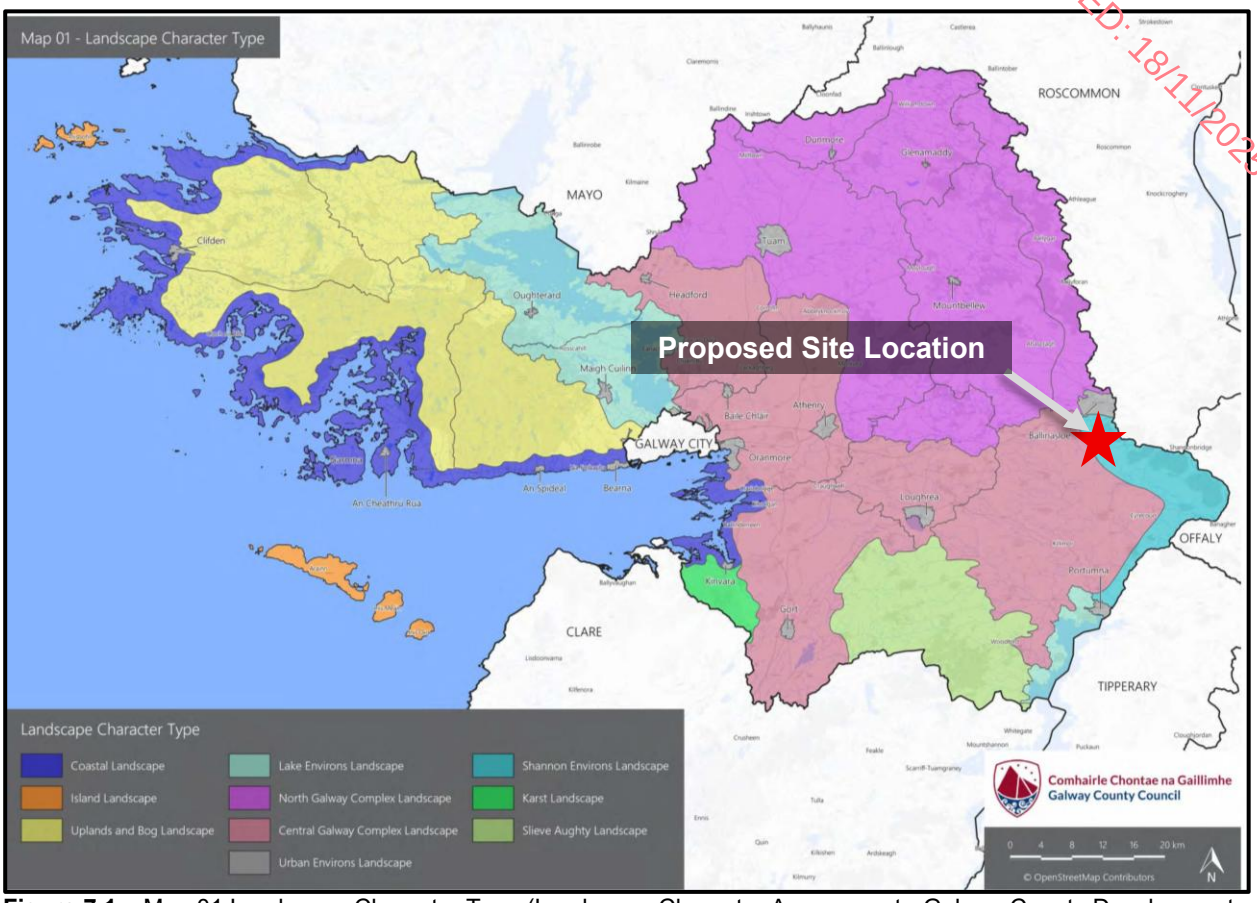

Figure 7.1 – Map 01 Landscape Character Type (Landscape Character Assessment - Galway County Development Plan 2022-2028)

The proposed development site is entirely within the area classified as "*Shannon Environs Landscape*". The study area comprising a range of 2km from the site indicates also there are other two landscape character types in the surrounding, "Central Galway Complex Landscape", *ca.* 235m to west and a small portion of "*Urban Environs Landscape*" *ca.* 1.9 km to the North. These areas can be seen on the **Figure 7.2.**

The *Shannon Environs Landscape Type* forms a distinctive and extensive area along much of the county's south-eastern boundary. Its core is characterised by open water, frequently fringed by broad expanses of naturalised vegetation along shallow shores and numerous elongated islands.

A defining feature of this landscape character type is the Shannon Callows: seasonally flooded grassland ecosystems situated adjacent to the low-lying river floodplain. These Callows are critical habitats, supporting internationally significant populations of wintering birds, which underscore the predominantly natural character of these areas.

Adjacent landscape character types are equally distinctive, comprising either extensive boglands or vast farm holdings interspersed with parkland features. The more productive soils within this region, often associated with large, flat fields, are a direct result of historical intensive agriculture and settlement. This prolonged human interaction has led to an elevated concentration of archaeological, architectural, and cultural remains, where features from

diverse periods of land management and settlement often occur in close proximity. Examples of such concentrations include Protected Structures around Lawrencetown, such as the Gothic style folly gateway in Ballymore, and the environs of the National Monuments of The Cathedral of St Brendan Clonfert and Clontuskert Abbey.

The overarching characteristic of this landscape is its open water, frequently bordered by extensive naturalised vegetation along shallow shores and numerous linear islands. This area exhibits a high sensitivity to any form of development or changes in management regime.

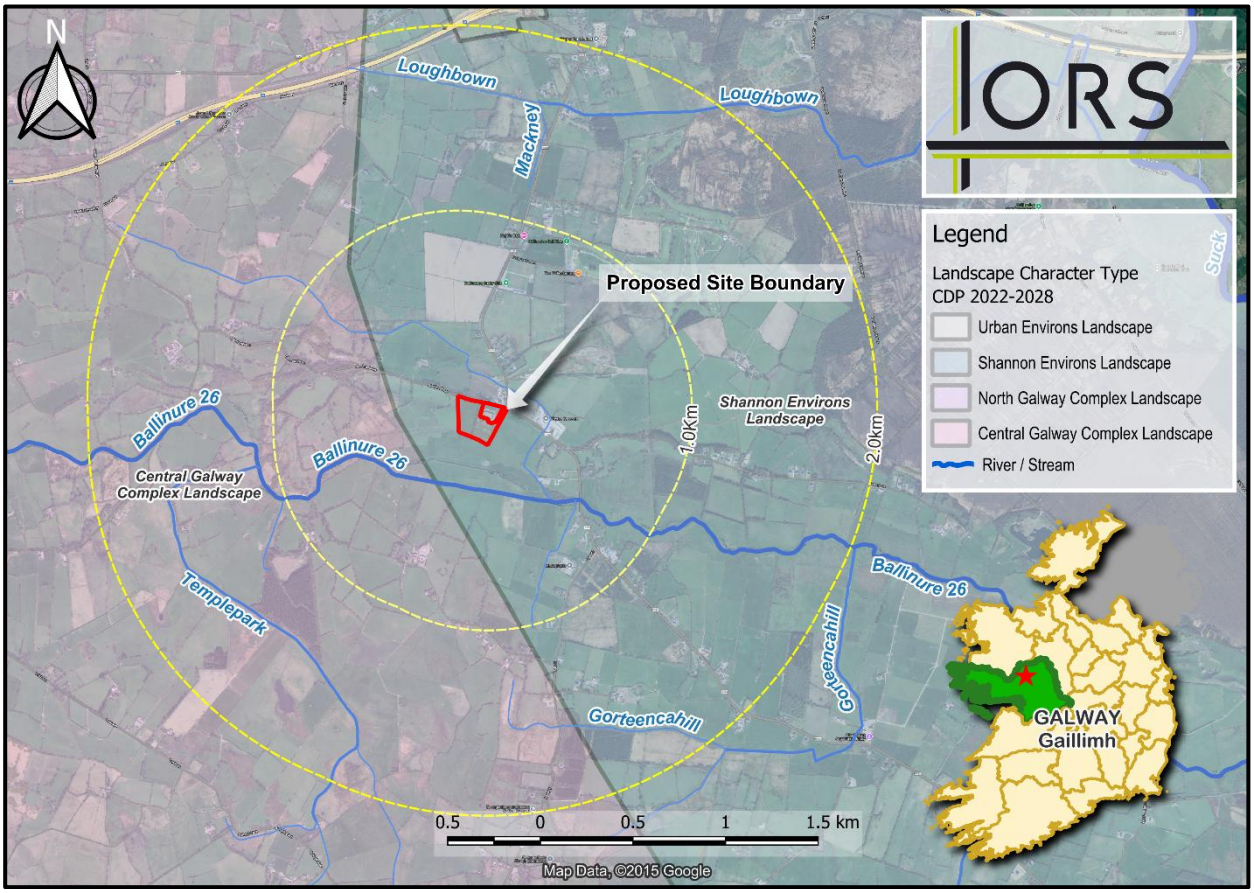

Figure 7.2 – Proposed Development Site overlain on Map 01 Landscape Character Type (Landscape Character Assessment - Galway County Development Plan 2022-2028)

The *Central Galway Complex Landscape Type* is an extensive grassland plain. It is typified by medium-to-large fields with low enclosures and numerous low stone walls serving as field boundaries. This landscape character type also incorporates distinctive elevated features, such as Knockma, southwest of Tuam, and areas offering views over Lough Corrib to the west and the intricate system of lakes and foothills between Gort and Loughrea in the south.

This region hosts the majority of County Galway's population, resulting in a high concentration of urban-generated rural housing, roads, and settlements. These range from large to small urban centres, complete with associated infrastructure, services, and commercial activity.

The western and southern portions of this LCT are underlain by karst limestone, leading to several unusual hydrological features, notably turloughs and large springs. The more

productive soils in this area have facilitated a long history of intensive historic settlement. This has, in turn, led to elevated concentrations of archaeological, architectural, and cultural remains from significant periods of land management, including Early Christian, Medieval, and 16th-19th-century estates. Features from various historical periods of land management and settlement are frequently found in close proximity, with examples of multi-period sites including Pallas, Eyrecourt, and Garbally Park.

The principal characteristic of this landscape character type is its complex mix of forms and scales, integrated within a context of remnant agricultural lands. It holds local significance to the resident community and exhibits low sensitivity to change.

The *Urban Environs Landscape Type* is found across County Galway, specifically outside the administrative boundaries of all settlement sizes.

These urbanised landscapes typically form around settlements and often feature concentrations of both older and newer individual dwellings. Around larger towns, they also incorporate modern estate housing, recreational facilities, and commercial, industrial, and educational developments. This development pattern shifts from concentric around the core settlement to radial along major transportation corridors that support numerous residential communities.

Many of County Galway's urban environs are particularly distinctive due to their close proximity to areas of strong natural character, such as rivers, lakes, or coastlines. Other settlements are adjacent to extensive areas of naturalised scrub vegetation, bogland, or low-lying wetlands.

The principal characteristic of this landscape type is the visibility of a complex mix of forms and scales, integrated within a context of remnant agricultural lands. These areas hold local significance for the resident community and exhibit low sensitivity to change.

The site is located in the townland of Glenloughaun, Ballinasloe, Co Galway, approximately 3 km south of Ballinasloe, Co. Galway, 25 km south-west of Athlone, Co. Westmeath, and 50 km east of Galway City. The site is part brownfield, housing some hardstanding areas and small buildings, and part greenfield, being surrounded by farmlands, indicating a rural landscape overall. The site is located along Glenloughaun Road (L-8412), which connects with the R355 regional road immediately to the east of the site. A concrete supplier (Whytes Concrete) is located approximately 315 m east-south-east of the site along the R355 regional road. Ballinasloe Rugby Club is located approximately 660 m north of the site and Ballinasloe Golf Club is located approximately 815 m north-north-east of the site. The Ballinure River (EPA waterbody name: BALLINURE_010) is located *ca.*130m to the south of the site boundary. An unnamed stream, classified as a tributary of the Ballinure River, is located *ca.*100m north of the site. This stream runs parallel to the site's northern boundary in a west-to-east direction for *ca.* 500m, before turning south *ca.* 200m east of the site. A peatland area is situated 1.6km to the east.

In terms of surface features, the GSI Viewer indicates the site is characterised by a "Hummocky glaciofluvial sediments topography." A slope model of the study area, derived from the NASA Shuttle Radar Terrain Mission (SRTM) dataset (tile N53W009_N53W009), is presented in **Figure 7.3**. This modelled surface reveals a slight slope from northwest to east, with elevations ranging from 85m to 33m AOD, broadly following the pathway of the Ballinure River.

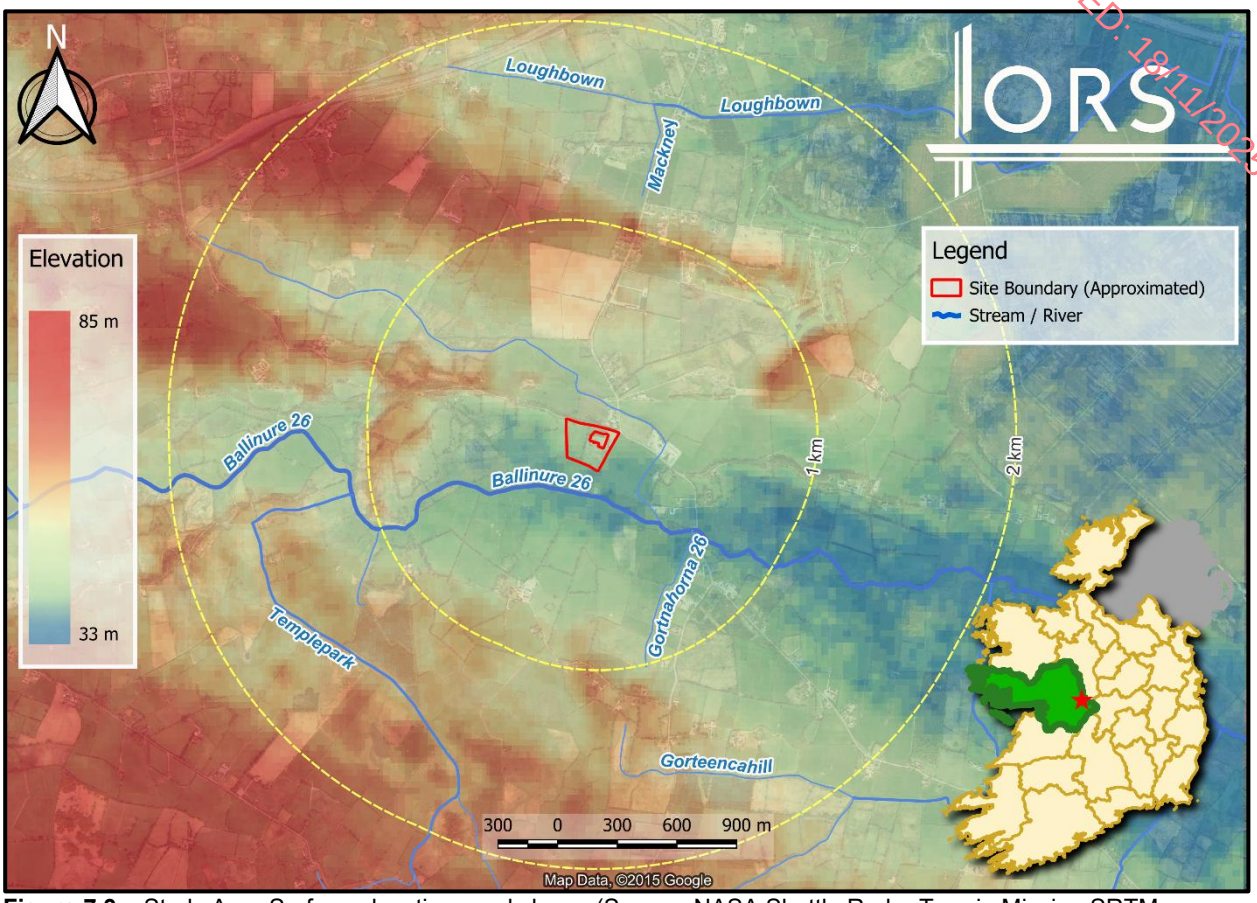

Figure 7.3 – Study Area Surface elevations and slopes (Source: NASA Shuttle Radar Terrain Mission SRTM adapted by ORS 2025)

A topographical survey was carried out for the entire site and issued to ORS on the 3rd of September 2024 and is shown in **Figure 7.4**. The subject site is adjacent to the premises of an existing meat processing operation, to which existing boundaries and access must be maintained.

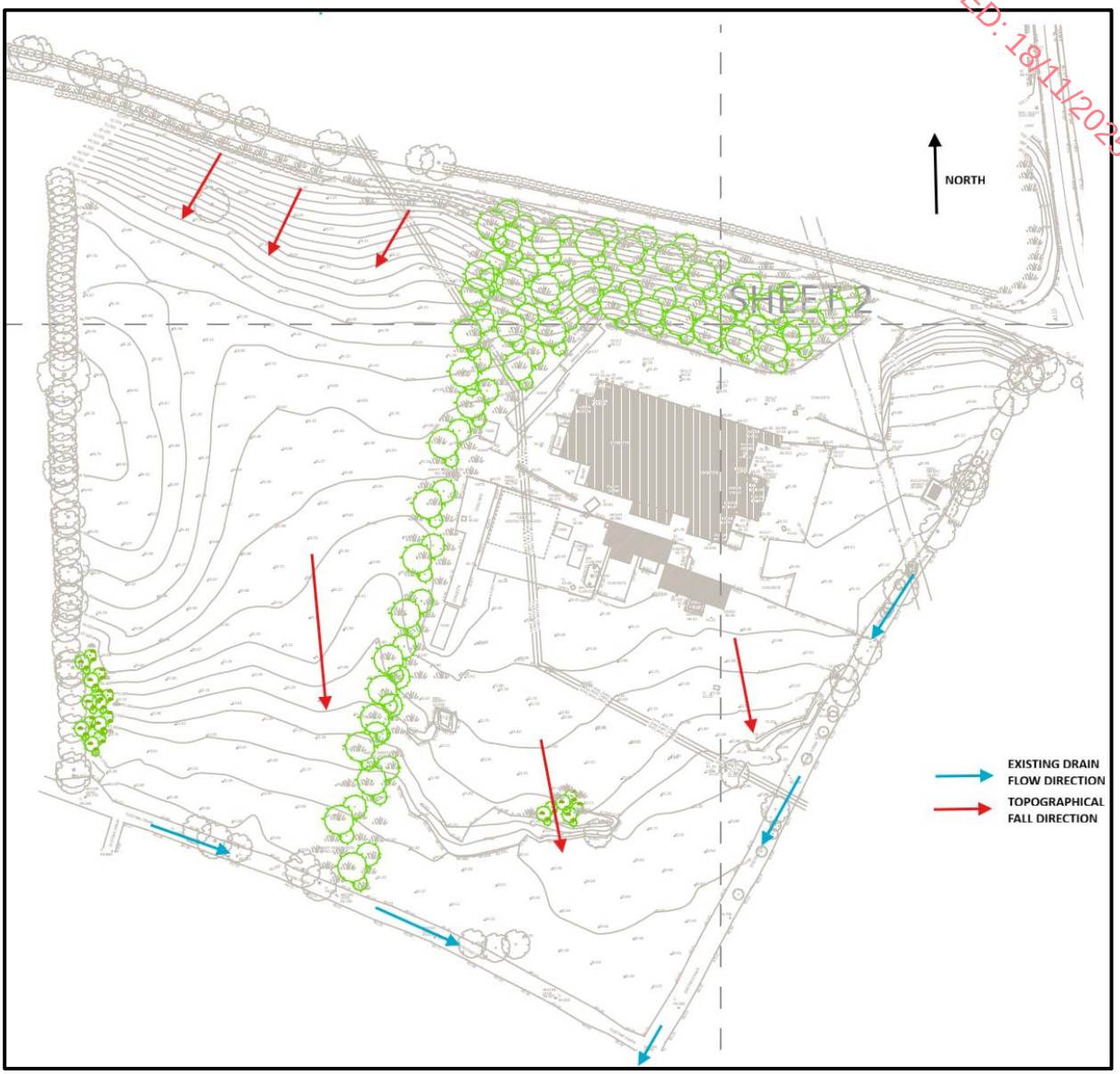

Figure 7.4: Site topography discharging to drainage ditch at the southeast of the site. (Source ORS/J. Weir Land Surveying LTD)

The site lies at a topographical elevation of approximately 50m O.D. The ground in the vicinity of the site slopes to the south towards the Ballinure River with an elevation at Ballinure Bridge of *ca.* 42m O.D. The River Ballinure flows from west to east, joining the Suck River *ca.* 6.6km to the east. **Figure 7.5** below illustrates the Site slope and elevations taken from the combined results from NASA Shuttle Radar Terrain Mission SRTM data (**Figure 7.3)** and the site-specific topographical survey **(Figure 7.4).**

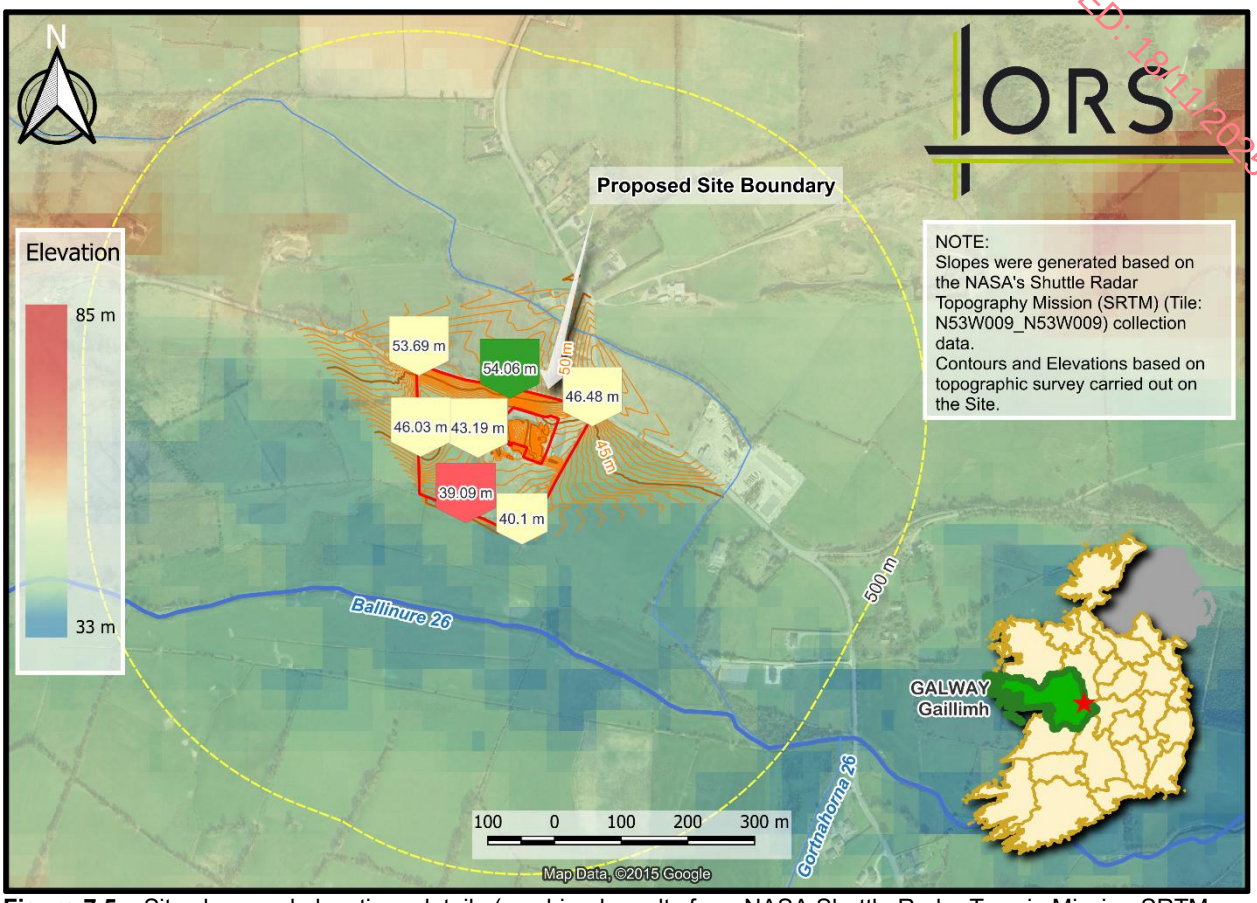

Figure 7.5 – Site slope and elevations details (combined results from NASA Shuttle Radar Terrain Mission SRTM data and site-specific topographical survey)

The site proposed for the biogas development lies to the west and the south of the existing meat processing building. The northwest portion of the site banks steeply up towards the existing Glenloughaun Road fronting the north of the development. The subject site generally grades downwards towards the southeast of the proposed development boundary which correlates with the existing drainage provided to the site for its current agricultural purpose. The subject site is bisected on the central north-south axis by a treeline that does not appear to contain a drainage channel.

As part of the development of the biogas operation it is proposed to substantially regrade the existing ground levels to form the digester tank sump yard in the northwest quadrant and the service yard centrally to ensure that vehicles can easily traverse the site. Notwithstanding, it is proposed that the existing drainage flow paths will be maintained and that runoff from the site will continue to discharge to the channel at the southeast corner as per the pre-development situation.

The existing drainage ditches for the site serve to remove surface water runoff and discharge at the southeast corner of the site. This discharge point is also hydraulically linked to the Ballinure River which runs from east to west *ca.* 130m to the south of the site.

This river has been modelled as part of the National Indicative Fluvial Mapping (NIFM) dataset which indicates that the southeast corner of the site will be within the extents of flooding for both

the scenarios of a 1:100 year and 1:1000 year Annual Exceedance Probability (AEP) event. The site layout has been proposed to avoid the mapped extents of both flood events as illustrated in Appendix C of the Site Specific Flood Risk Assessment report [**231960-ORS-XX-XX-RP-EN-13d-011-SSFRA**].

The CORINE Land Cover database, updated for the reference year 2018, classifies the immediate area of the subject site as predominantly comprising "*Pastures.*" *Ca.* 500 metres to the west, the land is categorised as "*Land principally occupied by agriculture, with significant areas of natural vegetation*." Additionally, "*Sport and leisure facilities*" are located roughly 950 metres to the northeast, while "*Peat Bogs*" and "*Transitional woodland-shrub*" are situated *ca.* 1.7 km to the east. The CORINE database employs a standardised methodology for the detection, identification, and mapping of land cover status across Europe, ensuring consistent and reliable classification.

7.4.3 Receptors

Designated Sites

The proposed site is not within or immediately adjacent to any site that has been designated as a Special Area of Conservation (SAC) or a Special Protection Area (SPA) under the EU Habitats or EU Birds Directive.

There are seven Natura 2000 sites within 15km of this Proposed Development site. These sites are summarised in **Table 7.4.** The location of the site in relation to these designated areas is shown in **Figure 7.6** and **Figure 7.7** and a full synopsis of these sites can be read online on the website of the National Parks and Wildlife Service (www.npws.ie).

Table 7.4: Natura 2000 Sites within 15km of the Proposed Development

Site Name & Code	Distance from Site	Qualifying Interests
Glenloughaun Esker SAC 002213	Located *ca.* 740m west of the proposed development	• Semi- natural dry grasslands and scrubland facies on calcareous substrates (*Festuco- Brometalia*) (*important orchid sites) (6210)
River Suck Callows SPA 004097	Located *ca.* 5.4km east of the proposed development	• Whooper Swan (*Cygnus cygnus*) [A038] • Wigeon (*Anas penelope*) [A050] • Golden Plover (*Pluvialis apricaria*) [A140] • Lapwing (*Vanellus vanellus*) [A142] • Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] • Wetland and Waterbirds [A999]
Ardgraigue Bog SAC 002356	Located *ca.* 12.8km south of the proposed development	• Active raised bogs [7110] • Degraded raised bogs still capable of natural regeneration [7120] • Depressions on peat substrates of the Rhynchosporion [7150]
River Shannon Callows SAC 000216	Located *ca.* 12.8km east of the proposed development	• *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] • Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510] • Alkaline fens [7230] • Limestone pavements [8240] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]

		• Otter (*Lutra lutra*) [1355]
Middle Shannon Callows SPA 004096	Located *ca.* 12.8km east of the proposed development	• Whooper Swan (*Cygnus cygnus*) [A038] • Wigeon (*Anas penelope*) [A050] • Corncrake (*Crex crex*) [A122] • Golden Plover (*Pluvialis apricaria*) [A140] • Lapwing (*Vanellus vanellus*) [A142] • Black-tailed Godwit (*Limosa limosa*) [A156] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Wetland and Waterbirds [A999]
Castlesampson Esker SAC 001625	Located *ca.* 14.3km north of the proposed development	• Turloughs [3180] • Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210]
Killeglan Grassland SAC 002214	Located *ca.* 14.7km north of the proposed development	• Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210]

As potential significant effects upon the sites identified could not be ruled out due to potential emissions arising from the operation of the proposed development, a separate NIS as required under Article 6 of the EU Habitats Directive has been submitted as part of this application. This NIS will allow the competent authority to undertake its statutory obligations with regards to Appropriate Assessment.

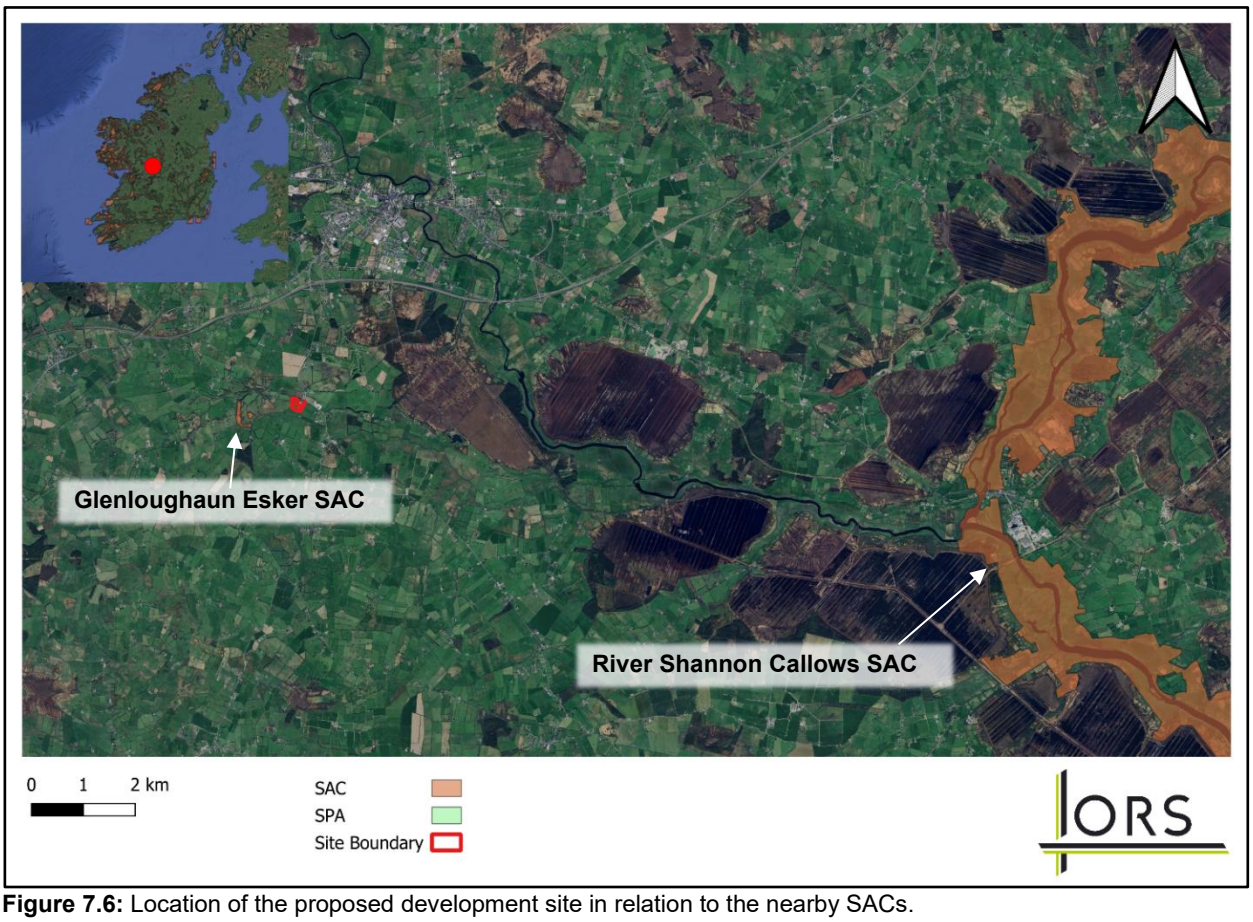

Figure 7.6: Location of the proposed development site in relation to the nearby SACs.

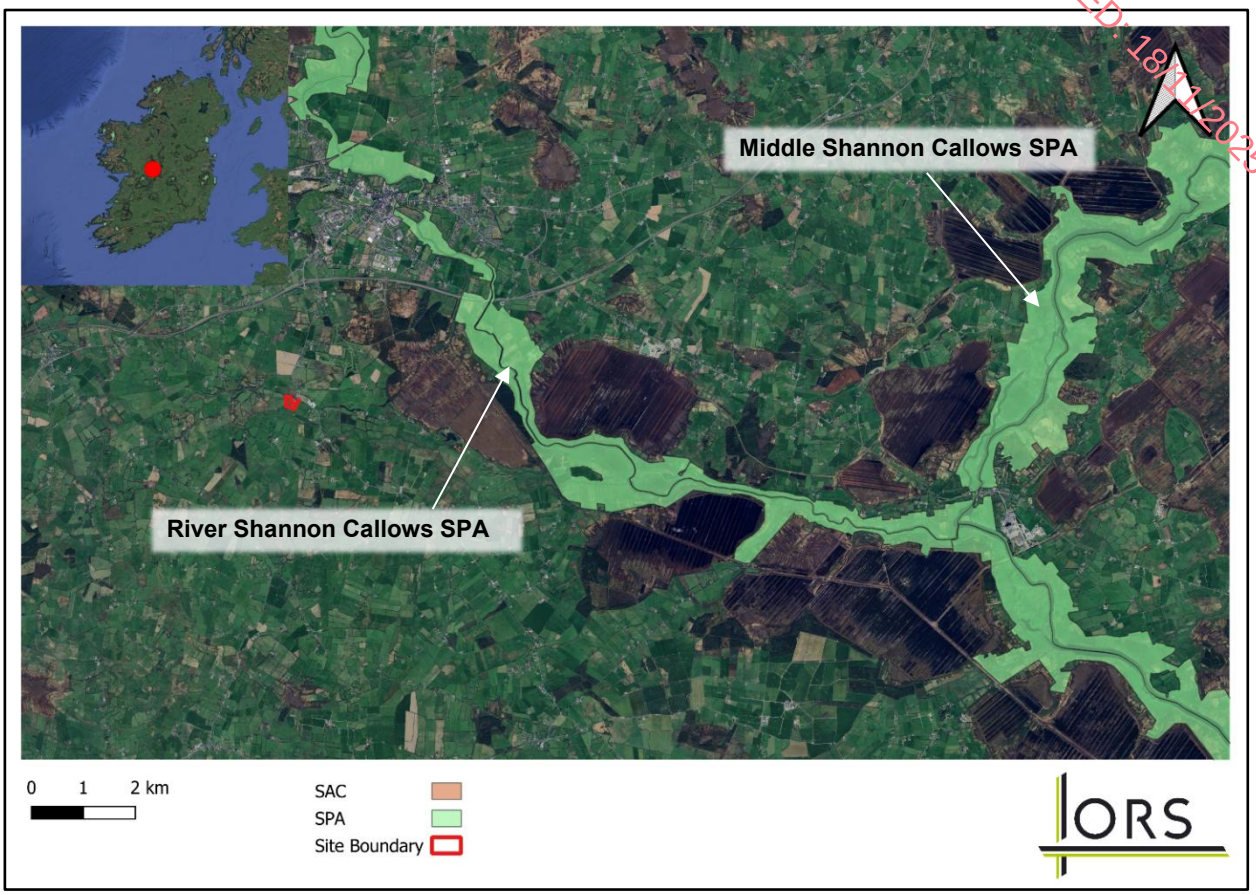

Figure 7.7: Location of the proposed development site in relation to the nearby SPAs.

Nationally Protected Sites (as classified by the NWPS)

Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHAs) are nationally protected sites due to their importance for the habitats present or species of plants and animals whose habitat needs protection. The Proposed Development is not within or immediately adjacent to any Natural Heritage Areas or proposed Natural Heritage Areas. Looking at a wider radius, 14 sites that have been designated as proposed Natural Heritage Areas are located within a 15km radius of the Proposed Development site. These sites are summarised in **Table 7.5** and a map showing their locations relative to the Proposed Development is shown in **Figure 7.8**.

Table 7.5: Nationally Important Sites within 15km of the proposed development.

Site Name & Code	Distance from Site
Cloonascragh Fen and Black Wood pNHA 001247	2.9km east
Suck River Callows NHA 000222	3.4km east
Ballinasloe Esker pNHA 001779	3.6km north
Killure Bog NHA 001283	5.3km north
Crit Island West NHA 000254	7.5km northwest
Annaghbeg Bog NHA 002344	9.0km north
Cranberry Lough pNHA 001630	9.9km northeast
Moorfield Bog NHA 001303	10.3km south
Eskerboy Bog NHA 001264	10.6km southwest

Cloonoolish Bog NHA 000249	11.3km south
Ardgraigue Bog pNHA 001224	12.8km south
River Shannon Callows pNHA 000216	12.9km east
Callow Lough pNHA 001239	12.9km northwest
Castlesampson Esker pNHA 001625	14.3km northeast

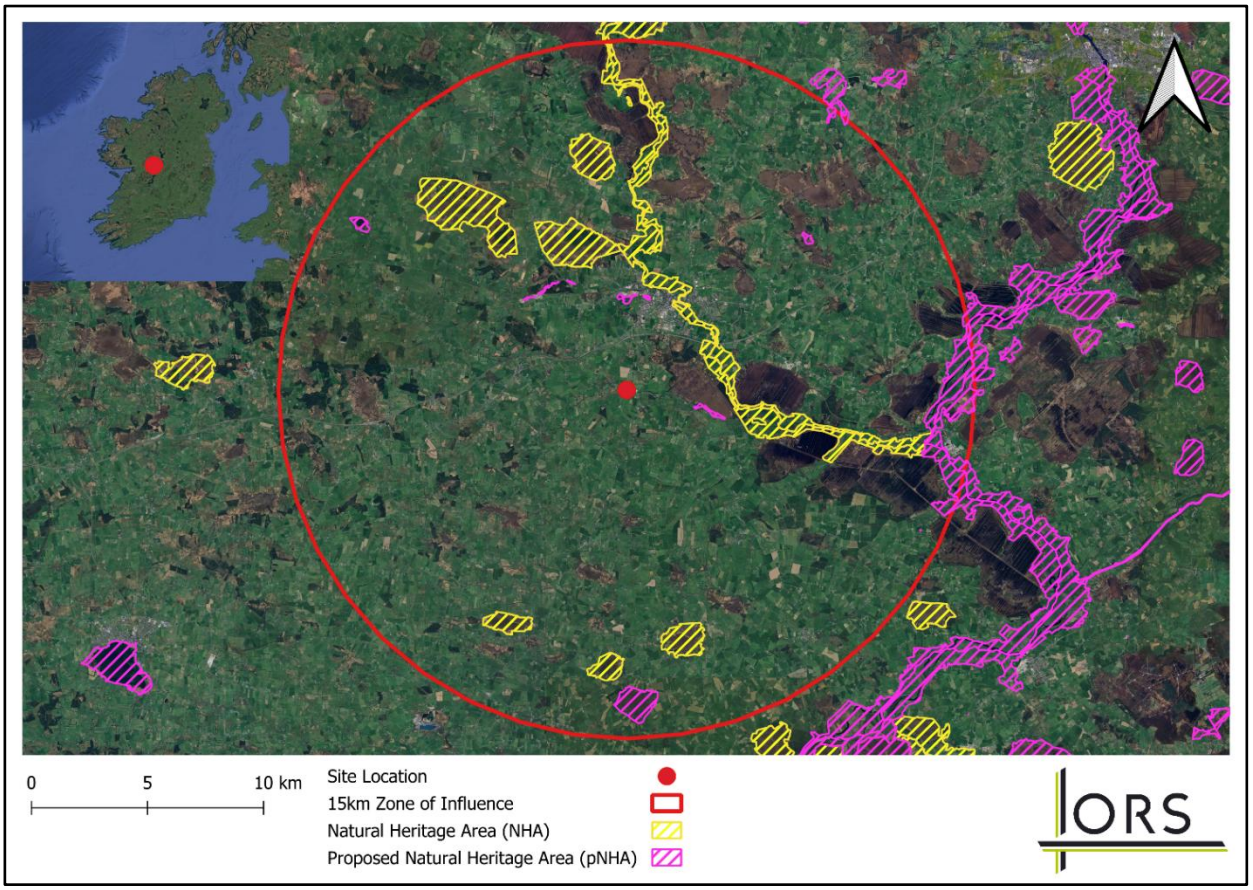

Figure 7.8: Proposed development in relation to Natural Heritage Areas and proposed Natural Heritage Areas within 15km.

Geological Heritage Sites (as logged on the GSI database)

Geological heritage sites are locations with important geological and geomorphological value, such as unique rock formations, fossils, or mineral deposits. These locations are identified through County Geological Sites (CGS) audits and are compiled on the Geological Survey of Ireland (GSI) database. These sites are then assessed in a partnership between the GSI, the National Parks and Wildlife Service (NPWS) and the Irish Geological Heritage (IGH) Programme as to whether they need protection through NHA designation. The Irish Geological Heritage (IGH) Programme identifies and selects a complete range of sites that represent Ireland's geological heritage under sixteen themes ranging from karst features to hydrogeology.

Reference to the GSI online database confirms the proposed site is not within a geological heritage site and that there are no designated geological heritage sites within the 2 km study area of the Proposed Development. The closest site is Suck River Callows (GY127), which is described as "*A long, flat site which includes the Suck River floodplain*" located *ca.* 3.35 km

northeast of the site, which is outside the 2km study area. **Figure 7.9** indicates the Geological Heritage Site within the wider region.

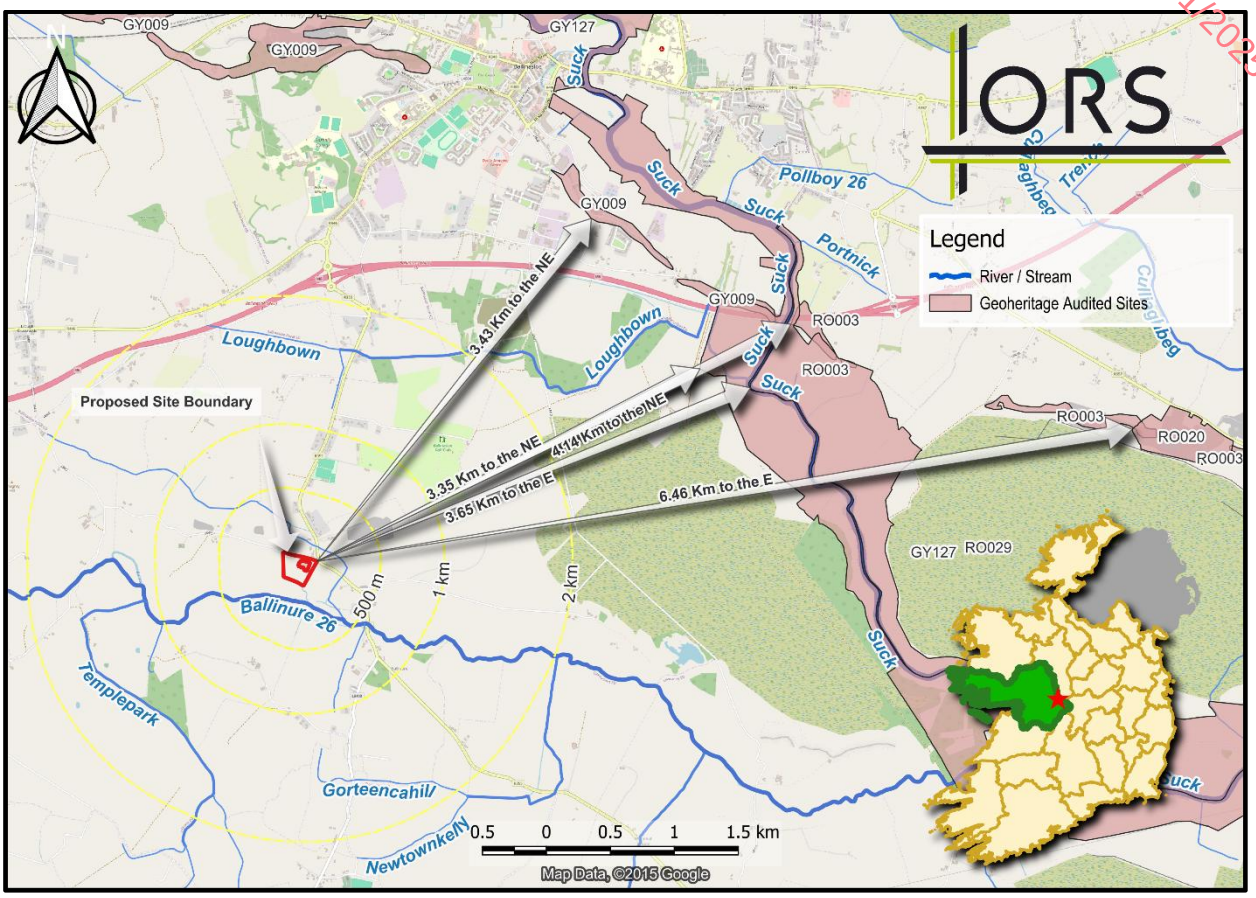

Figure 7.9 - Geological Heritage Sites within the vicinity of the site

The five closest geological heritage site details, as indicated in **Figure 7.9,** are listed below in the **Table 7.6.**

Table 7.6 – Closest geological heritage sites to the proposed development site

Site Code	Site Name	Description	Geological	Location
GY127	Suck River Callows	A long, flat site which includes the Suck River floodplain	The callows exist due to the geomorphological / hydrogeological process of repeated flooding	3.35 Km to the NE
GY009	Ballinasloe Esker	A large accumulation of sands and gravels deposited under and in front of the ice sheet	The feature is a haphazardly arranged, high, striking example of a dry sand and gravel ridge	3.43 Km to the NE
RO029	Suck River Callows	The suck callows include the suck floodplain and extends for 70km from Castlecoote to Shannonbridge	The site has extensive areas of callow, or seasonally flooded, semi-natural, lowland wet grassland, along both sides of the river	3.65 Km to the E
RO003	Ballinasloe-Split Hills-Clonmacnoise-Clara Esker	This is a long, beaded, often high, sinuous esker ridge that extends for almost 70km	The esker is one of the finest examples of a long, wide tunnel-deposited esker in the country	4.14 Km to the NE

RO020	McKeon's Pit	This is a gravel pit cut into a wide, hummocky sand and gravel feature which partially smothers an esker	The fan feature is a fine example of the type of deglacial feature that forms adjacent to eskers	6.46 Km to the E

7.4.4 Drift (Quaternary) Geology

Drift is a general term applied to all mineral material (clay, silt, sand, gravel and boulders) transported by a glacier and deposited directly by or from the ice or as fluvioglacial deposits. It generally applies to deposits laid down during the Pleistocene (Quaternary) glaciations. Drift can also be included under Holocene (Quaternary) deposits. The drift geology of the area principally reflects the depositional process of the last glaciation. Typically, during the ice advance, boulder clays were deposited, sub-glacially as lodgement till over the eroded rock head surface, whilst moraine granular deposits were laid down at the glacier margins. Subsequently, with the progressive retreat of the ice sheet from the region, granular fluvio-glacial deposits were laid down in places by melt waters discharging from the front of the glacier.

While the study area contains several physiographic units across all three classification levels (as per the GSI physiographic dataset and illustrated in **Figure 7.10** below), the proposed development site lies entirely within a zone characterised by a distinctive hummocky glaciofluvial sediment topography. This classification reflects a landscape shaped primarily by the depositional processes of glacial meltwater streams.

At Level 1, the broader classification is Hummocky Sediments, indicating an undulating terrain formed by unconsolidated deposits. Level 2 provides greater specificity, refining this to Hummocky Glaciofluvial Sediments Topography, which underscores the direct influence of glacial meltwater in transporting and depositing these sediments. The most detailed classification, Level 3 (Hummocky Eskers and Associated Gravel), precisely identifies the principal geomorphological features present.

This landscape is dominated by features such as eskers—long, winding ridges of sand and gravel laid down by subglacial or englacial meltwater channels. These eskers are typically accompanied by kames (steep, mound-like accumulations of stratified drift) and kettles (depressions formed by the melt-out of buried ice blocks), collectively creating the characteristic hummocky or rolling surface. The associated gravels found throughout these areas are well-sorted and stratified, reflecting their fluvial (riverine) transport within the glacial environment. Such landforms are common in formerly glaciated regions, where retreating ice sheets left behind extensive meltwater deposits.

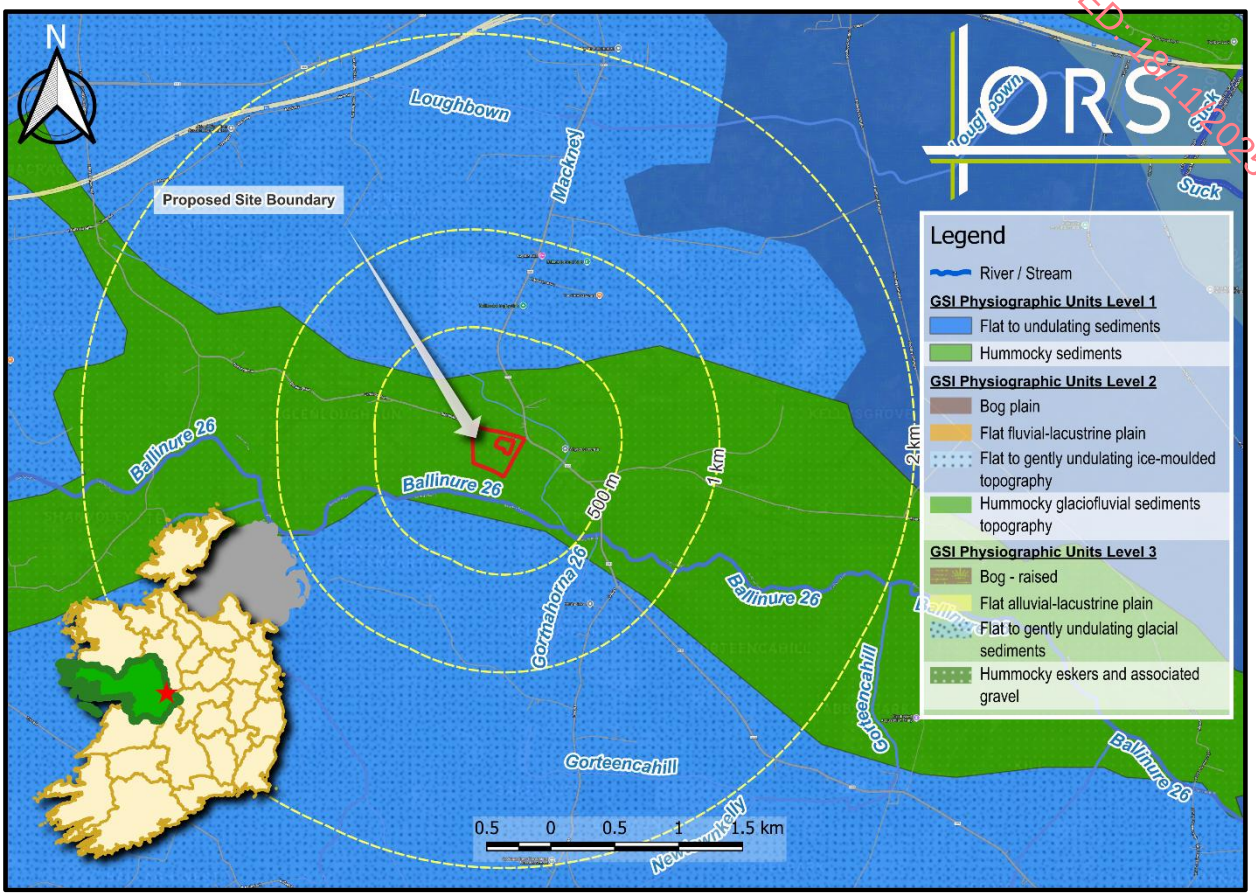

Figure 7.10 - Physiographic character of the site and surrounding landscape (Source: GSI adapted by ORS 2025)

The site is classified within a Flat to Undulating Lowland landscape unit under the An Foras Talúntais National Soil Survey of Ireland, as documented in the accompanying publication to the Second Edition of the General Soil Map of Ireland at a scale of 1:575,000. This classification identifies the area as comprising Mainly Dry Mineral Soils and Mainly Wet Mineral and Organic Soils. The physiography of this lowland region is characterised by gentle slopes typically less than 3° and elevations predominantly below 100 metres, making it fully suitable for all forms of agricultural machinery operation without topographic constraints.

Covering approximately 2.47 million hectares, this landform extends from the Golden Vale through the Central Plain to the eastern coastal areas north of the Wicklow Mountains, while also occupying substantial tracts of east Galway and Roscommon. The local soil composition consists principally of Grey Brown Podzolics (70%), with associated Brown Earth (20%), Gley (5%) and Basin Peat (5%). These soils have developed on limestone morainic gravels and sands - coarse-textured fluvioglacial deposits of predominantly Carboniferous limestone origin that were widely deposited during the last glacial period as kames, eskers and outwash materials.

The topography across this soil association varies from level to gently rolling, though some sectors exhibit distinctly hummocky terrain with abrupt slope transitions ranging from 0° to 12° and occasionally reaching 20°, particularly along the steeper flanks of esker formations. These pronounced variations in microrelief are primarily responsible for the observed soil diversity and

the complex spatial distribution patterns within the association.

Four principal soil types occur in this setting: moderately deep, shallow, imperfectly drained and poorly drained components. The moderately deep soils, representing about 70% of the association, occur across the flatter to undulating terrain and lower slopes of hummocky features. These well-drained Grey Brown Podzolics consist of friable, gravelly sandy loams with high base status. Their profiles typically exhibit a dark greyish-brown to dark brown surface horizon (25-40 cm depth) overlying a brown to yellowish-brown leached layer, which in turn rests upon an undulating, dark greyish-brown B horizon showing distinct clay accumulation. The parent material, encountered at 0.5-0.8 metres depth, consists of very coarse-textured gravelly sands.

The lighter-textured Grey Brown Podzolics represent versatile agricultural soils, while the heavier variants demonstrate particular suitability for pasture production, responding effectively to appropriate fertilisation and management practices. The combination of favourable topography and generally productive soil characteristics has rendered this landscape unit among Ireland's most agriculturally significant regions.

Quaternary sediments comprise unconsolidated deposits laid down over the past 2.6 million years. In Ireland, these are predominantly represented by tills (boulder clays), gravels, sands, and peat, which mantle the bedrock across most of the country.

Regarding the Proposed Development site, the Geological Survey of Ireland’s (GSI) 1:50,000 Quaternary Sediments vector dataset indicates that nearly the entire area is underlain by "*tills derived from limestones*", as illustrated in **Figure 7.11**. A minor stretch adjacent to the Glenloughaun Local Road (L8412) is classified as "*eskers comprised of gravels of basic reaction*". Additionally, alluvial deposits are present along the southern boundary of the site. In view of the Proposed Development, the soils which are likely to be affected by the development are characteristic in the local and regional context and occur in abundance

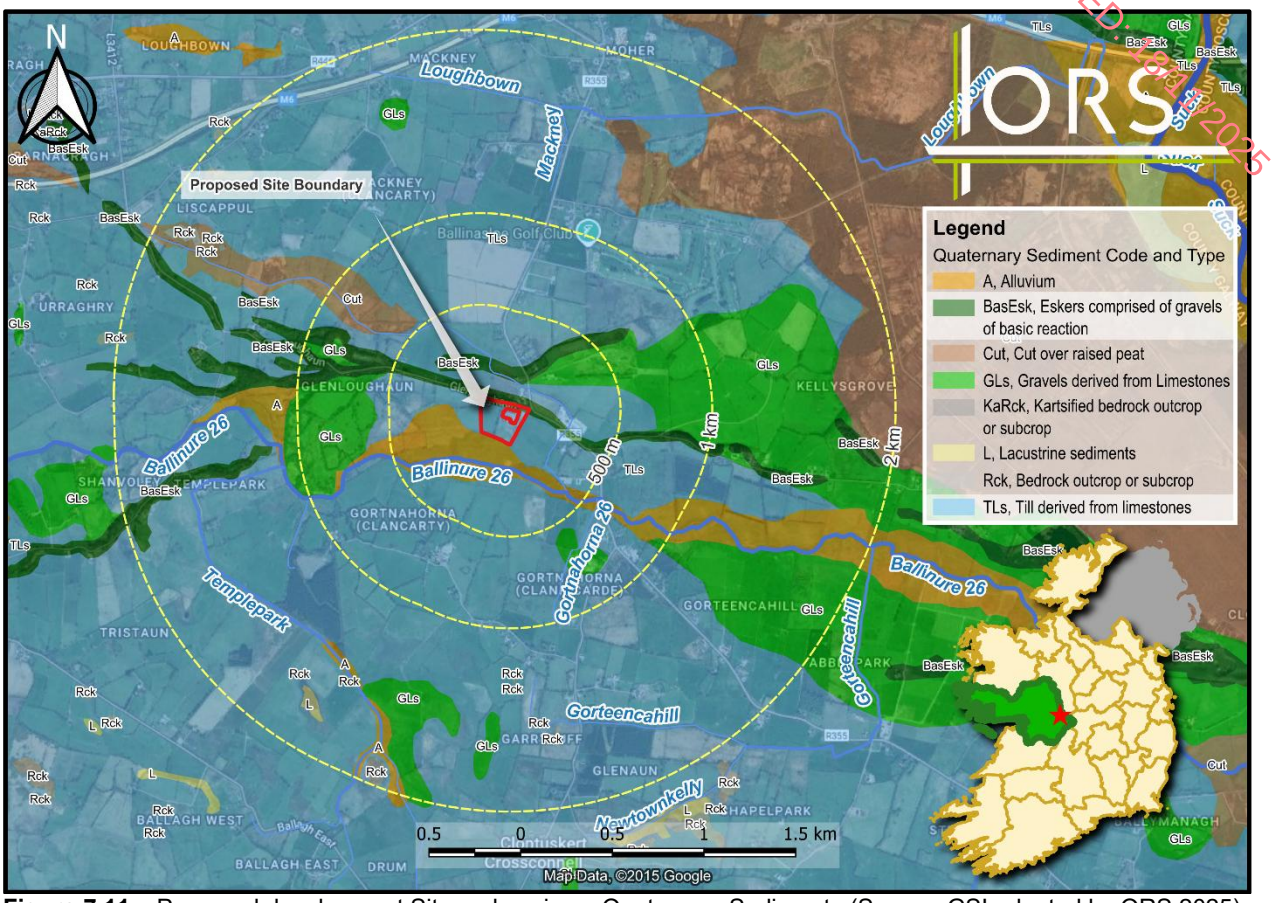

Figure 7.11 – Proposed development Site and environs Quaternary Sediments (Source: GSI adapted by ORS 2025)

7.4.5 Bedrock Geology

Regional Bedrock Geology

County Galway displays a highly complex geological structure. The bedrock of Connemara, stretching from Galway City to Inishbofin, consists of ancient schist and gneiss. This region forms a major structural unit within the Dalradian Supergroup, which also appears in North Mayo, Donegal, and western Scotland. Precambrian exposures occur in fault-uplifted zones, while Connemara itself is classified as a terrane, a distinct crustal block displaced and fused by tectonic movement.

The Twelve Bens are composed of quartzite, their rugged profile owing to greater erosion resistance than surrounding rocks. At their base, Connemara marble, a metamorphosed limestone with green serpentine banding, is prominent.

South Connemara is dominated by the Galway Granite, a 400-million-year-old batholith comprising multiple intrusive masses. Contemporaneous Devonian fluvial deposits now form sandstone outcrops in Slieve Aughty, with Silurian slate inliers exposed below.

East of Galway City, Carboniferous limestone underlies much of the landscape. Though karst features exist, glacial till has subdued the terrain compared to the Burren, creating fertile

grazing land with dry-stone walls. The Aran Islands, however, exhibit classic limestone pavement with scattered granite erratics.

Post-Carboniferous rocks are scarce, limited to Paleogene dolerite dykes in the west and Pliocene lignite near Headford. Fossils are absent in Connemara's metamorphics but abundant in eastern limestone, with Ordovician-Silurian exposures near Killary Harbour yielding trilobites, graptolites, and nautiloids.

Historically, small-scale lead and zinc mines operated around Oughterard, while Connemara marble quarries (notably near Clifden) exploited its ornamental value. The Tynagh Mine (1950s) revived Ireland's metals industry, and Headford's aeolian sands remain quarried for glass production.

As illustrated in **Figure 7.12** (adapted from Geological Survey Ireland Hydrostratigraphic Rock Unit Groups dataset), County Galway exhibits a clear east-west division along Lough Corrib, reflected in its hydrostratigraphic rock unit distribution. The western portion is dominated by Granites & Other Igneous Intrusive Rocks, extending from Galway City along the coast to Ballyconneely and inland to Moycullen, Recess and Oughterard. Precambrian Quartzites, Gneisses & Schists are extensively developed north of this granite zone, with minor occurrences near Ballyconneely. Silurian Metasediments and Volcanics form another significant unit, while Dinantian Lower Impure Limestones underlie Lough Corrib itself.

In contrast, the eastern portion of the county is characterised by Dinantian Pure Bedded Limestones as the principal unit, overlain successively by Dinantian Upper Impure Limestones and Devonian Old Red Sandstones. This fundamental lithological contrast between the carbonate-dominated east and the igneous/metamorphic-dominated west creates markedly different hydrogeological regimes across the county.

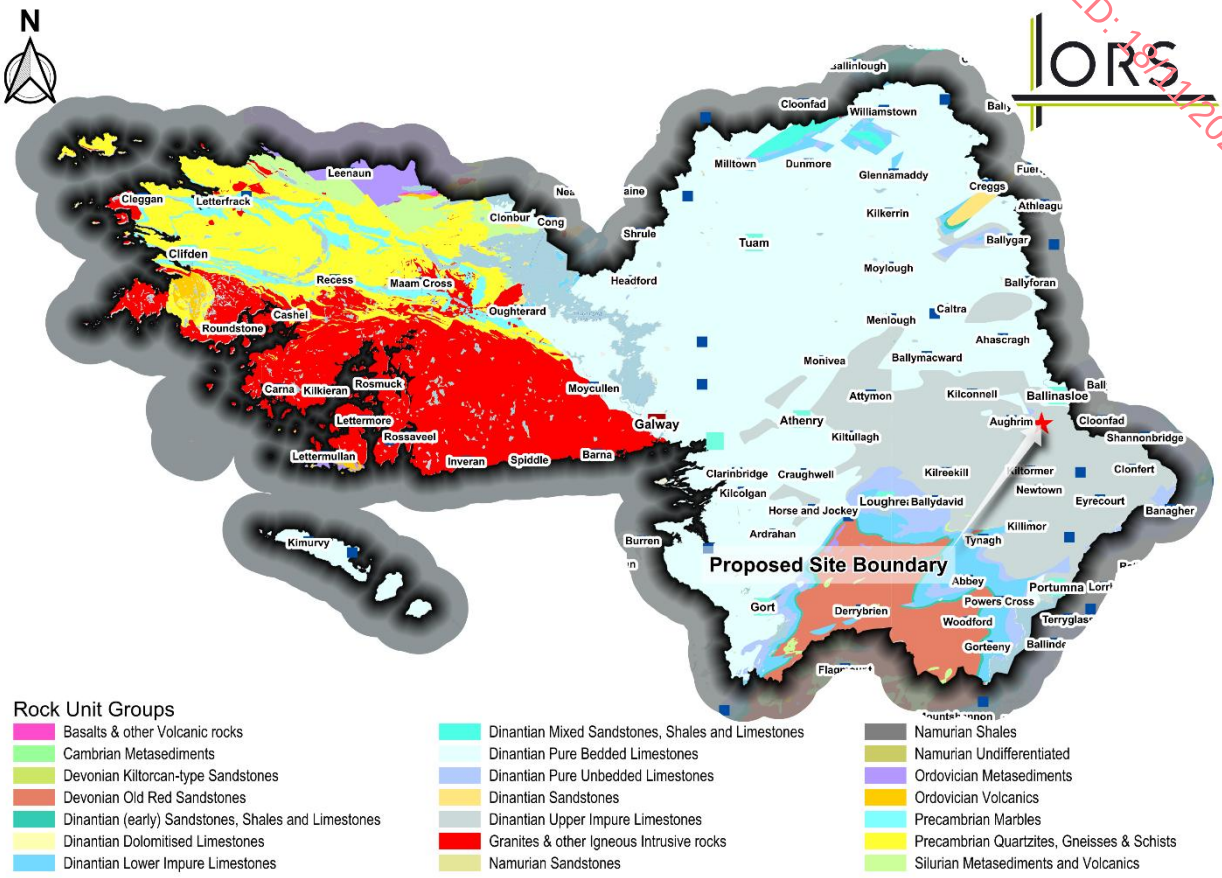

Figure 7.12 - Hydrostratigraphic Rock Unit Groups Within Co. Galway (GSI)

As shown in **Figure 7.13** below, the GSI/GSNI Bedrock Geology 1:500,000 dataset illustrates the significant geological diversity of County Galway. The western portion contains a broader variety of bedrock classes, predominantly comprising Caledonian, Palaeozoic and Neoproterozoic formations.

In contrast, eastern Galway exhibits more homogeneous geology, with bedrock consisting entirely of Palaeozoic strata dating from Upper Ordovician to Carboniferous periods. This east-west contrast reflects the county's position across major tectonic boundaries in Ireland's geological framework.

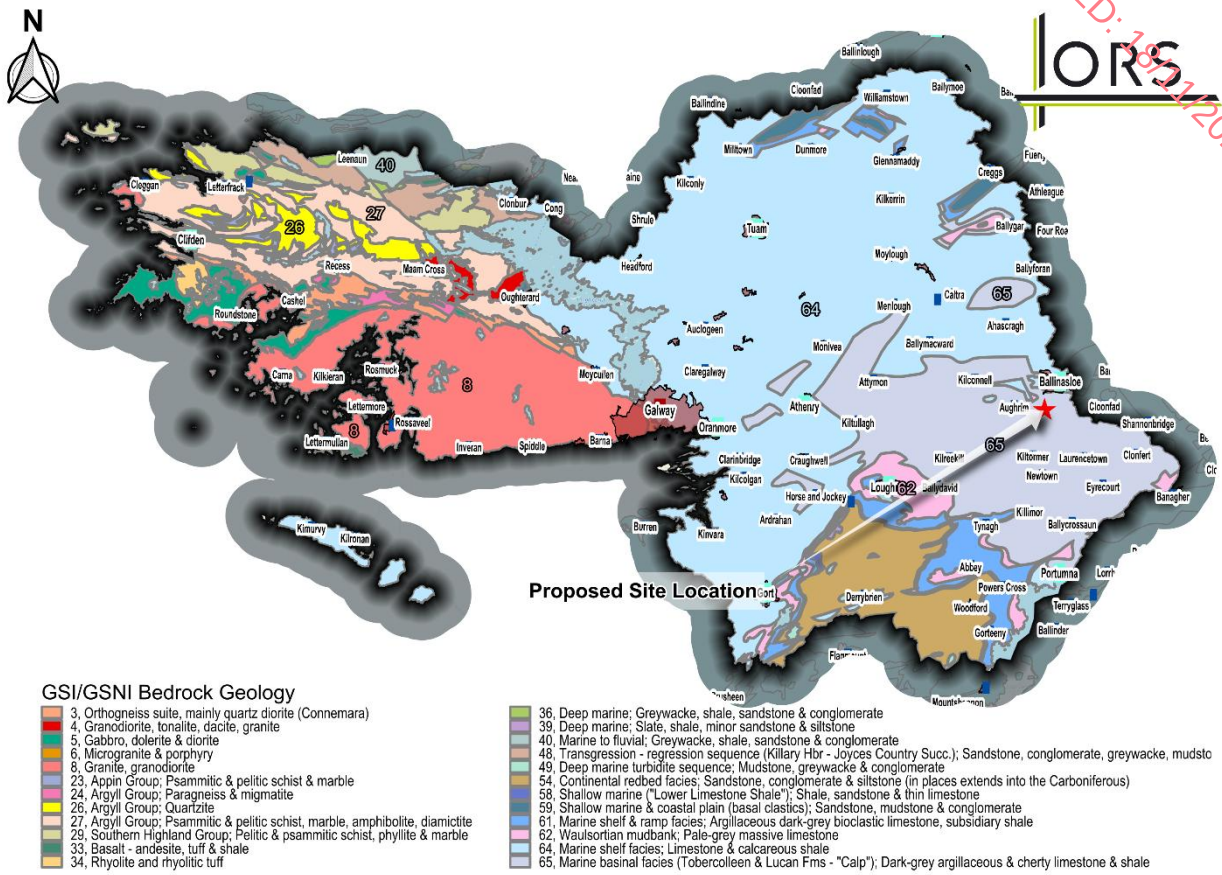

Figure 7.13: County Galway - GSI / GSNI Bedrock Geology 1:500,000

The development site and its study area predominantly overlay Dinantian Upper Impure Limestones, dating from the Palaeozoic Era, Carboniferous Period, Mississippian Subperiod. These bedrock units are primarily composed of Marine basinal facies (Tobercolleen & Lucan Fms - "Calp"): dark-grey argillaceous and cherty limestone and shale (65). A small exception, *ca.* 1.9km northwest of the Site, around Loughbrown and Liscappul, features Dinantian Pure Unbedded Limestones.

Local Bedrock Geology

Bedrock, the consolidated mineral aggregate beneath surface soils, typically underlies weathered, unconsolidated material. Sedimentary rock formations, composed of distinct lithologies, may be horizontal or inclined, resulting in variable surface exposures over short distances.

As per the Geological Survey of Ireland, the bedrock within the Proposed Development's 2km study area is predominantly Carboniferous, specifically the Lucan Formation. The 1:100,000 Bedrock Solid Geology Map identifies this unit as dark limestone and shale ('calp').

The Lucan Formation consists of deep marine mudstones and siltstones, interpreted as distal turbidites. Primary lithologies include dark argillaceous limestones, shales, and calcareous mudstones, with minor skeletal units and common chert and pyrite. Thickness varies from 300m to 1123m. Sevastopulo and Wyse-Jackson (2009) describe four megacycles: two

Arundian, one Holkerian, and a final Holkerian–Asbian cycle, each progressing from coarse detrital material to basinal limestones and shale.

Deposited in moderate to deep marine conditions (below storm wave base), the Lucan Formation exceeds 1100m in thickness and features interbedded dark argillaceous limestone, shale, and calcareous mudstone. Skeletal material is sparse, while chert and pyrite are frequent. The shallow-water clastics are likely sourced from the western margin of the Balbriggan Shelf.

Pracht and Somerville (2015) describe the Lucan Formation as well-bedded, fine-grained, weakly laminated, and bioturbated argillaceous limestone, alternating with dark grey to black calcareous mudstone. Siliceous bands, common pyrite, and rare slumped intervals occur. Microfacies analysis indicates wackestone and packstone limestones, with rare grainstone beds. Dominant skeletal components include spicules and calcispheres, alongside crinoids, bryozoans, ostracods, and rare foraminifers; algae are absent except for kamaenids. This suggests a deep-water, low-energy basinal setting below the photic zone. Detrital quartz and feldspar indicate terrigenous input, while pyrite implies dysphotic to anaerobic conditions. Skeletal material was likely derived from an adjacent shelf.

The bedrock geology and linework on the 1:100,000 scale mapping from the GSI, as shown in **Figure 7.14** indicates that there is only one geological linework, a fault, within the 2km study area, which is s located *ca.* 1.6 Km Northwest of the site and runs from Southeast to Northwest. Waulsortian Limestones (Massive unbedded lime-mudstone) can also be found *ca*. 1.8km Northwest of the Site, along the fault line which runs perpendicular to the formation and encroaches upon the Visean Limestones (undifferentiated) formation to the west.

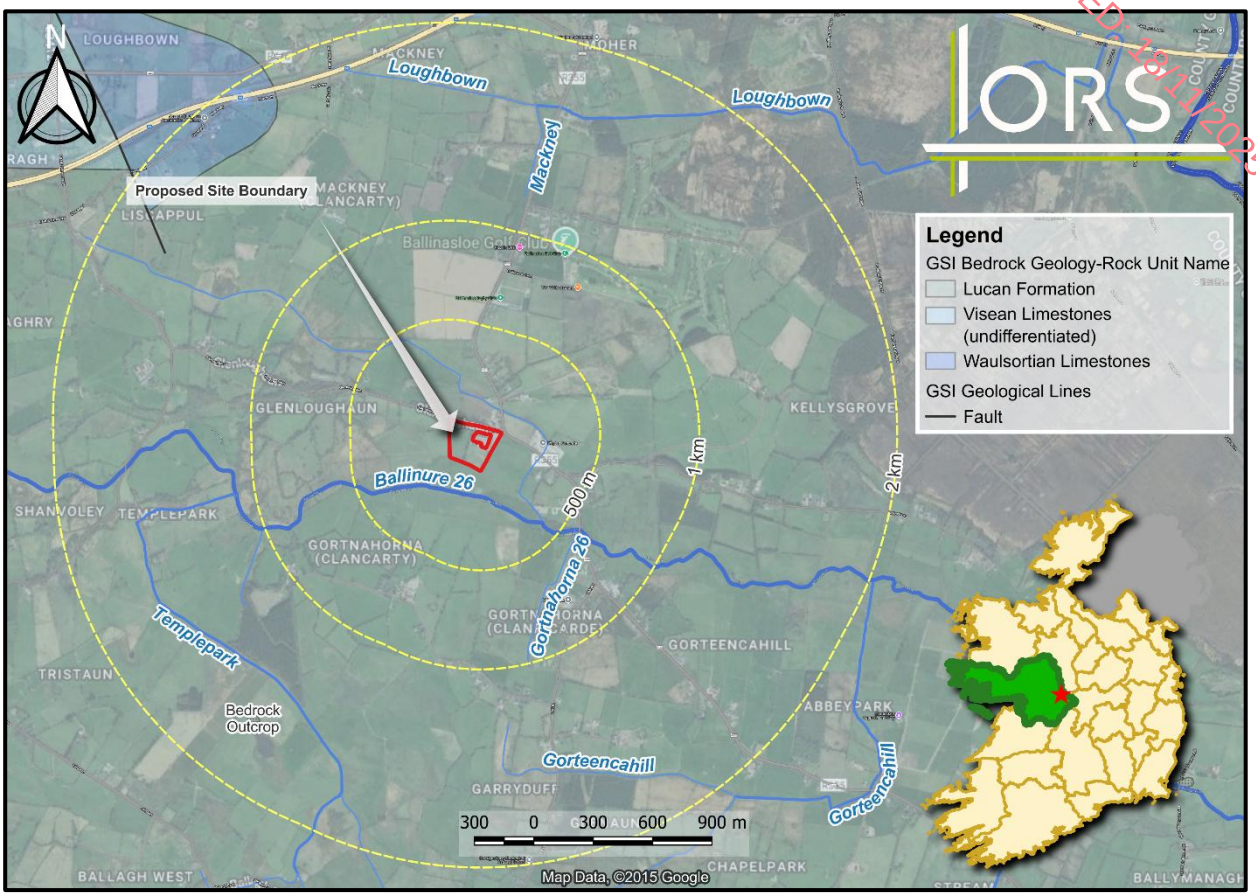

Figure 7.14: Regional Bedrock Formations (GSI)

Depth to Bedrock

Within the 2km study area, the GSI database identifies one groundwater well and three boreholes, all categorised as boreholes, with detailed specifications outlined in **Table 7.7**. **Figure 7.15** illustrates their approximate locations relative to the area's groundwater vulnerability rating, with the site boundary highlighted in red. The groundwater well in the wider area exhibits a good yield class. The Site lands are primarily designated as having moderate groundwater vulnerability, with a shift to high vulnerability along the northern boundary, aligning with the Glenloughaun Local Road (L8412). The broader study area displays a varied range of vulnerability ratings, from low to extreme. Recorded depths to bedrock for boreholes in the wider area typically fall between 3.7m and 14m below ground level (bgl). The subject site is underlaid by the Aughrim Groundwater Body, which the GSI National Draft Bedrock Aquifer Map classifies as a Locally Important Aquifer (Ll), deemed only moderately productive in localised zones, with overall poorly productive bedrock.

Table 7.7: Groundwater Wells and Boreholes within 2km of the site (GSI Well Database)

GSI Reference	Easting Northing	Well Type	Depth (m bgl)	Depth to Rock (m)	Well Use	Yield m^3/d	Proximity to site
1721NEW009	585622.00, 725905.00	Borehole	25.9		Agri & domestic use	109	1.92 Km to the SE
97-3459-09	582230.00, 727038.00	Borehole	22.2		NA		1.12 Km to the W
BE-15-3459	581884.00, 728517.00	Borehole	30.48	3.7	NA		1.87 Km to the NW
BE-14-3459	581964.00, 728437.00	Borehole	123.75	14	NA		1.75 Km to the NW

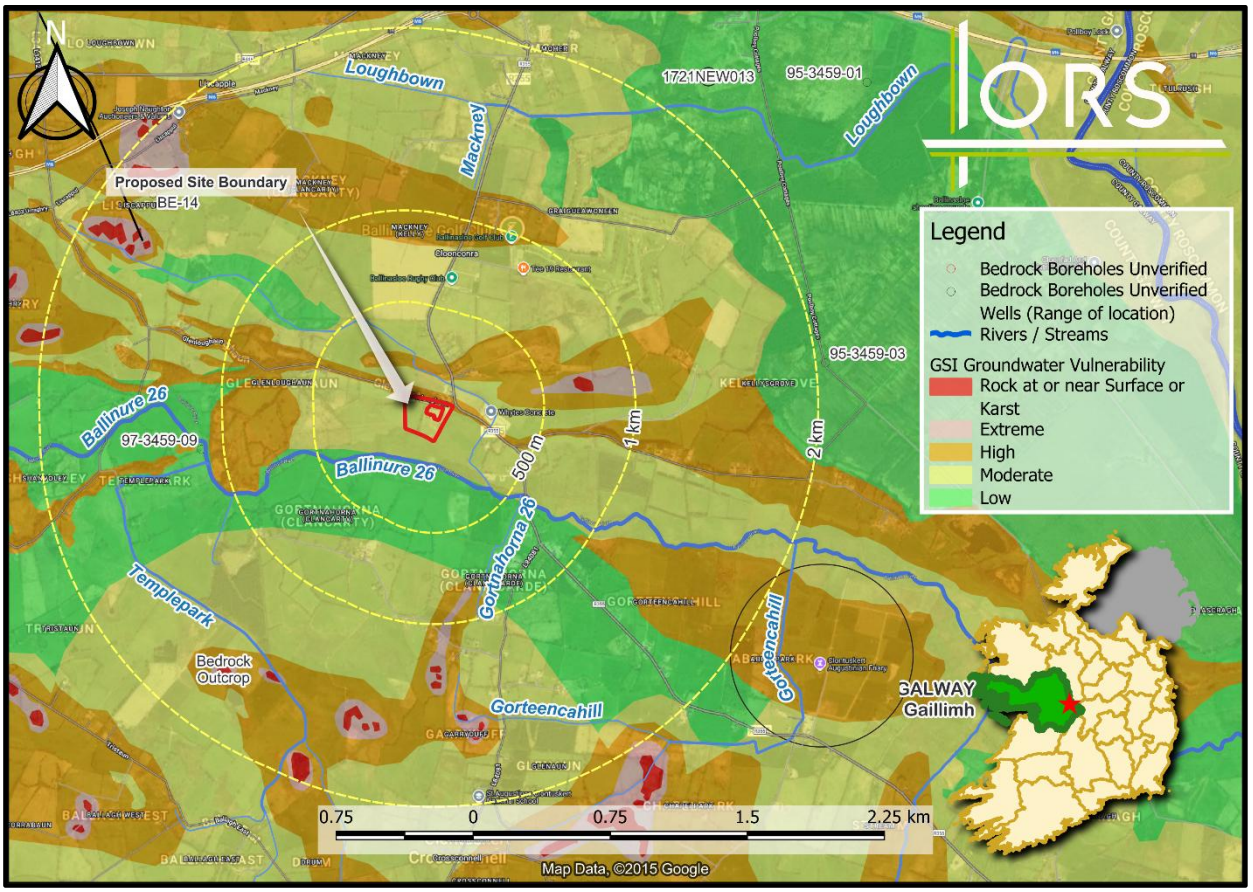

Figure 7.15 - Groundwater Vulnerability and location of Groundwater Wells and associated depth to bedrock (GSI Maps)

Karst Features

Karst, as defined by Klimchouk and Ford (2000), is a mass transfer system in soluble rocks where fluid flow is dominated by dissolution-enlarged conduits. With limestone constituting over 40% of Ireland's bedrock, including key agricultural and populated regions, karst aquifers are vital groundwater sources. Irish karst hydrogeology differs markedly from non-karst systems, a distinction formally recognised in national aquifer classification.

Most Irish karst is lowland, forming complex systems with dynamic surface water interactions, including turloughs, protected ephemeral wetlands. These terrains pose geotechnical

challenges, particularly for infrastructure, as 75% of motorways traverse limestone bedrock.

Carboniferous limestone occurs in nearly all counties except Wicklow. While recorded karst features are absent in Wexford and Carlow (due to limited limestone exposure), most Irish limestone is likely karstified to some degree, even where masked by thick subsoils. Lowland karst dominates (*ca.* 80% of outcrops below 100m OD), with upland karst restricted to areas like the Burren and parts of Sligo, Leitrim, Cavan, and Fermanagh.

Distinctive mini-plateaux in Roscommon and East Galway (elevated 20–40m above adjacent lowlands) lack integrated drainage, instead feeding small peripheral springs. Extensive Quaternary deposits in the western midlands obscure bedrock, complicating assessment of underlying karst conduits, though evidence suggests older, reactivated systems exist.

For example, the Ballyglunin cave system (39km northeast of the site) includes dry N-S conduits (indicating palaeo-flow) and active E-W passages fed by the River Abbert. Resurgent waters emerge 11km west at Aucloggeen Spring.

Turloughs, predominantly in western lowlands, range from permanent lakes to rapidly fluctuating depressions like Blackrock Turlough (Co. Galway). Lough Funshinagh (10km NW of Athlone), a rainfall-fed lake with no groundwater inflow, periodically drains via a sink to the Cross River (5km south, 15m lower), demonstrating the dynamic nature of shallow karst. Karst terrains are highly vulnerable to pollution due to their unique hydrogeological characteristics. Rapid infiltration occurs through solutionally enlarged conduits, swallow holes, and dolines, bypassing natural filtration processes. The typically thin soil cover provides minimal attenuation capacity, allowing contaminants to reach groundwater with little natural remediation.

Primary contamination sources include agricultural wastes from poorly managed slurry storage and farm effluents, inappropriate disposal of sheep dip, and domestic wastewater discharges from septic tank systems. Historical waste disposal practices involved dumping in natural karst features, though modern regulations now prohibit landfill placement on regionally important karst aquifers. Leaking fuel storage tanks also pose significant risks.

The most common pollutants are microbial contaminants from human and animal waste, along with chemical constituents such as nitrates and ammonia from agricultural and sewage sources. Improper sheep dip disposal introduces organophosphates and phenols, while hydrocarbon leaks from fuel storage cause taste, odour, and potential health concerns even at low concentrations.

Effective protection requires stringent source control measures combined with robust water treatment systems, including filtration and disinfection. However, complete elimination of microbial contaminants remains challenging in karst environments due to the rapid transport pathways characteristic of these systems.

Karst aquifers can be particularly vulnerable to pollution and karst features can also give rise to flooding. The closest identified karst landform, a turlough, is located *ca.* 7.7 km east of the Proposed Development Site. Geological Survey Ireland (GSI) groundwater tracing investigations have indicated interconnectivity between karst features *ca.* 12 km northeast of the Study Area, revealing an easterly to westerly groundwater flow direction that diverges from the Proposed Development Site. **Figure 7.16** below illustrates the absence of recorded karst features within the 2 km Study Area, although a bedrock outcrop is identified *ca.* 1.6 km

southwest of the Site. To date, no hydrogeological connectivity has been established with any features within the 2 km Study Area or within a 10 km radius of the Site.

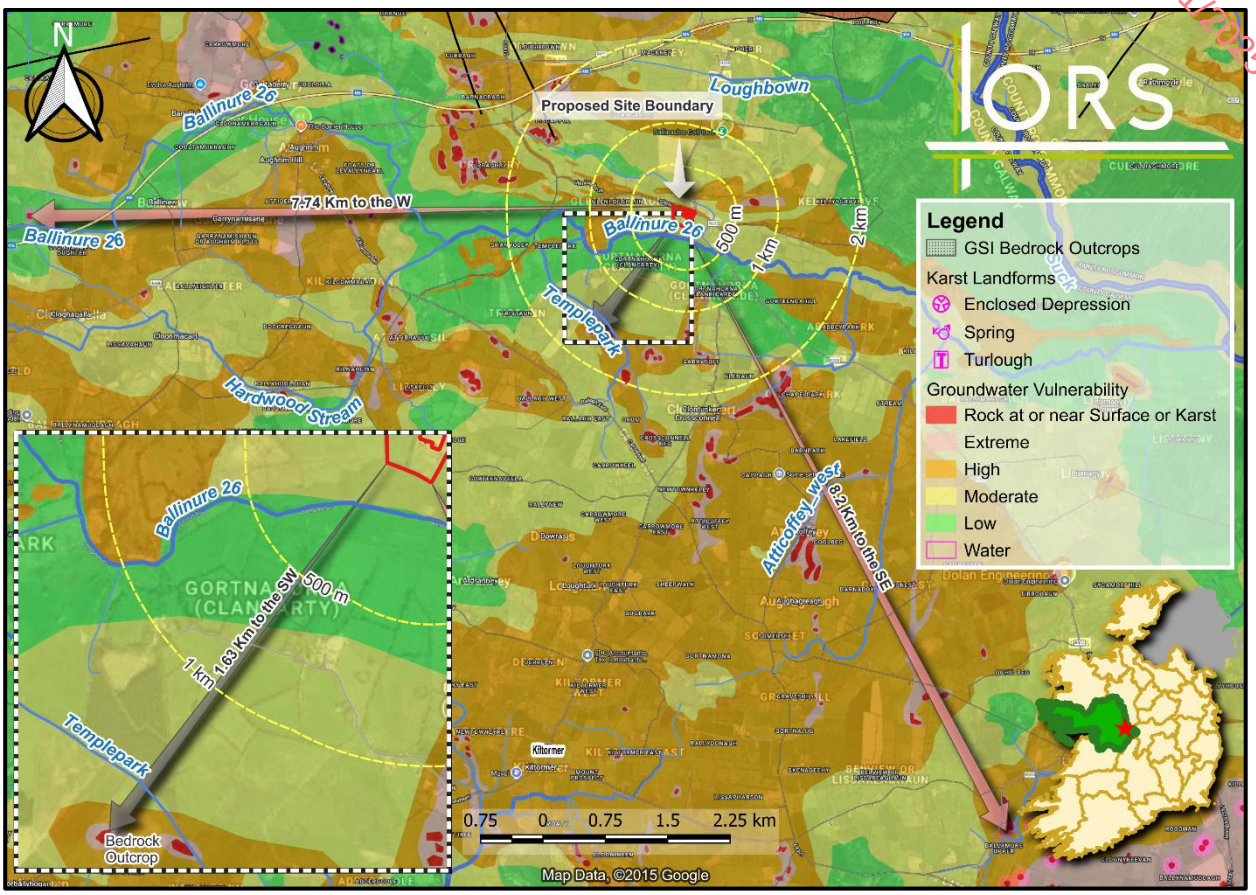

Figure 7.16 - Karst Features, Traced Groundwater Movements, Groundwater Vulnerability, And Groundwater Source Protection Areas Overlaying Regional Bedrock Formations and Outcrop Extents. (GSI)

Mineral Aggregate Resources

There are no active quarries within the Proposed Development. The nearest active quarry recorded on the GSI's online database is a quarry named Sheppard's *ca.* 300m northeast of the site in Glenloughaun, an active pit in esker ridge producing sand, gravel and crushed rock. There are no other active mineral localities within the 2km study area.

Within the 2km study area, there are a few locations mapped as low to high potential for crushed rock and stones, with the area classified as low potential overall.

Radon

Radon is a naturally occurring radioactive gas resulting from the decay of uranium and thorium, elements that can be present in varying concentrations within bedrock, soils, and groundwater. The International Agency for Research on Cancer (IARC) classifies radon as Group 1 – carcinogenic to humans – second only to smoking as a leading cause of lung cancer. In Ireland, it is estimated that radon exposure is linked to *ca.* 250 lung cancer cases annually, accounting for over half of the total radiation dose received by the Irish population (EPA, 2016).

The national Reference Level for radon in homes and schools in Ireland is 200 Bq/m³, while for workplaces, the Reference Level is 300 Bq/m³.

Consultation with the Environmental Protection Agency (EPA)'s online Radon Map provides a prediction of the percentage of homes within a given grid square that are likely to exceed the national Reference Level. Grid squares with a predicted percentage of 10% or greater are designated as High Radon Areas.

The EPA's Radon Map indicates that the Proposed Development Site is situated within a Moderate Radon Area. This classification suggests that 10% of properties in the site's vicinity are likely to have radon levels above the residential Reference Level. Consequently, all on-site office and canteen structures should incorporate radon barriers to minimise potential staff exposure. While employers in High Radon Areas are legally mandated to test their premises for radon, such testing is not mandatory for this development given its location in a Moderate Radon Area.

Seismic Activity

No seismicity data is available from GSI online resources. Seismic activity is recorded by the Irish National Seismic Network. The Geophysics Section of the School of Cosmic Physics, Dublin Institute for Advanced Studies, has been recording seismic events in Ireland since 1978. **Figure 7.17** below illustrates historical and recorded seismic events since 1980. Ireland is not considered as an area with high seismic risk. As can be seen below, there is no significant seismic activity recorded within the vicinity of the Site.

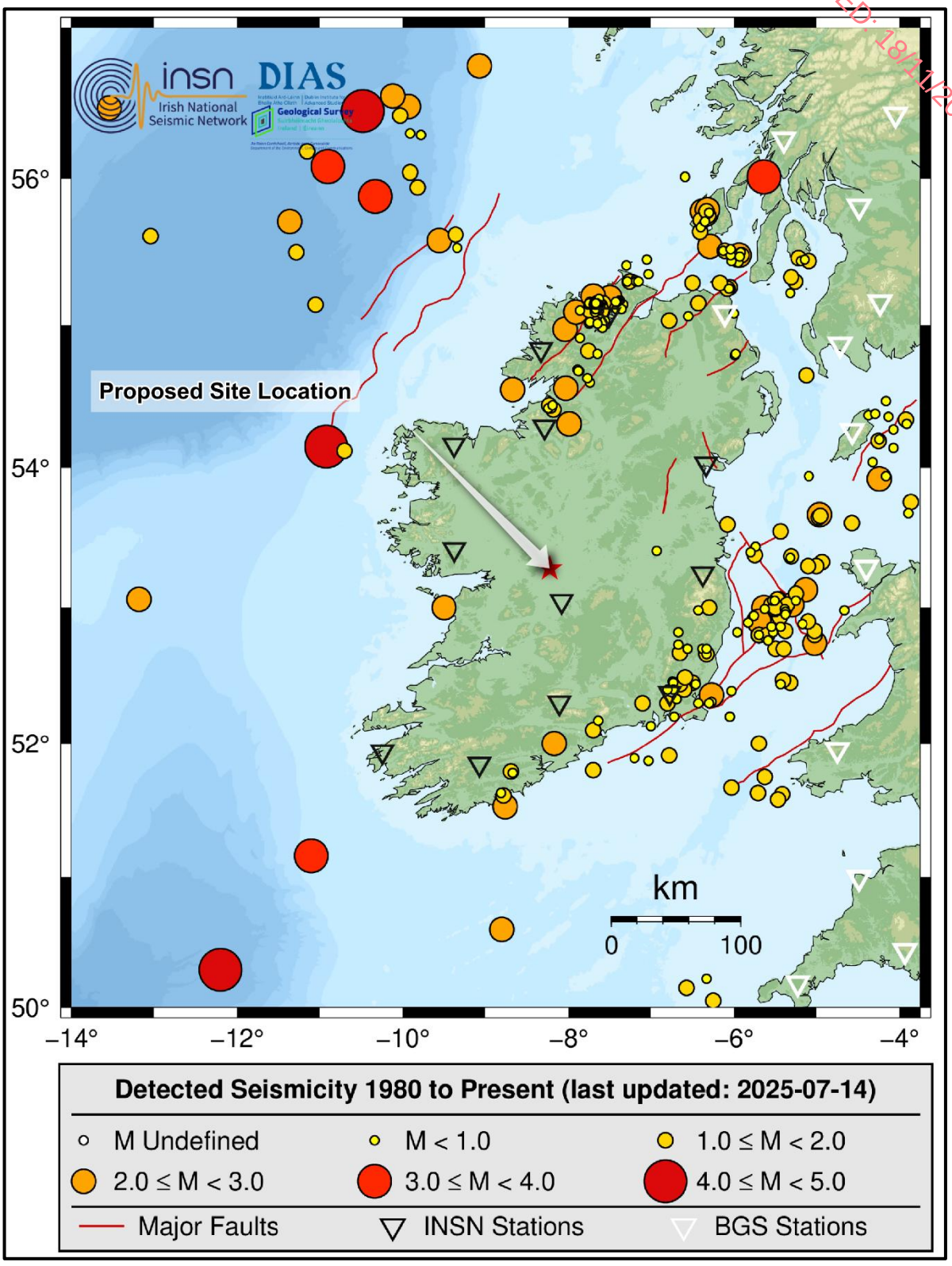

Figure 7.17 - Recorded seismic activity in Ireland since 1980.

7.4.6 Soils and Subsoils

Soils can be referred to as topsoil or subsoil. Topsoil is the active layers at ground level where living organisms are found. Changes in soil characteristics are delineated in “horizons”. Topsoil is referred to as horizons ‘A’ and ‘B’. Subsoil is the loose uncemented (unlithified) sediments present between the soil ‘B’ horizon and bedrock. Subsoils are termed the ‘C’ horizon.

Regional Soil and Subsoil

The formation of soil is dependent upon geology, climate, vegetation, altitude, and landform shape. Soil landscapes found in Ireland are a consequence of the changing climatic conditions over the last 100,000 years (the last glacial age was ca.12,000 years ago) and the management of land by farmers.

County Galway's pedological landscape is primarily characterised by Brown Earths, prevalent across its eastern and central regions, and extensive blanket peat and peaty soils, which dominate the north-western upland areas. Raised bogs and cutaway raised bogs are predominantly found in the eastern parts of the county, while blanket bog is widespread west of Lough Corrib. Both active blanket bogs and active raised bogs are designated as priority habitats under Annex I of the EU Habitats Directive. The presence of ombrotrophic (rain-fed) and minerotrophic (groundwater-fed) peat soils is typically indicative of areas highly sensitive to development, owing to inherent ecological vulnerabilities and challenges posed by impeded drainage. Many of these peatland areas also benefit from specific ecological designations.

As depicted in **Figure 7.18**, additional soil types identified within the county include: Lithosols (primarily in the western and north-western uplands), Alluvial soils (common in river and stream floodplains, and coastal zones), Groundwater Gleys and Surface Water Gleys (both largely in the south-east), Podzols (in the north-western uplands), Brown Podzols (distributed throughout the county), and Luvisols (predominantly in the east and north-east).

Outcropping rock is observed in numerous upland and coastal locations. Extensive areas of limestone pavement occur south of Kinvara and on Oileán Árann (Aran Islands), with more isolated patches identified along a corridor from Kilcolgan to Tuam and near Maigh Cuilinn. These limestone pavement areas are frequently associated with species-rich calcareous grassland and can support protected species. Notably, The Burren, currently on the Tentative UNESCO World Heritage Site list, extends from County Clare into Kinvara in south County Galway.

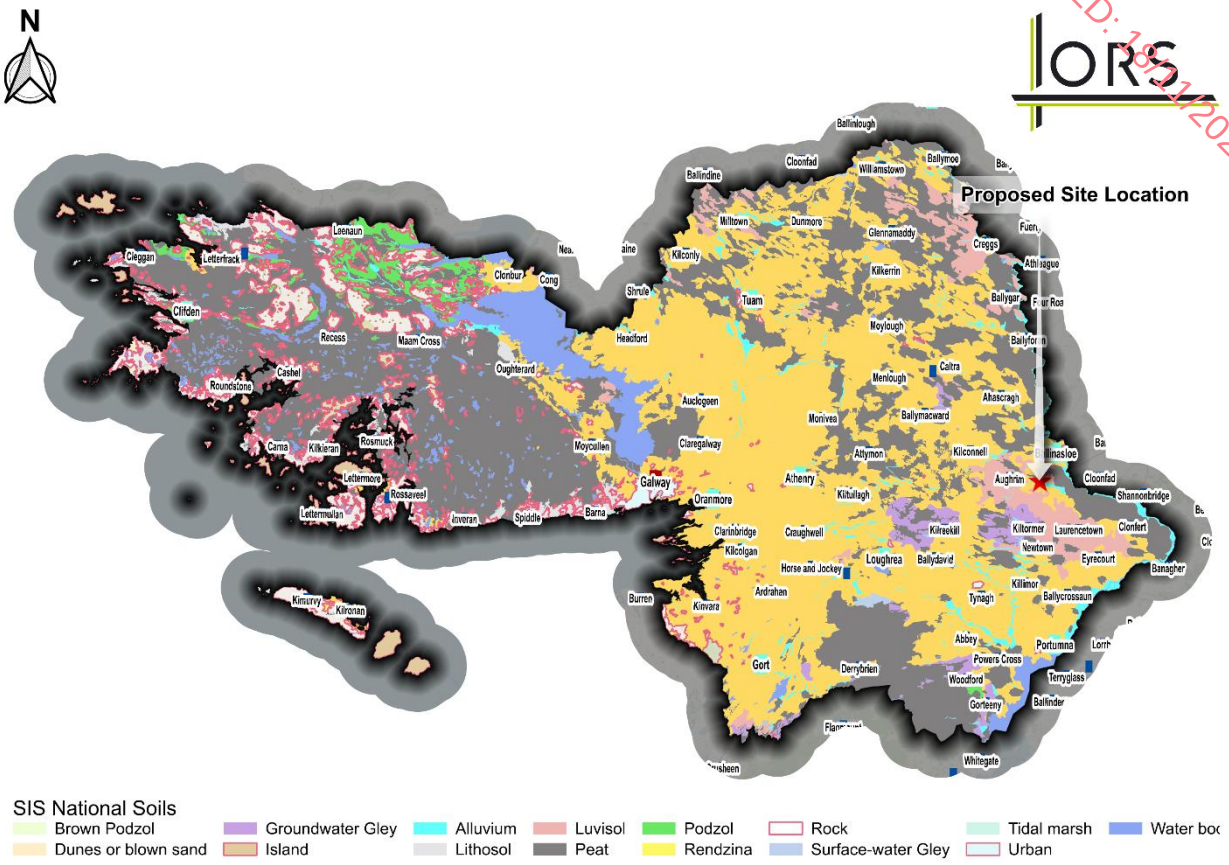

Figure 7.18 - National Soil Map of South County Galway (Source: Teagasc/EPA)

Local Soil and Subsoil

According to GSI online mapping data, the site predominantly overlies deep, well-drained mineral soils (BminDW), derived chiefly from calcareous parent materials. These soils are classified as Grey Brown Podzolics and Brown Earths, exhibiting medium to high base status. As outlined in Gardiner and Radford (1980), this soil association consists primarily (*ca.* 70%) of Grey Brown Podzolics: well-drained, friable, gravelly sandy loams with elevated base saturation. The soil profile is typified by a 25–40 cm dark greyish-brown to dark brown surface horizon, underlain by a brown to yellowish-brown leached A2 horizon. Beneath this lies an undulating, dark greyish-brown B horizon displaying pronounced clay accumulation, ultimately grading into very coarse-textured (gravelly coarse sand or gravel) parent material at depths of 0.5–0.8 m. Diagnostic features include high gravel content, a distinct tonguing A2 horizon, a well-developed textural Bt horizon, and consistently elevated pH and base saturation. While these soils exhibit moderate moisture retention capacity, prolonged dry spells may induce moisture deficits.

On hummock crests and elevated sections of eskers and kames, soils transition to very shallow, excessively drained, gravelly/stony coarse sandy loams with high base status. These Brown Earths account for up to 20% of the association. In contrast, low-lying areas with a permanently high water table support imperfectly to poorly drained sandy loams of high base status, classified as Gleys, which constitute approximately 5% of the association. Additionally, Basin Peats (*ca.* 5%) are intermittently distributed across the site. When reclaimed, these soils

demonstrate strong potential for both tillage (notably vegetable production) and grassland agriculture.

Excluding the poorly drained Gleys, which are best suited to summer grazing, this soil association supports a moderately broad range of agricultural uses. The soils are well-suited to diverse farm, fruit, and vegetable crops, are readily workable, and are widely utilised for cereal cultivation, including malting barley, and sugar beet production. However, the shallow soil component is prone to drought stress, while the deeper profiles may experience moisture deficits, potentially leading to uneven crop maturation. With appropriate fertilisation and management, short-term grass leys perform effectively, allowing for near year-round intensive grazing.

Presently, the site's soil association is predominantly characterised as Brown Earths and Calcareous Brown Earths developed on coarse loamy drift overlying limestone, associated with Luvisols and minor occurrences of Rendzinas and Peat. Brown Earths are well drained soils possessing rather uniform profiles with little differentiation between horizons.

To the north of the Proposed Development, along the Glenloughaun Local Road (L8412) alignment, soils are classified as shallow, well-drained mineral soils (BminSW), derived from calcareous parent materials and comprising Rendzinas and Lithosols. Alluvial soils are present adjacent to the southern boundary. These three soil types dominate the study area, with sporadic and limited occurrences of Man-Made soils and Peat.

The Irish Soil Information System (SIS) project has developed a national association soil map for Ireland at a scale of 1:250,000, together with an associated digital soil information system, providing both spatial and quantitative information on soil types and properties across the country. This resource groups similar soil groups together into 11 soil 'Great Groups' and associated 'Sub-Groups', allowing for the taxonomical classification of soil types throughout Ireland.

The site overlies the Mullabane Series (1100q) as indicated in the **Figure 7.19**. Under the SIS classification system, this soil group is comprised of Typical Brown Earths, found with Calcareous Brown Earths on drift with limestones associated with Luvisols, Rendzinas and peat. The association is classified as a coarse loamy drift with limestones.

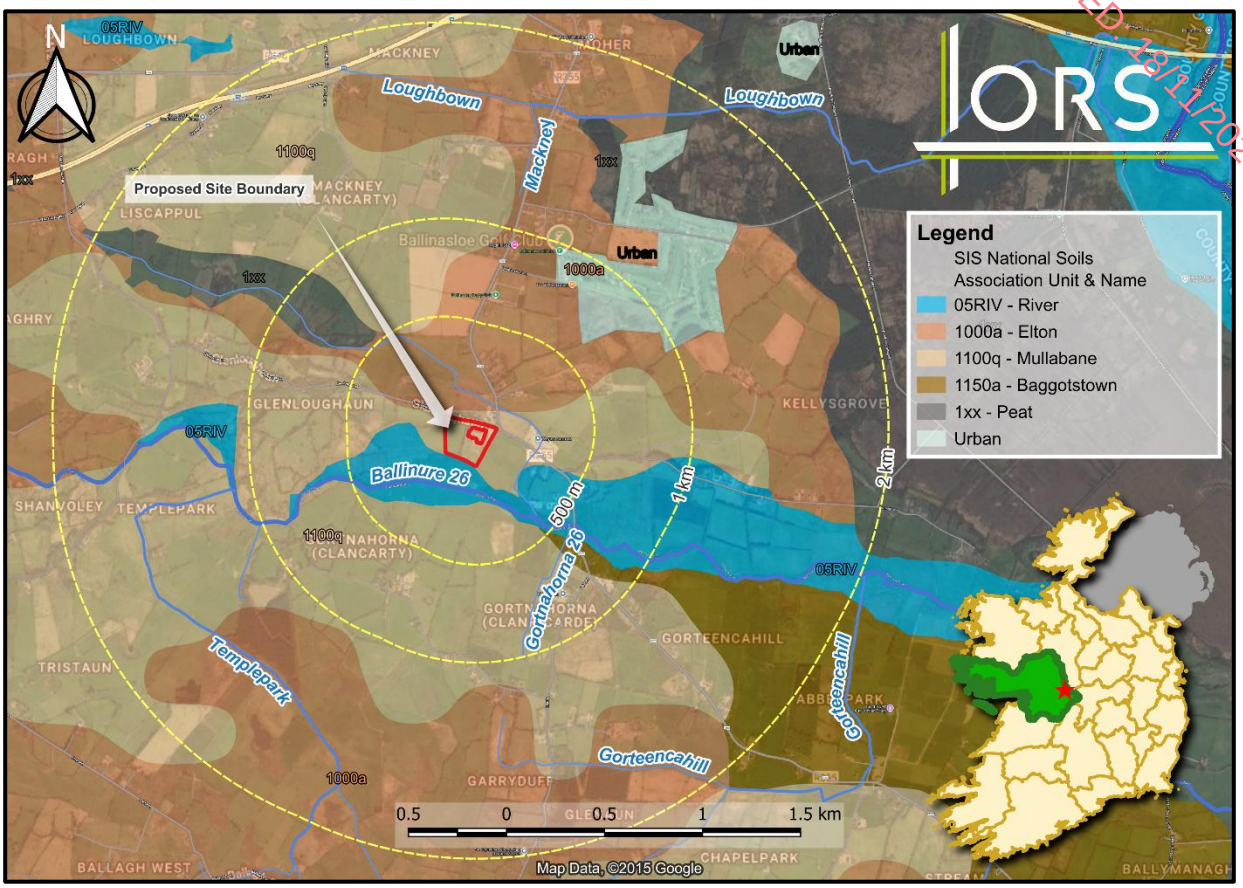

Figure 7.19 - Irish Soil Information System (ISIS) Map – Surface Soils. Map detailing soil types underlying the site (EPA and Teagasc)

The Teagasc representative soil profile description for the 'Mullabane' series notes it as having a fine loamy texture. The definition is Coarse loamy drift with limestones over which contains a high proportion of sand (55%) and smaller proportions of silt (32%) sized particles with lower proportions of clay (13%) in the top horizon (0-18 cm).

Throughout the lower horizons (18-120cm) this proportion of particle sizes remains relatively consistent with a slight variations, no bigger than 4%, on the percentage of particles sizes along the following horizons. Towards the final horizon a higher proportion of sand (64%) and lower proportions of silt (29%) and clay (7%) are noted. A detailed representative soil profile description from the Teagasc SIS database of the 'Mullabane' soil series is included in **Appendix 7.1**. This representative soil description available for the 'Mullabane' series is not taken from the subject site and so will differ from the proposed site in Glenloughaun.

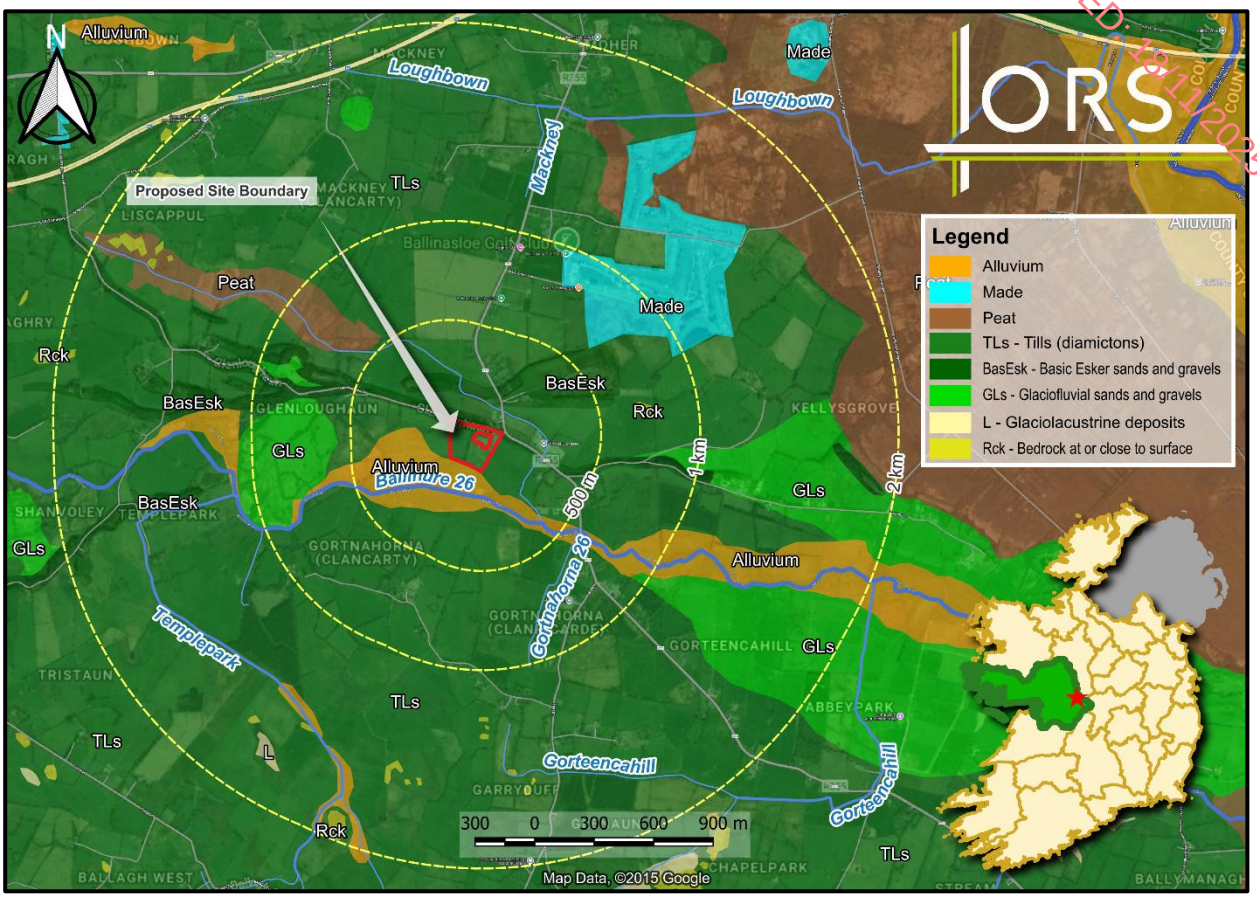

Figure 7.20 - Teagasc Subsoil Map detailing subsoil types underlying the site (Teagasc)

The EPA databases indicate the parent material for the subsoils beneath the site are composed of a till type, a sediment deposited by or from glacier ice – TLS (Diamictons), as indicated in **Figure 7.20** above. The strip shaped area along the northern boundary is overlaid by basic esker sands and gravels (BasEsk). Adjoining the southern boundary, there is undifferentiated alluvium subsoils.

Licensed Sites

A review of the EPA and Department of Climate, Energy and the Environment (DCEEC) (gov.ie) website for existing and historic, licensed and illegal waste activities, mines and industries was carried out to identify any potential contamination sources present in the area and to identify any potential contaminating activities near the Proposed Development. The desk study indicated that no illegal waste activities sites were present within a 2km radius of the proposed area. Relevant to this report, it is found within the study area, a licensed peat extraction installation boundary located *ca.* 1.7Km East from the site (Ref P0502-01), and a licensed existing landfill named as Pollboy Landfill Facility (W0027-02), in Pollboy, Ballinasloe, Co. Galway, located *ca.* 1.7 km to the Northeast. There is also a Compliant Domestic Wastewater Treatment System at Gortnahorna (Clanricarde), located *ca.* 640m to the Southeast of the site, downstream of the Ballinure River.

A number of extractive industries registered sites[1] were identified in the environs of the site, as outlined in **Table 7.8** below.

Table 7.8 - EPA extractive industries registered sites within the 2km study area

Reg. Number	Type of Extraction	Distance from site	Operator Name
QS1429	Quarry	1.7Km W	John Paul Butler
QS1616	Quarry	935m W	Vincent Cannon and Company 2
QS1453	Quarry	660m W	Patrick Goode
QS1426	Quarry	250m NW	Edward Sheppard
QS1427	Quarry	Across the Glenloughaun Local Road (L8412)	Edward Sheppard 1
QS1492	Quarry	240m E	Whytes Sand and Gravel
QS1615	Quarry	420m NE	Vincent Cannon and Company 1
QS1428	Quarry	1.9Km E	Edward Sheppard 2

No Integrated Pollution Prevention Control (IPPC) development was found within the study area. The EPA's IPPC Boundary dataset identifies two inactive licensed sites northeast of the Proposed Development, located *ca.*3.7 kilometres beyond the 2km study area. These adjacent facilities, situated within Poolboy Industrial Estate in Ballinasloe, were both operated by Premier Proteins (2000) Limited under licenses P0045-05 and P0045-06. The installations were classified under major activity category 7.7.1 (Food and Drink Industry) for the disposal/recycling of animal carcasses and waste with a treatment capacity exceeding 10 tonnes daily. Both licenses have since been ceased (revoked). The facilities' historical classification and current inactive status have been duly noted in the environmental assessment.

A review of recent planning decisions within a 2km radius of the subject site reveals multiple granted permissions for residential, agricultural and ancillary developments between 2020 and 2025. These include the construction of a 96sqm equipment storage shed at Graigueawoneen Rugby Club, *ca.* 703 m to the North, a 544sqm cattle shed with manure storage at Gortnahorna, *ca.* 705 m to the south, and several new dwellings ranging from 191sqm to 337sqm in floor area at various locations. Notable residential developments include a recently permitted dwelling at Gornahorna, located *ca.* 820 m Southwest of the Site and extensions/renovations to existing properties, such as the 162.92sqm extension with wastewater upgrades at Abbeypark, located *ca.*1.80km Southeast. Agricultural developments comprise primarily of livestock housing, while community infrastructure includes boundary amendments and new facilities at St. Teresa's Children's Respite Unit *ca.* 2.00 km to the North. All reviewed applications were granted permission, with the most recent decision dated July 2025, demonstrating continued development activity in the area while maintaining compliance with planning regulations. The nature and scale of permitted developments indicate a clear pattern of measured rural growth consistent with local planning objectives.

Table 7.9 provides the previous applications for permission next to site as consulted in the Co. Galway Planning Applications Dataset, for the last five years.

1 As indicated in the EPA dataset *Extractive Industries Registered Sites* <<EPA:LEMA_Facilties_Extractive_Facilities>> consulted on 16th July 2025.

Table 7.9 – Planning Applications submitted to Galway Co. Co. in the site's surroundings

Reg. Ref	Location	Description of Development	Decision (Decision date)	Distance
21119	Graigueawoneen	to construct a new shed for storage of pitch maintenance equipment and associated site works at the rugby club grounds. Gross floor space of proposed works: 96 sqm	Grant Permission (29/03/2021)	703.55m to the N
2261310	Gortnahorna, Clontuskert Ballinasloe, Co. Galway	for the construction of a Slatted and Loose Bedded Cattle Shed, Roofed manure Pit and Ancillary Concrete. Gross floor space of proposed works 544.00sqm.	Grant Permission (23/02/2023)	705.47m to the S
2560649	Gornahorna (Clancarty), Clontuskert, Ballinasloe	for a new dwelling house, domestic garage, wastewater treatment system, percolation area and all associated site works and services. Gross floor space of proposed works: 232.00 sqm(H), 50 sqm(G)	Grant Permission (10/07/2025)	820.49m to the SW
22389	Kellysgrove	to complete dwelling house and garage along with site works to include proprietary treatment system and percolation area and all ancillary site development works originally granted under pd 06/2669. Gross floor space of work to be retained: 218 sqm + 35 sqm. Gross floor space of proposed works: 35 sqm	Retention Permission (11/07/2022)	1.28 Km to the E
20727	Gortnahorna Clontuskert	for erection of dwellinghouse, domestic garage and associated site services. Gross floor space of proposed works; 191sqm (house) 76sqm (garage)	Grant Permission (05/08/2020)	1.36 Km to the S
23494	Garryduff, Clontuskert, Ballinasloe	for a wastewater treatment system to serve an existing house	Grant Permission (08/02/2024)	1.41 Km to the S
2361090	Templepark, Aughrim, Ballinasloe	change in house design to that previously granted under pl. ref. no. 22/60284 & all associated site services	Grant Permission (07/11/2023)	1.52 Km to the W
2260284	Templepark	(a) demolition of existing derelict dwelling and out buildings (b) the construction of a Dwelling House, Treatment Unit, Percolation area and all associated site services. A Natura Impact Statement has been prepared as part of this planning application.	Grant Permission (01/09/2022)	1.53 Km to the W
2261048	Templepark, Aughrim, Ballinasloe	change in house design to that previously granted under planning reference number 22/60284 and all associated site services. Gross floor space of proposed works 239.62sqm.	Grant Permission (09/12/2022)	1.53 Km to the W
24222	Abbeypark, Clontuskert, Ballinasloe	to (a) Demolish single storey annex to rear of existing dwelling and construct an extension to the rear of the existing single storey dwelling. (b) Decommission existing septic tank and install a new waste water treatment system with percolation area. (c) Demolish an existing domestic store and construct a new domestic garage. (d) and all associated site works. Gross floor space of proposed works: 162.92 sqm. Gross floor space of any demolition: 55.38 sqm (annex) 51.60 sqm (shed)	Grant Permission (18/09/2024)	1.80 Km to the SE
2360140	Moher, Ballinasloe, Co. Galway.	to construct a single storey dwellinghouse, detached domestic garage, waste water treatment system and associated services. Gross floor space of proposed works 337.24sqm	Grant Permission (12/04/2023)	1.90 Km to the N

Reg. Ref	Location	Description of Development	Decision (Decision date)	Distance
22153	Liscappul	for the demolition of 10.2sqm existing single-storey bay to rear, construction of 81sqm single storey extension with alterations to rear and side of existing two storey detached dwelling and upgrade and relocation of wastewater treatment system. Retention permission is also sought for the following; 38sqm attic conversion and associated dormer to rear of dwelling and single story 83sqm detached stables to east. Also retention of alterations to previously approved detached garage/out office (pl ref: 036597) also to east as follows: additional 3sqm floor area, conversion of attic and alterations to elevations and all ancillary site development works. Gross floor space of proposed works: 81sqm. Gross floor space of works to be retained: 156sqm.	Grant Permission (05/04/2022)	1.96 Km to the NW
2498	Moher, St. Teresas Children's Respite Unit, 25 Moher Ballinasloe	to enlarge the site, amend the boundaries and add staff car parking and a play space	Grant Permission (04/06/2024)	1.99 Km to the N

Historic Land Use

A review of historical mapping and aerial imagery, sourced from MapGenie, documents the site's evolution from the mid-19th century to 2018, and is summarised in **Table 7.10**. The earliest available records (1837-1842) show the site and surrounding lands as undeveloped greenfield, bounded by the existing L8412 and R355 public roads, with natural drainage channels delineating its southern and eastern boundaries. By 1995, minor alterations were evident, including localised made ground and the appearance of new residential properties, along with the establishment of Edward Sheppard Quarry in the vicinity.

The early 2000s saw further development, with the construction of additional buildings, hardstanding areas, and the opening of Whytes Sand and Gravel facility to the east. A farm shed was also erected opposite the site on the L8412 during this period. Subsequent years brought further modifications, including a significant extension to a structure on the northern boundary and the accumulation of stored materials on-site. Despite these changes, the wider area retained its predominantly greenfield character, with only isolated new residential developments. The most recent assessment (2013-2018) confirms a period of relative stability, with no major alterations observed in comparison to preceding years.

This chronological analysis demonstrates a gradual progression from an entirely undeveloped landscape to one with intermittent infrastructural and industrial interventions, while maintaining a largely rural setting.

Table 7.10 - Historical Land Use (https://webapps.geohive.ie/)

Date / Period	Source	Description
1837-1842	MapGenie 6 First Edition Black & White	The proposed site and its adjacent lands are classified as greenfield areas. Scattered dwellings are present in the lands to the north of the site. The site is bounded by two existing public roads: the currently known as L8412 (Glenloughaun Local Road) and the R355 (Kellysgrove Regional Road). Furthermore, the southern and eastern boundaries of the site appear to be delineated by drainage channels, which flow southwards and connect into a larger drainage scheme. The Ballinure River is situated *ca.* 130 metres to the south of the site. A review of the surrounding area within a 2.0 Km radius indicates the absence of any other significant buildings, developments, or key environmental features.
1837-1842	MapGenie 6 Inch First Edition Colour	
1830's - 1930's	MapGenie 6 Inch Last Edition Black & White (Reviewed)	No notable change in the site and surroundings
1863 - 1924	MapGenie 25 Inch	
1995	MapGenie Imagery 1995	The assessment of the site indicates that a small area has been converted to made ground, directly adjacent to an existing building. Furthermore, recent development is apparent in the surrounding area, with new houses now present *ca.* 180 metres north of the site, along the R355. The image also clearly shows the new Edward Sheppard Quarry as a prominent feature in the landscape.
1996 - 2000	MapGenie Imagery (1996 - 2000)	There has been a discernible reduction in the density of trees and shrubs within the eastern portion of the site. Concurrently, the adjacent building appears to have undergone an extension. While no other major changes are evident, some new housing developments are now identifiable in the wider surrounding area.
2001 – 2005	MapGenie Imagery (2001 - 2005)	The eastern part of the site has been developed with several buildings and areas of hardstanding. Whytes Sand and Gravel is situated to the east of the site, along the R355. Additionally, a farm shed / farm machinery store have been constructed across the L8412 to the north
2006 – 2012	MapGenie Imagery (2006 - 2012)	The building located on the northern boundary of the site has been significantly extended, which currently houses the Torva Ireland Ltd. The portion of the site immediately adjacent to this building shows an increase in stored material, specifically rubble. The surrounding lands remain predominantly greenfield.
2013 – 2018	MapGenie Imagery (2013 - 2018)	The site and its surrounding environs remain unchanged from previous years, maintaining its current use as agricultural pastureland. The northern boundary is adjacent to Torva Ireland Limited, a meat processing and preservation facility. The site is otherwise bordered by agricultural pastureland to the south, east, and west. Whyte's concrete plant is situated *ca.* 225 metres east of the proposed development. An unnamed tributary of the Ballinure River flows approximately 100 metres along the northern boundary and continues for roughly 230 metres along the eastern boundary of the site. No significant changes to site and the surrounding environs compared to previous years.

Landslides

The GSI's online landslide database indicates there are no historic landslides recorded on the site or within a 2km radius of it. The nearest recorded landslide is *ca.* 31 km northeast of the site on the slopes of the Tullywood, surroundings of Baylin, Co. Westmeath.

7.4.7 Ground Investigation

Ground investigation works were carried out by a chartered ORS environmental scientist for the Proposed Development at Glenloughaun on the 14th of July 2025. The location and depth of the

trial pits is shown on **Figure 7.21**, and a summary of the soil profiles encountered at each investigation location is presented in **Table 7.11**.

The trial pit investigations revealed variable subsurface conditions across the site. TP01 encountered loose brown gravelly silt with frequent rootlets from 0 to 0.4 metres, transitioning to firm pale brown laminated silt between 0.4 and 1.2 metres, which became increasingly gravelly with cobbles towards the base. From 1.2 to 1.4 metres, firm grey sandy gravelly silt with moderate cobbles was observed, followed by loose brown-grey silty very sandy gravel with frequent cobbles and rare boulders extending to 2.4 metres. A similar stratigraphy was noted in TP02, with firm brown gravelly silt in the upper layer (0-0.7 metres), firm laminated silt at mid-depth (0.7-2 metres), and loose gravelly deposits with cobbles and boulders below 2 metres. TP03 exhibited comparable layers, including loose slightly gravelly silt (0-0.4 metres), firm laminated silt (0.4-1.1 metres), firm gravelly silt (1.1-2 metres), and loose gravelly deposits with cobbles and boulders beyond 2 metres.

TP04 contained organic silt topsoil (0-0.5 metres) overlying gravelly silt with cobbles (0.5-1.8 metres) and silty very sandy gravel with cobbles and boulders (1.8-2.1 metres), where rapid groundwater inflow was encountered. TP05 featured made ground with plastic fragments in the upper layer (0-0.4 metres), underlain by firm dark brown very gravelly silt (0.4-2 metres), a dark brown organic silt lens (2-2.4 metres), and loose grey sandy gravelly silt with cobbles (2.4-3.5 metres), with groundwater inflow noted at 3.5 metres. TP06 consisted of loose brown slightly gravelly silt (0-0.8 metres) overlying soft dark grey clay extending to 3 metres. The findings indicate heterogeneous ground conditions, with variations in soil composition, density, and groundwater presence across the site. No bedrock was reached in any of the Trial Pits.

Based on a comparison of the Teagasc SIS National Soils database, as presented in **Section 7.4.6,** with the observations from the trial pit investigation, as summarised in **Table 7.11**, the geology and subsoil conditions on site were somewhat inconsistent with those indicated in the existing geological mapping. For example, the Teagasc database classifies the area as Mullabane (1100q) soil association, typified by a well-drained Brown Earth soil profile developed on coarse loamy drift with limestones. However, the trial pit investigation revealed a more varied stratigraphy than the generalised Teagasc classification suggests. While coarse-grained materials like gravelly and sandy layers were confirmed, the upper strata primarily comprised loose to firm gravelly silt with organic content. Deeper deposits transitioned to loose sandy gravel containing cobbles and boulders, indicating a more heterogeneous composition than the uniform coarse loamy drift described. Other localised differences were observed, including the presence of laminated silt and organic lenses in some pits, and notably, a rapid inflow of groundwater into trial pits TP04 and TP05, at 2.1 and 3.5 m BGL, respectively. These specific findings indicate localised variations in drainage conditions, which stands in contrast to the well-drained nature typically associated with Brown Earth soils. This is perhaps not that surprising as the site is located at a junction of varying geomorphological features, including fluvial alluvium deposition, glacial silt, sand and clay deposition and esker gravel deposition.

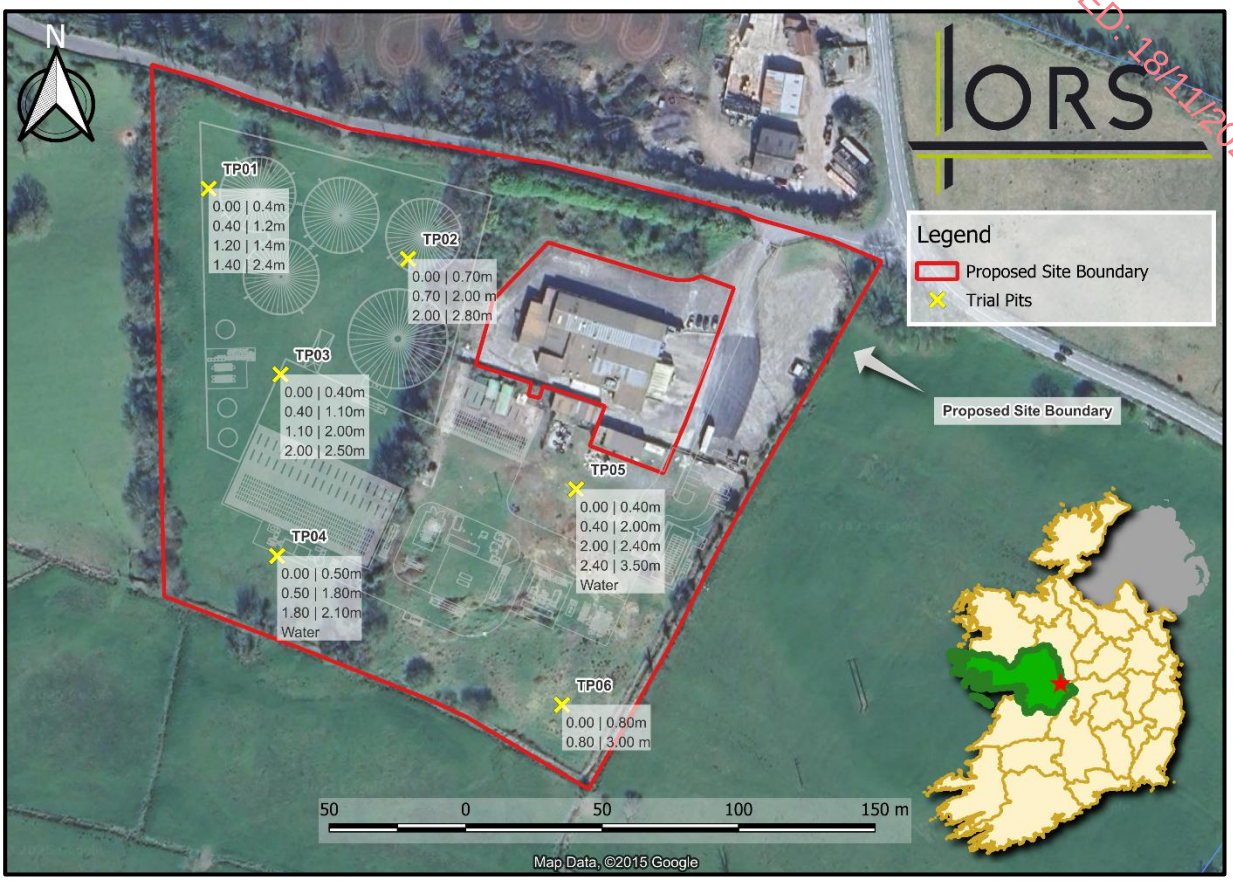

Figure 7.21 - Location and depths of Trial Pits (TP)

Table 7.11 - Ground profile for each Trial Pit

Location	Depth (m)	Ground Profile	Comments
TP01	0 – 0.4m	• Loose brown gravely SILT with frequent rootlets. Gravel is fine to coarse, rounded to sub-rounded.	Trial pit Collapsed
	0.4 – 1.2m	• Firm pale brown laminated SILT. Becomes more gravelly with cobbles towards base.	
	1.2m-1.4m	• Firm grey sandy gravely SILT with moderate cobbles present. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded.	
	1.4m-2.4m	• Loose brown-grey silty very sandy GRAVEL with frequent cobbles and rare boulders present. Sand is fine to coarse. Gravel is fine to coarse, rounded to sub-rounded. Cobbles and boulders are rounded to sub-rounded.	
TP02	0-0.70m	• Firm brown gravelly SILT with frequent rootlets present. Gravel is fine to coarse, rounded to sub-rounded.	Trial pit Collapsed
	0.70m-2m	• Firm pale brown laminated SILT. Becomes more gravelly with cobbles towards base.	
	2m – 2.8m	• Loose brown-grey silty very sandy GRAVEL with frequent cobbles and rare boulders present. Sand is fine to coarse. Gravel is fine to coarse, rounded to sub-rounded. Cobbles and boulders are rounded to sub-rounded.	

TP03	0 – 0.4m 0.4 – 1.1m 1.1 – 2m 2m – 2.5m	• Loose brown slightly gravely SILT with frequent rootlets. • Firm pale brown laminated SILT. • Firm brown gravely SILT. Gravel is fine to coarse, angular to sub-angular. • Loose brown-grey silty very sandy GRAVEL with frequent cobbles and rare boulders present. Sand is fine to coarse. Gravel is fine to coarse, rounded to sub-rounded. Cobbles and boulders are rounded to sub-rounded.	
TP04	0-0.5m 0.5 – 1.8m 1.8 – 2.1m	• Organic silt topsoil • gravely SILT with cobbles • silty very sandy GRAVEL with cobble and boulders.	Rapid GW Inflow at 2.1mbgl
TP05	0-0.4m 0.4 – 2m 2- 2.4m 2.4 – 3.5m	• MADE GROUND comprising of loose brown very gravely silt with frequent cobbles present. Gravel is fine to coarse, rounded to sub-rounded. Contains frequent plastic fragments and plastic sheeting • Firm dark brown very gravely SILT with rare cobbles. Gravel is fine to coarse, rounded to sub-rounded. Cobbles are rounded to sub-rounded • Dark brown organic SILT lens. • Loose grey sandy very gravely SILT with frequent cobbles present. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded to angular. Cobbles are sub-rounder to angular	Rapid GW Inflow at 3.5mbgl
TP06	0-0.8m 0.8 – 3m	• Loose brown slightly gravely SILT with frequent rootlets. • Soft dark grey CLAY.	

In accordance with the Geological Survey Ireland's (GSI) Groundwater Vulnerability mapping guidelines, a methodology adapted from the 1999 protocol by the Department of the Environment and Local Government (DELG) et al., as described in **Section 7.4.5**, the site's overall groundwater vulnerability is classified as Moderate. However, a more granular, site-specific assessment based on the trial pit findings reveals a higher degree of vulnerability in certain localised areas. Groundwater was observed in two of the trial pits, TP-04 and TP-05, while TP-06 exhibited a soft, dark grey clay subsoil indicative of prolonged saturation, consistent with a persistently high groundwater table. Based on the groundwater inflow observed in these trial pits, these areas around TP04 and TP05 would be classified as having a high vulnerability. It is recommended that additional Trial Pit excavations are conducted prior to the commencement of the construction phase, particularly in the southwestern portion of the site, to confirm the water table level and at the north of the proposed bunded area, where a small portion of the site has been assigned a high groundwater vulnerability.

Examination of the man-made ground conditions at the site is also recommended in order to confirm absence of ground contamination as a result of any existing/historical infrastructure e.g. a decommissioned soakaway from a septic tank associated with the adjacent meat processing and preserving facility.

7.5 Likely Significant Effects

The assessment focuses on predicted impacts in relation to soils and geology. The assessment relates to impacts occurring during both the construction and operational phases of the development.

For a risk from ground contamination to exist, a contaminant source, pathway for migration and

viable receptor must exist. The presence of all three of these elements is known as a 'pollutant linkage'.

Based on the dataset obtained during the desk study, intrusive site investigation, and anecdotal evidence collected the following risk assessment has been carried out. This identifies the relevant sources, pathways and receptors (pollutant linkages) and assigns a qualitative risk classification of 'Positive, Neutral or Negative/ Adverse' risk to the identified Potential Pollutant Linkages (PPLs).

The likely potential pollutant linkages identified as a result of this assessment and specific for the site have been provided in the initial Conceptual Site Model (CSM). The model has been based upon the site setting at the time of the assessment, the land use (current and reasonably foreseen future use) of the surrounding area and the state of what the proposal is (i.e. development, ongoing use, etc.).

As well as identifying the potential pollutant linkages the model includes a preliminary assessment of risk based upon the probability of effect and the likely severity of effect in the context of the site setting and proposed future site use.

The criteria used for the risk assessment classifications in this report is detailed in the EPA guidance notes 2022, **Table 1.1** of **Chapter 1** in this report, and in the *CIRIA Report 552*.

7.5.1 Do-Nothing Scenario

If the Proposed Development does not proceed there would be no additional impact on the local soil, geology or geological heritage. The current rate of surface water percolation and runoff would continue to operate in its current state.

Under the 'Do Nothing' scenario there would be no change to the current land use of the site which would remain as a partial brownfield and greenfield agricultural land. In implementing this 'Do-Nothing' alternative, an Anaerobic Digestion Facility would not be developed and there would be no changes made to existing land-use practices. The site is anticipated to remain underutilised for agricultural grazing. The area containing the man-made ground, which may contain potential environmental contamination, would persist in an untreated state, thereby presenting a risk of leaching and migration to both soils and the underlying groundwater. Agricultural manures and slurries will be sourced from agricultural operators within a 30km radius of the Proposed Development. In the 'Do-Nothing Scenario' these agricultural wastes would not be treated locally through the AD process. Untreated and unpasteurised manures and slurries would continue to be applied direct to land at current volumes, with the continued addition of chemical fertiliser. Furthermore, the associated CH_4 emissions would not be captured within the AD process.

7.5.2 Receptor Sensitivity

The sensitivity of the receptors identified during the study of soil and geological features within the vicinity of the site are summarised in **Table 7.12**.

Table 7.12 - Receptor Sensitivity

Receptor	Receptor Importance	Receptor Sensitivity	Rationale
Topsoil	Local Level	Low	The trial pits revealed more variable subsurface conditions than the Teagasc SIS classification of well-drained Brown Earth soils (Mullabane 1100q association). The stratigraphy showed loose to firm gravelly silts overlying sandy gravels with cobbles/boulders, alongside localised features like laminated silts, organic lenses and groundwater inflows. Construction waste was present in eastern parts of the site, while the western portion remains undisturbed pastureland. Topsoil will reused on site for fill and landscaping
Underlying Deposits	Local Level	Low	The development has been designed to utilise the existing site topography as far as possible **(231960-ORS-ZZ-00-DR-AR-200),** minimising the disturbance to the subsoil to achieve the desired site levels. Where possible drift deposits will remain on site and be utilised as infill material. The underlying till deposit is predominantly a till derived from limestones. The development site is located across a GSI designated Flat to Undulating Lowland which is characterised by gentle slopes, making it fully suitable for all forms of agricultural machinery operation without topographic constraints.
Bed Rock Geology	Regional Level	Moderate	The underlying bedrock is characterised as well-bedded, fine-grained, weakly laminated, and bioturbated argillaceous limestone, alternating with dark grey to black calcareous mudstone. Karst features have not been recorded within the site vicinity nor within the wider region. The Site lands are primarily designated as having moderate groundwater vulnerability, with a shift to high vulnerability along the northern boundary. The Lucan Formation encompasses the wider study area and further.

7.5.3 Sources - Construction Phase

The construction phase is likely to yield the most potential impacts on the surrounding land, soil and geology. Potential construction phase impacts are considered in detail below and summarised in **Table 7.16**.

The Proposed Development civil design has aimed to minimise excavation as far as possible, with the service yard levels set to accommodate the existing topography of the site, whilst excavation towards the northern boundary for the containment sump with result in finished floor levels of 42.00 m OD.

Figure 7.22 - Site layout with proposed and existing site levels (Drawing No: 231960-ORS-ZZ-00-DR-AR-200)

Excavation works to facilitate the insertion of a *ca.* 3.3km length gas pipeline and new connection to the existing gas line will be required. The proposed gas pipeline connecting the Proposed Development to the existing Gas Networks Ireland pipeline along the R355 will be installed underneath the new access and the Glenloughaun Local Road (L8412). The following sections outline the potential effects to Land, Soil and Geology posed by the proposed excavation and infilling of the site.

Topsoil Removal

The initial phase of construction will involve the removal and stockpiling of the topsoil. The pre-construction geotechnical site investigations conducted indicate a topsoil horizon varying from 0.00 – 0.40 m and to 0.80 m in depth of a brown topsoil with varying degrees of silt and gravels content with some Organic Silt topsoil and Man-Made Ground. This inert material will be stripped throughout the Proposed Development site and be stockpiled. For the gas pipeline route the topsoil will be temporary stockpiled before being used to redress the installed pipe. The method of stripping will involve the use of a tracked excavator/ bulldozer along with the use

of haul trucks.

Stockpiles in the absence of mitigation measures will be susceptible to erosion by climatic and hydraulic factors. Any excess topsoil will be removed from site and disposed of in accordance with current waste management regulations.

The most significant risk posed by the topsoil excavation is through the migration of sand, silt and other sediment off site through wind and water borne modes of transportation. If incorrectly stockpiled and under specific climatic conditions these sediments can find their way into nearby streams. In significant quantities they can pose a risk to aquatic life and result in a degradation of water quality, as outlined in **Chapter 8: Hydrology and Hydrogeology**.

In the absence of mitigation, the removal and stockpile of topsoil would result in a ***negative***, ***moderate*** and ***reversible*** effect on soil.

Excavation/Subsoil Removal

The site investigation revealed variations in subsoil horizon depths across trial pits. In TP-01, topsoil overlay firm pale brown laminated silt (0.4-1.2m bgl), transitioning to gravelly material with cobbles at depth, followed by firm grey sandy gravelly silt (1.2-1.4m bgl) containing moderate, sub-angular to sub-rounded cobbles in a fine to coarse sand/gravel matrix. TP-02 exhibited similar laminated silt beneath topsoil (0.7m bgl), becoming increasingly gravelly with depth. TP-03 mirrored TP-01's sequence, with firm laminated silt (0.4m bgl) overlying gravelly silt containing angular to sub-angular gravel (1.1m bgl).

The southern and eastern trial pits displayed distinct characteristics. TP-04 contained gravelly silt with cobbles (0.5-1.8m bgl), while TP-05's made ground overlay firm dark brown very gravelly silt with rare cobbles (0.4-2.0m bgl), followed by a 0.4m organic silt lens. TP-06 encountered soft dark grey clay from 0.8m to 3.0m bgl. Notably, TP-04 and TP-05 recorded rapid groundwater inflows at 2.1m and 3.5m bgl respectively, indicating localised variations in hydrogeological conditions.

The industrial site requires the creation of a sump for the containment of effluent in the event of a failure of the digester or digestate tanks. The volume required for the sump is equivalent to 110% of the largest tank (Digestate Storage Tank: 9161m^3 x 1.1 = 10077m^3) or 25% of the cumulative tank volume at the lower level (21590m^3 x 0.25 = 5397m^3). The available sump area, excluding the tank footprints, is 5078m^2. Consequently, a sump depth of 2.00m, providing 10156m^3 of capacity, is required to facilitate the containment of potential effluent in the event of tank failure.

The finished floor level for the lower level also needs to allow for the collection and attenuation of surface water with discharge to the southern drainage ditch, with a water level of approximately 39.20m AOD. As such, the sump finished floor level was set at 42.00m AOD to allow for an attenuation depth and gravity surface water network. The top of wall and ramp level of 44.00m AOD provides the containment volume required for EPA licensure. To minimise excavation, the service yard levels are set to accommodate the existing topography of the site. The central service yard area is relatively flat and will tie into a new service road for accessing both the subject site and the existing meat processing operation. To accommodate existing topography the southern portion of the service yard will grade at approximately 1:25 towards the southern boundary. A swale and SuDS Pond are proposed to cater for surface water runoff conveyance

and attenuation for the site on the southern edge of the service yard.

The formation levels were set to minimise the unnecessary excavation of the site with expected cut and fill quantities detailed on the **Table 7.13** below.

Table 7.13 - Cut & Fill Summary

2D Area (Sq.m)	Cut Cu.m	Fill Cu.m	Net Cu.m
24,479.93	51,017.29	2,074.36	48,942.92 (Cut)

The proposed sump area will require the implementation of a slope reinforcement scheme to specialist geotechnical design (e.g. Tensar Geogrid or Similar) to ensure that the road and embankment to the north remain stable. The sump walls will be to a structural engineer's design to retain this slope and the boundary between the sump area and the existing meat processing operation and will provide the impermeable sump volume required.

The cut and fill exercise undertaken for the site assumes a service yard and sump area build-up of 350mm of capping, 150mm of sub-base and 250mm of reinforced concrete (to be confirmed by structural engineer at tender stage).

Naturally the extent of excavation on the sump and service yard will generate a significant volume of excavated material. To minimise the quantities of the excavated material being removed from site, excavated material will be reused on site where possible to provide visual and auditory screening. Further reuse of excavated material may be possible for landscaping and backfill or proposed drainage lines if classified as acceptable backfill material.

Excavated soil will be reused on-site for fill and landscaping purposes where suitable. Surplus material requiring off-site export shall be tested and classified in accordance with the EPA's *Waste Classification - List of Waste & Determining if Waste is Hazardous or Non-hazardous*. Non-hazardous soils may be declared a by-product under Article 27 of the European Communities (Waste Directive) Regulations 2011, provided they meet the specific criteria set out therein, including formal notification to the EPA. The EPA's *Guidance on Soil and Stone By-Products* (Version 3, June 2019) shall be adhered to for all such determinations. Comprehensive records of all Article 27 declarations, Waste Acceptance Criteria (WAC) analytical results, and Hazardous Waste Online (Haz Online) assessments shall be maintained on-site throughout the works.

For further information of the expected cut and fill quantities please refer to drawing **231960-ORS-ZZ-00-DR-CE-490**.pdf.

In the absence of mitigation, the extraction and reduction and alteration in the subsoil horizon will have a ***negative, moderate*** and ***permanent*** effect on the subsoil.

Excavation of Bedrock

The GSI groundwater vulnerability maps have classified the entire site as overlaying two vulnerability classes. A longitudinal stripe of *ca.* 20m into the site along the Glenloughaun Local Road (L8412) is indicated as a High vulnerability risk, and, the majority of the site is above a "Moderate" groundwater vulnerability class. Except for the north part of the tanks bund area, which is underlaid by a High vulnerability risk, the whole development is over a moderate groundwater vulnerability.

Based off the groundwater vulnerability guidelines this would indicate a soil depth of *ca.* > 10 m at the portions of site where vulnerability is described as moderate and 5 – 10 m where vulnerability is described as high.

The site investigation encountered bedrock at 1.8m bgl to the centre of the site, similarly the site suitability assessment encountered bedrock at 1.6m bgl on site. Groundwater was encountered at 1.8m bgl in Trial Pit 04 towards the centre of the site. The findings of the site investigations indicate a gradual deepening of the underlying deposits to the east (>1.8m bgl) with bedrock found closer to the surface in the centre of the site, as shown in **Figure 7.10**. Based on the relevant guidelines, the proposed development is considered acceptable despite the site being classified as having a moderate to high vulnerability rating, subject to adherence to standard good practice and notwithstanding the variable soil depth conditions encountered.

A potential effect of the construction stage could be the exposure of the underlying bedrock. Excavations of up to 9.00m bgl will be required to reach the finished floor level (FFL) of the Digesters and Digestate Storage Tanks bunded area. The second depths excavation will be required to receive the central rainwater harvesting tank, which will require and excavation up to 5 m bgl and the open attenuation pond will require an excavation of 1.34 m bgl. When excavation to FFL has been achieved, further earthworks will then follow to facilitate the construction of foundations and the installation of services/drainage infrastructure. Foundations of up to 2m below the FFL will be required along the structural outline of buildings. Refer to the proposed Cut and Fill drawing in **Appendix 7.2** and relevant structural site layout drawings as referenced in **Section 2.2**, Chapter 2 – Project Description

In the absence of mitigation, encountering bed rock will have a ***negative, significant***, and ***permanent*** effect.

Access Road and installation of Gas Pipeline

During the initial stages of the construction phase, enabling works will consist of stripping and stockpiling of topsoil and subsoil at the proposed compound area, as outlined above. Similarly, excavations are required for the construction of site access, located at the north of the site and to install the gas pipeline.

An access road will be constructed to facilitate the connection of the proposed facility to the surrounding road network. This connection will be constructed at the site entrance and will be shared with the existing Torva Ireland Ltd facility adjoining the northern boundary of the site, which will join the Glenloughaun Local Road located to *ca.* 115 m north of the site entrance.

The proposed gas pipeline connecting the Proposed Development to the existing Gas Networks Ireland pipeline along the R355 will be installed underneath the new access and the Glenloughaun Local Road (L8412) as indicated in the **Figure 7.23**.

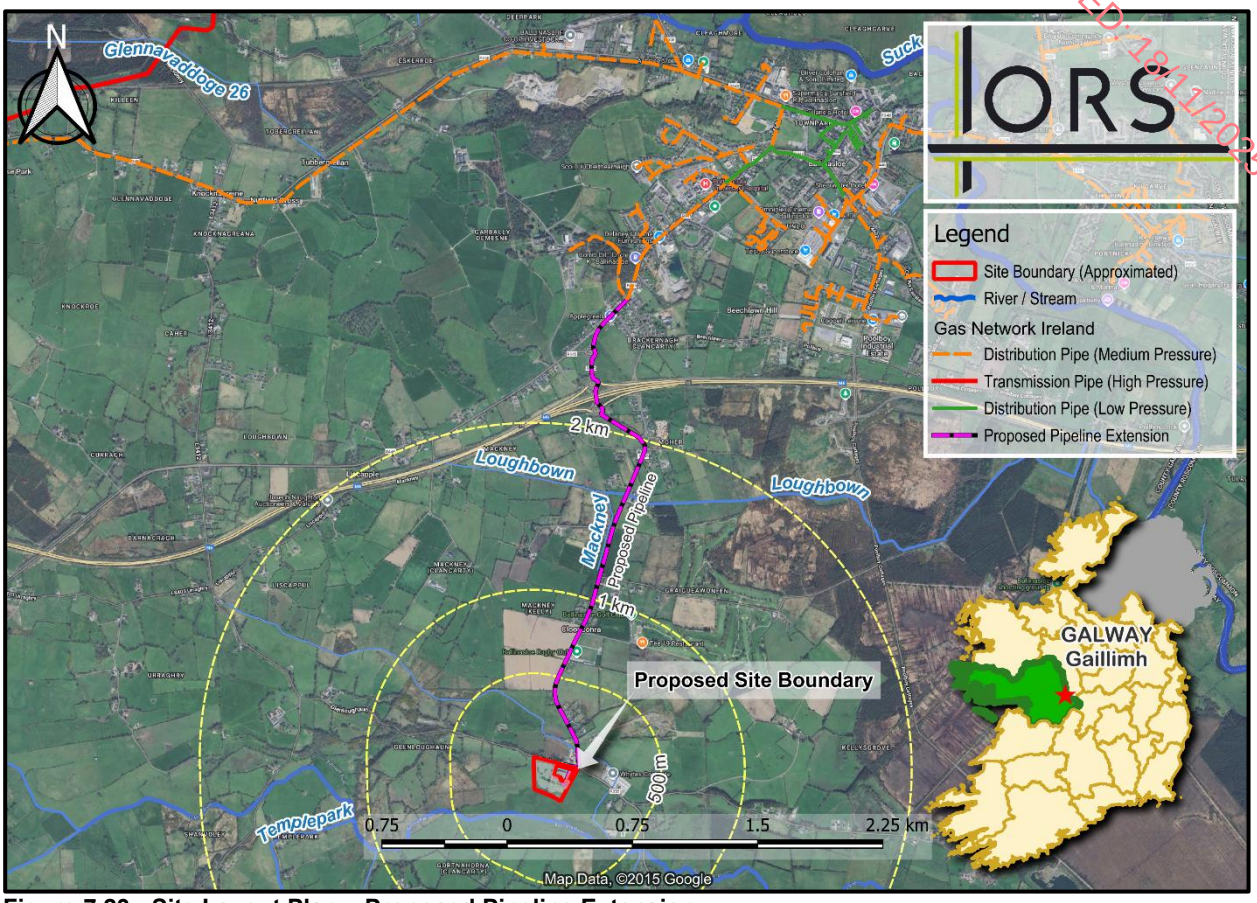

Figure 7.23 - Site Layout Plan – Proposed Pipeline Extension

This is an indicative routing of the pipeline to the site and is subject to change pending detailed network modelling and design. Installation of the pipeline will involve temporary excavation work and will result in disturbance of the underlying soil and subsoil. This may have an effect on the exposed soil and subsoil with implications for the soil surface with regard to stock piling and mobile plant. The trenches will be backfilled shortly after excavation following the installation of each section. Trenching along a road network will give rise to asphalt waste material. If unproperly managed these materials can pose a risk to the environment due to the presence of Polycyclic Aromatic Hydrocarbons (PAHs). PAHs are organic pollutants that persist in the environment and are considered potentially dangerous with side effects related to cancer development (A. Nagalli, 2015).

In the absence of mitigation, the access road and gas pipeline installation would have a ***negative, slight*** and ***permanent / temporary*** effect on the existing surface level materials and subsoil.

Construction of Built Structures

The construction of the Anaerobic Digestion Plant will result in the conversion of permeable soils to hard standing surfaces. This sealing/ capping of land has a long-term impact on the underlying soil's structure and function to the wider environment. It reduces the water infiltration to the underlying soil/ bedrock and alters the structure and functionality of the soil over time.

The construction of the built structures requires excavations of up to 9 m below current ground levels. As is common practice with the construction of foundations a compressed infill gravel base/ pad is required on top of which a concrete blinding is poured. Steel reinforcements will be installed, with shuttering erected around this to facilitate the final concrete pour. Infilling and compaction of excavations around structures is then conducted to ensure structural integrity. The infill material and concrete poses a risk of contaminating the subsoil and bedrock if installed in adverse weather conditions.

In total, the Proposed Development will result in the construction *ca.* 2,908 m^2 of hard standing, inclusive of built structures and concrete/ asphalt aprons.

The use of plant and machinery during the construction stage will involve the use of hydrocarbon-based fuels and oils. There is a risk of contamination to soils and eventual percolation to the underlying bedrock. Hydrocarbons should be stored in bunded facilities, and the use of hydrocarbons should be contained to bunded areas with spills cleaned up immediately.

In the absence of mitigation, the impact of the construction of built structures would have a ***negative, moderate*** and ***long-term*** effect.

Central Rainwater Harvesting Tank and Attenuation Pond

The overflow from the rainwater harvesting will be collected in an attenuation facility provided for the site (central rainwater harvesting tank) and there will be also an open attenuation pond to the southeastern corner of the site which will be used for attenuation of surface war run-off from roads, yards, roofs and the impermeable bunded area.

No material will need to be imported to site in order to line the location of the proposed attenuation pond. Excavated material will be re-used on site and may be used in the construction of the proposed attenuation pond. As no importation of soil / clay material is required, the associated risk translocating invasive species and contaminated materials is **not significant**.

The construction of an attenuation pond will result in the degradation of the underlying soil quality and ensure anaerobic conditions. On the contrary the wetlands will result in the addition of a new Fossitt designated habitat within the locality, FL8 “Other artificial lakes and ponds”. Its implied, if appropriately managed, wetlands will result in an increase in flora, fauna and biodiversity. Increased food availability may entice burrowing fauna to establish in the locality. Burrowing animals have a positive effect on soil quality on a localised level.

The constructing of the attenuation ponds is foreseen to have a ***negative-neutral, moderate*** and ***permanent*** effect.

Contaminated Soils

Excavation and construction activities will generate materials for on-site reuse or off-site disposal and recovery. While the site is partially greenfield, the area adjacent to the existing meat processing facility has shown evidence of soil contamination, as confirmed by Trial Pit 05, which encountered frequent plastic fragments and sheeting. Additionally, a decommissioned soakaway (filter bed) from a former septic tank associated with the facility is known to be

present within the vicinity of Trial Pit 05. A comprehensive site investigation will be undertaken prior to any construction works to fully characterise soil conditions. It is anticipated that contaminated soils will be encountered during construction activities.

The construction management plan will include a set of procedures to be implemented in the incidence of contaminated soils encountered. Encountering contaminated soils would have a ***negative***, ***significant*** and ***temporary*** effect.

Table 7.14: Severity/ Magnitude of Impact during construction phase

Receptor	Potential Environmental Effects	Quality	Significance	Duration
Topsoil	Topsoil Removal	***Negative***	***Moderate***	***Reversible***
	Gas Pipeline	***Negative***	***Slight***	***Temporary***
Underlying Deposits/ Subsoil	Construction of Built Structures	***Negative***	***Moderate***	***Long-term***
	Excavation/ Subsoil Removal	***Negative***	***Moderate***	***Permanent***
	Central Rainwater Harvesting Tank and Attenuation Pond	***Negative/ Neutral***	***Moderate***	***Permanent***
	Contaminated Soils	***Negative***	***Significant***	***Temporary***
	Gas Pipeline	***Negative***	***Slight***	***Temporary***
Bed Rock Geology	Excavation of Bedrock	***Negative***	***Significant***	***Permanent***

7.5.4 Sources - Operational Phase

The operational phase effects anticipated and considered throughout the lifetime of the operation of the facility are considered below and summarised in Table 7.17

It is not envisaged that there will be many potential sources of effects to soil, land or geology during the operation of the facility.

Hydrocarbon Contamination

It is proposed that the site will be frequented by numerous hauliers and farmers transporting both liquid and solid feedstocks for production of biomethane. There is a possible risk of vehicular accidents on the site which could result in the accidental release of hydrocarbons.

Mobile plant and fixed machinery are a potential source of contamination on site. Accidental leaks or spills of fuels and oils from hydraulics would be the source of such contaminates.

The 1,000L fuel tank is an obvious source of such contaminants and as such it will be bunded to comply with EPA guidelines.

Strict enforcement of traffic management measures, adherence to standard operating procedures (SOP's) for refuelling and regular inspection of bunds should eliminate the potential

for such sources of contamination. On top of this the process area will be bunded which will further reduce the possibility of such chemicals making contact with the local soil and geology.

In the absence of mitigation, hydrocarbon leaks and spills would have a ***negative, moderate to significant*** and ***long-term*** effect.

Leaks of Nutrient Laden Liquids/Solids

Accidental discharge, spills or leaks of digestate, sewage, nutrient rich liquids or solid wastes from the Reception Hall, Digesters or wastewater treatment system could pose a risk to the local soil. Such nutrient rich substances have a high Biological Oxygen Demand (BOD) and would pose a risk to groundwater and bedrock aquifers by potential introducing microbial contaminants and threatening aquatic life by consuming available dissolved oxygen in watercourses. The long-term threat to soil is considered to be less than hydrocarbons as such nutrient rich substances will be biodegraded in the soil and absorbed by flora. However, excessive volumes can be detrimental to soils by killing off the microbial and microorganism populations and stunting or killing plant growth by inhibiting the absorption of micro-nutrients. The overall effect is dependent on the volume and duration of such nutrient leaks.

In the absence of mitigation, nutrient leaks to the surrounding soil would have a ***negative, slight*** and ***short-term*** effect.

Land Spreading of Biobased Fertiliser

Utilising biobased fertiliser (digestate) offers several scientific benefits over the continued use of raw manures, slurries, and chemical fertilisers. These include balanced nutrient availability, slow-release nutrients, improved soil health and a reduction in pathogens and weeds when compared to slurries and manures. These advantages support sustainable agricultural practices whilst simultaneously improving soil conditioning.

Balanced Nutrient Availability: Biobased fertiliser typically contains a balanced mix of essential nutrients, including nitrogen (N), phosphorus (P), potassium (K), and micronutrients crucial for plant growth. This balanced nutrient profile contrasts with chemical fertilisers, which often supply only specific nutrients. Studies have shown that the diverse nutrient composition of digestate supports comprehensive plant nutrition, contributing to improved crop yields and overall plant health (Möller and Müller, 2012). Digestate is particularly rich in ammonium nitrogen (NH4-N), a form of N that is readily available for uptake by plants (Doyeni et al, 2021).

Slow-Release Nutrients: Biobased fertiliser releases nutrients gradually over time as it decomposes in the soil. This gradual release mechanism ensures a sustained supply of nutrients to plants, contrasting with untreated manures, slurries, and chemical fertilisers, which can be prone to leaching or volatilisation. The slow-release nature of digestate reduces the risk of nutrient loss and enhances nutrient uptake efficiency by plants (Yao et al., 2011). Digestion of livestock slurry has also been shown to increase the plant availability of nitrogen in slurry by *ca.* 10%.

Enhanced Soil Health: Rich in organic matter, Biobased Fertiliser improves soil structure, promotes water retention and stimulates microbial activity. These soil health benefits contribute to improved nutrient cycling, root development, and overall soil fertility (De Vries et al., 2015).

Pathogen and Weed Reduction: Manure and slurry may contain a range of bacterial, viral, and parasitic pathogens and land application of these organic fertilisers typically occurs without prior treatment. In contrast, Anaerobic Digestion, and subsequent pasteurisation of digestate significantly reduces the presence of pathogens and weed seeds, making it safer for agricultural use compared to untreated manures and slurries (Vinnerås et al., 2006).

At full capacity it is proposed that the total tonnages for transportation off-site from the Proposed Development as biobased fertiliser to local agricultural operators will be *ca*. 24,500 tonnes of Digestate Fibre and ca. 53,500 tonnes of Digestate Liquid Concentrate. Of the maximum 90,000 tonnes of annual feedstock intake to the Proposed Development, *ca*. 53,500 tonnes of untreated manures and slurries would normally be land spread locally. This represents a significant reduction in the hydraulic loading of land spreading locally.

Post pasteurisation, the biobased fertiliser will meet the standard of an EU fertilising product under Regulation (EC) No 2019/1009 under the criteria outlined for Product Function Category (PFC) 3 B: Inorganic Soil Improver. The proposed operator will apply for End of Waste Criteria. All biobased fertilisers will be used in accordance with S.I. 113 of 2022 European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2022). The spreading of the biobased fertiliser on the customer farms will be done in accordance with the specific Nutrient Management Plan for that farm.

If appropriately managed land spreading of biobased fertiliser has the potential to have a ***positive, slight*** and ***long-term*** effect on nutrient management and soil quality.

Attenuation Pond

The existence of the attenuation pond will result in the degradation of the underlying soil quality and ensure anaerobic conditions. However, the attenuation will result in the addition of a new Fossitt designated habitat within the locality, FL8 “Other artificial lakes and ponds”. If appropriately managed, attenuation pond will result in an increase in flora, fauna and biodiversity. Increased food availability may entice burrowing fauna to establish in the locality. At a local level burrowing animals have a positive effect on soil quality.

If inappropriately constructed the attenuation pond may pose a risk to the underlying bedrock aquifer. If contaminated materials are discharged into the wetland they may percolate into the underlying locally important bedrock aquifer. From here they can degrade the quality of the aquifer and migrate downgradient to sensitive receptors. As such, the attenuation pond will be lined with an impermeable membrane to limit the risk of contaminants leaching into the underlying locally important bedrock aquifer. There are few recorded boreholes recorded within the 2km study area, as indicated in **Section 7.4.5**, and listed in the **Table 7.7**.

In the absence of mitigation measures, the wetland is envisaged to have a **neutral**, **significant** and **permanent effect**.

Table 7.15: Severity/ Magnitude of Impact during operation phase

Receptor	Potential Environmental Effects	Quality	Significance	Duration
Topsoil	Nutrient Leaks	***Negative***	***Slight***	***Short-term***
	Land Spreading of Digestate	***Positive***	***Slight***	***Long-term***

	Attenuation Pond	***Neutral***	***Moderate***	***Permanent***
Bed Rock Geology	Hydrocarbon Contamination	***Negative***	***Moderate/ Significant***	***Long-term***

7.6 Mitigation Measures and Monitoring

This section highlights the mitigation measures proposed for the operation and construction stages of the Proposed Development to mitigate potential impacts to the near and wider environment.

7.6.1 Construction Phase

7.6.1.1 General Mitigation Measures

A Construction Environmental Management Plan (CEMP) will be prepared and implemented by the main contractor during the construction phase. This is a practical document which will include detailed procedures to address the main potential environmental impacts on site, encompassing soil, geology, noise, dust, air quality, surface and ground water, and highlights the proposed construction methods, activities and procedures. Refer to the preliminary CEMP report submitted in conjunction with this EIAR (Document No.: **231960-ORS-XX-XX-RP-EN-13d-010**). The implementation and compliance with the conditions of the CEMP will be overseen by the Project Supervisor Construction Stage (PSCS) and/or onsite Environmental or Ecological Clerk of Works (ECoW) where necessary. Proposed mitigation measures include;

- Site preparation and construction must be confined to the Proposed Development only and it must adhere to all the mitigation measures outlined in this Chapter. Work areas should be kept to the minimum area required to carry out the proposed works and this area should be clearly marked out in advance of the proposed works.
- Prior to the commencement of developments on site, the PSCS/ ECoW will ensure that contractors will be made aware of the sensitive receptors identified in this chapter and the associated mitigation factors. A signed statement saying that they have taken on board the mitigation measures contained herein should be presented to the local authority along with the Notice of Commencement.
- A wheel wash/ power wash facility will be established at the site-setup stage of construction to limit the translocation of sediment onto the local road network.
- A best practice measure in reducing the risk of the translocation of invasive species all machinery initially arriving to site will be inspected. Any dirty equipment will be refused entry to site.
- All construction waste will be removed from site by a registered contractor to a registered site. Evidence of the movement and safe disposal of the construction waste will be retained and presented to the Local Authority upon request. Removal of the construction waste will occur as soon as possible after construction works.
- The following Guideline documents should be adhered to:
    - Construction Industry Research and Information Association (CIRIA) (2005) Environmental Good Practice on Site (C692).
    - Construction Industry Research and Information Association (2001) Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (C532).
    - Construction Industry Research and Information Association (2000) Environmental

Handbook for Building and Civil Engineering Projects (C512).
- Environmental Protection Agency (2015) List of Waste and Determining if Waste is Hazardous or Non-Hazardous.
- Environment Agency et al. (2015) Guidance on the Classification and Assessment of Waste, Technical Guidance WM3.

7.6.1.2 Topsoil Removal

The removal of topsoil is part of the first stage of the construction process. As mentioned above the initial phase will involve the stripping and stockpiling of the topsoil layer. This material will be reused on site as far as possible during the landscaping stage to remediate slopes and soils within the vicinity of the site, including the buffer zone.

Stockpiles in the absence of mitigation measures will be susceptible to erosion by climatic and hydraulic factors.

- Silt fencing and interceptor trench to be installed along the eastern extents of the site
- Excavated topsoil will be stockpiled in an area abounded by silt fencing to contain/ reduce any sediment run-off during times of inclement weather.
- Driving machinery on topsoil stockpiles is not advised as it damages the soil structure, reduces porosity, and subsequent percolation rates, and can result in ‘smearing’ of the soil surface, which prevents water infiltration into the soil.
- Any excess topsoil will be removed from site and disposed of appropriately.
- Stockpiling and slight compaction of stockpiles to minimise both hydraulic and climatic erosion.
- Running stockpiles in the direction of prevailing wind to minimise windborne erosion rates, SW-NE. (EPA, 2013).
- Construction of silt fences around topsoil stockpiles to contain sediment run-off.
- Minimise the export of topsoil off site by incorporating in the final landscape design.
- Minimise handling and tracking of material to maintain optimum soil structure.
- Landscaping to take place as soon as possible to reduce exposure of subsoil and topsoil stockpiles.
- Works will be avoided during periods of extended rainfall.
- All topsoil generated from site works should be stored within the Proposed Development until it is required for landscaping. It must not be stored outside the Proposed Development boundaries and it must not be used for the infilling of any area outside of the Proposed Development. If there is more topsoil than is needed for landscaping, it must be removed from site by a registered contractor for appropriate use elsewhere. The end location of the topsoil must be identified and records presented to the local authority if requested.

7.6.1.3 Excavation

As with most of construction projects, civil earthworks are the first stage of the construction process. Excavation work to set the site levels, foundation, drainage and buried utilities is essential in facilitating the construction of the built structures. Excavation work will be conducted in stages to minimise the exposure of unprotected soil, subsoil and bedrock.

The development is proposed to be constructed within the range of the existing contours on site. This will limit the extent of significant earth works and greatly reduce the risk of encountering bedrock. Where possible excavated subsoil material will be reworked and used

on site. A geotechnical investigation of the site will be required in order to assess the potential of the underlying soil, subsoil and bedrock for reuse.

Temporary excavations which are required for the installation of drainage, gas and buried networks will be excavated and backfilled within as short a timeframe as possible to minimise exposure of surfaces to erosion. Excavation stability is important and deep excavations will employ the use of appropriate excavation techniques (e.g. temporary shoring) to ensure excavation wall stability.

The following measures will help mitigate the impacts during excavation:

- Excavation work will be conducted in stages to minimise the exposure of unprotected soil, subsoil and bedrock.
- Where possible excavated subsoil material will be reworked and used on site.
- A geotechnical investigation of the site will be required in order to assess the potential of the underlying soil, subsoil and bedrock for reuse.
- Stockpiling material in appropriate locations, away from water sources, with a silt fence surrounding it to reduce the rate of run-off from hydraulic conditions.
- Light compaction of stockpiles to minimise the rate of erosion from climatic methods.
- Stockpile heights should be kept to a minimum to ensure stockpile stability and minimise wind borne erosion.
- Excavations will be postponed in high rainfall conditions to reduce the risk of excavation collapse and erosion to soil and subsoil profiles.
- If extreme weather conditions are forecast high sediment stockpiles will be covered to minimise erosion.
- Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and bedrock.
- All temporary excavations will be conducted in a safe manner to ensure sidewall stability and prevent collapse of excavations. Mobile shoring equipment will be utilised to this end where required.
- All long-term soil stockpiles are to be planted with a vegetative cover to bind the soil and improve slope stability.
- Engineered retaining walls are to be installed where required to ensure stability of contiguous and Proposed Development topography.
- Excavated soil will be subject to continuous assessment by a competent Ecological Clerk of Works (ECoW) both prior to and during excavation activities to identify any potential contamination. All soils will be batched, documented, and stored separately to facilitate their subsequent management as a Soil & Stone By-product in compliance with Article 27. Suitable material will be incorporated into landscape fill on-site, while any surplus soil not conforming to the Article 27 requirements shall be removed from site by a licensed and qualified hauler for deposition at a licensed landfill facility.

7.6.1.4 Soil Compaction

Heavy tracked and wheeled construction vehicles will be in use throughout varies stages of the construction process. The soil on site is noted as being un-compacted and coarse-grained materials like gravelly and sandy layers were confirmed, the upper strata primarily comprised loose to firm gravelly silt with organic content. Deeper deposits transitioned to loose sandy gravel containing cobbles and boulders, indicating a more heterogeneous composition than the

uniform coarse loamy drift described. To reduce compaction during construction the following mitigation measures will be undertaken:

- Construction of a hardcore gravel access road on and around the site.
- Confine site traffic to designated routes.
- Minimise traffic flows on site and establish a construction stage parking compound.
- Avoid the use of oversized machinery when and where possible.
- Prevent movement of vehicles on site during and after periods of rainfall.
- Driving machinery on topsoil stockpiles will be avoided as it damages the soil structure, reduces porosity, and subsequent percolation rates, and can result in 'smearing' of the soil surface, which prevents water infiltration.

7.6.1.5 Run-Off

Sediment laden run-off from exposed soil and stockpiles poses a risk to waterways and aquatic life. The main pollutants of site water are silt, fuel/oil, concrete and chemicals. There are a number of steps outlined below to eliminate contamination of site surface water runoff.

- As a standard best practice measure a silt fencing will be erected along the eastern and south extents of the Proposed Development site to limit accidental discharge of sediments into the adjacent existing drain which runs to the Ballinure River. The fencing is to be made of a permeable filter fabric (Hy-Tex Terrastop Premium silt fence, or similar), with the footing of the fencing to be buried into the ground and the visible fencing to be *ca*. 0.5m high.
- An interceptor trench will be installed in front of the silt fence.
- The silt fence will be visually inspected daily to ensure that they remain functional throughout the construction of the Proposed Development. Maintenance of the fences will be carried out regularly. Fences will be inspected thoroughly after periods of heavy rainfall.
- Excavated and/or imported material will be stockpiled and silt fencing will be constructed around stockpile locations to contain/ reduce any sediment run-off during times of inclement weather.
- Compacting of stockpiles will reduce the rate of airborne and hydraulic erosion.
- Stockpile areas for sands and gravel should be kept to minimum size, well away from storm water drains and gullies leading off-site.
- Silt Fences to be erected where excavation works are required in close proximity to water features and along depressions in land where there's increased surface water flow rates.
- Harmful materials such as fuels, oils, greases, paints and hydraulic fluids must be stored in bunded compounds well away from storm water drains and gullies. Refuelling of machinery should be carried out using drip trays.
- A temporary drainage system will be established complete with a settlement pond to remove contaminants from run-off, prior to discharge.
- Temporary staff welfare facilities will be installed on site at the pre-commencement stage. These will include toilet facilities. All foul discharges from welfare facilities will be collected in a septic storage tank. This tank will be regularly emptied, and the contents disposed of at a registered facility.

7.6.1.6 Concrete

The underlying bedrock contains a locally important groundwater body. The Site lands are

primarily designated as having moderate groundwater vulnerability indicating a overlying burden of > 10 m, with a shift to high (5-10m thick) vulnerability along the northern boundary, aligning with the Glenloughaun Local Road (L8412).

Due to its elevated pH, unset concrete possesses a risk to adjacent soil, surface waters and the underlying groundwater body. The following mitigation measures are proposed to limit the accidental discharge of concrete and to minimise waste.

- Concrete Washout Skip: Chutes of concrete trucks are only to be washed out into an impermeable lined (polythene) skip. The washout water is to be treated prior to discharge.
- The concrete washout skip is to be located to the east of the site, where the overburden is greater.
- Excavations lined with an impermeable liner are not permitted as concrete washout bays.
- Large excess loads of concrete are to be returned to the supplier or poured into concrete block moulds (Betonblock or similar design) in order to minimise waste and reduce the risk of contaminants leaching into the surrounding environment.
- Best practice in bulk-liquid concrete management should be employed on site addressing pouring and handling, secure shuttering, adequate curing times etc.
- Where concrete shuttering is used, measures will be put in place to prevent against shutter failure and control storage, handling and disposal of shutter oils.
- Activities which result in the creation of cement dust will be controlled by dampening down the areas.
- Raw and uncured waste concrete will be disposed of by removal from the site.

7.6.1.7 Construction Contaminants

A wide array of chemicals and materials will be used during the construction of the development. This includes hydrocarbons which can persist in the wider environment for decades. To mitigate the exposure of the surrounding soil and geology to these substances it is proposed to undertake the following:

- Fuels, oils and other environmental deleterious chemicals are to be stored in a bunded well-ventilated chemical stores.
- Use of such chemicals and fuels is to be contained to bunded areas, where possible.
- Fuel bowsers to be located in bunded areas which can cater for 110% of the primary vessel capacity.
- Any spills or leaks to the soil is to be immediately contained and the soil in question is to be removed by a licensed contractor and disposed of in a registered facility.
- Oil spill containment kits are to be situated near areas of potential spills.
- Regular inspections carried out on plant and machinery for leaks and general condition.
- Use of ready-mixed supply of wet cement products.
- Scheduling cement pours for dry days.
- Maintenance and repair works will be carried out at least 10m from any collection of surface water.
- No refuelling will be undertaken within 50m of the Ballinure River, from any of drain channel to it.
- Ancillary machinery equipment such as hoses, pipes and fittings which contain hydrocarbons will be stored within a bund or drip tray.
- Any repair works required on machinery involving fuel and oil control will be carried out

offsite where practical, if not possible then repairs will be undertaken on a clean hardcore area of site. Unless unavoidable, repair works carried out in the field where machinery is
- operational will use spill trays and absorbent materials to prevent release of contaminants to the ground.
- Daily checks prior to start-up of plant and machinery will minimise the risk of breakdown and associated contamination risks for on-site repairs. Daily pre-start checks will be undertaken and records maintained. A clean site policy and diligent housekeeping will also reduce the potential of hydrocarbon release on-site.

7.6.1.8 Importation of Contaminated Materials

The Proposed Development will involve the importation of gravel and concrete.

- All material will be sourced and transported by registered suppliers.
- All materials will be inspected prior to acceptance on site.
- Any deliveries found to be contaminated will be refused access to deposit on site. Any contaminated materials accidentally deposited on site will be removed immediately from site. If this is not possible then it will be stored in a “quarantine zone”.
- The quarantine zone is to be lined with an impermeable liner which the material will be stored on. A cover will be placed over the liner to avoid hydraulic run-off of contaminated materials. The quarantine zone is to be fenced off and surrounded by silt fencing, as a secondary containment measure.

7.6.1.9 Excavation of Contaminated Soils

The site predominantly comprises open pastureland, with a limited area where made ground was identified during the site investigation. It is documented that a decommissioned septic tank soakaway, associated with the adjoining meat processing facility, is present within this portion of the site, indicating a potential for localised contamination. Consequently, all excavated materials will be subject to visual assessment for signs of contamination. Any suspect material will be sampled and analysed by an accredited environmental laboratory. Confirmed contaminated soils will be quantified, segregated, and removed from site by a licensed waste contractor for appropriate disposal or recovery in accordance with waste legislation.

7.6.2 Operational Phase

The disturbance to soil and geology at the Proposed Development during the operational phase of the Anaerobic Digestion Facility is not foreseen to result in any significant impacts. The most significant threat to the underlying soil and geology is posed by the uncontrolled release of digestate or manure and the operation of the attenuation pond.

7.6.2.1 General Mitigation Measures

An Environmental Operating Plan (EOP) will be prepared and implemented by the plant management company during the operational phase. This is a practical document which will include detailed procedures to address the main potential effects on surface water and groundwater.

The proposed facility will operate under an Industrial Emissions Licence (IEL) issued by the Environmental Protection Agency (EPA). The licence will contain several conditions which the

operator must remain in compliance with for the entire duration of the facility's lifespan. Typical conditions relating to the protection of water receptors include:

- Emissions Limit Values for all emissions including surface water
- Monitoring requirements for surface waters
- Resource use and energy efficiency
- Waste management control and documentation
- Storage and transfer of substances
- Facility management
- Accident prevention and emergency response including fire water retention
- Operational Controls

7.6.2.2 Uncontrolled Releases and Spillage

Mitigation of relevance to the management of uncontrolled releases will include:

- Dedicated hard standing for off-loading areas, with a minimum separation distance from adjacent water courses.
- Use of spill kits, bunded pallets and secondary containment units, as appropriate.
- All bunds sized to contain 110% of the volume of the primary storage vessel.
- Environmental Management Plan (EMP) to include site specific standard operating procedures pertaining to waste management and emergency response.
- There will be no intentional discharge of untreated storm water to surface or ground waters during the operational phase. All stormwater discharges from site will be via the attenuation pond with all areas, with the exception of the roofs, being directed through Class 1 petrol/oil interceptors before passing through the attenuation pond prior to discharge.
- The Digestion Tanks and Digestate Storage tanks will be located within a bunded location to the northeast of the site, this will act as a secondary containment in the event of loss of tank contents.
- All primary pipelines and bunded structures will be inspected and integrity tested prior to handover from the appointed construction contractor. All works will be installed to Construction Quality Assurance (CQA) plan.

7.6.2.3 Land Spreading of Biobased Fertiliser

To mitigate the risk to soil, groundwater and surface water features the following measures will be complied with:

- In order to avoid any reductions in water quality within the catchment as a whole, all biobased fertilisers must be used in accordance with S.I. 113 of 2022 European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2022).
- The spreading of the biobased fertiliser on the customer farms must be done in accordance with the specific Nutrient Management Plan for that farm.
- Application of biobased fertiliser to be conducted in compliance with the Nitrates Action Programme (e.g. prohibited periods and nitrogen application rates).
- All biobased fertiliser is to be pasteurised prior to removal from the Proposed Development to comply with Regulation (EU) 142/2011 on Animal By-Products in Organic Fertilisers.

7.6.3 Decommissioning Phase

The decommissioning phase will entail similar activities to the construction phase. The construction stage mitigation measures outlined in **Section 7.6.1** above will be undertaken to limit and avoid effects to the underlying soil from compaction and contamination. The goal of the decommissioning phases is to render the site safe both physically and environmentally so that it no longer poses a risk to the surrounding population and environment. A Closure, Restoration and Aftercare Management Plan (CRAMP) will be developed as a condition of the industrial emission licences and in compliance with the Guidance to Licensees on Surrender, Cessation and Closure of Licensed Sites set by the EPA (2012).

7.7 Cumulative Effects

Within the European Commission - Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, dated May 1999, cumulative effects are described as "impacts that result from incremental changes caused by other development, plans or projects together with the Proposed Development or developments".

The cumulative effects of the proposed construction and operation of an Anaerobic Digestion Facility at Glenloughaun, Co. Galway with other developments in the area is reviewed in this section with specific regard to the local and regional Land, Soil and Geology.

Excavated soils will be reused and repurposed for landscaping purposes and for the construction of earth berms on site. There will be no disposal of excess soil and subsoil from site to licensed facilities and so the Proposed Development will not have an effect on capacity at such sites. This will result in a **neutral** effect on such sites.

7.8 Residual Effects

According to Environmental Protection Agency guidelines, Residual Impact is described as ‘the degree of environmental change that will occur after the proposed mitigation measures have taken place.’ The mitigation strategy above recommends actions which can be taken to reduce or offset the scale, significance and duration of the effects on the surrounding land, soil and geology.

The purpose of this assessment is to specify mitigation measures where appropriate to minimise the ‘risk factor’ to all aspects of the soil and geological environment such as to minimise the potential for contamination effect to soil, groundwater or aquifers and reduce the risk of erosion and sediment run-off, etc. This ‘risk factor’ is reduced or offset by recommending the implementation of a mitigation strategy in each area of the study. On the implementation of this mitigation strategy, the potential for impact will be lessened.

A site-specific Construction Environmental Management Plan (CEMP) will be devised and implemented throughout the duration of the construction phase. This document will contain all the necessary procedures required to prevent and minimise any environmental risks posed by the project on the surrounding environment.

7.8.1 Construction Phase

A summary of the predicted impacts associated with the construction phase in terms of quality, significance, and duration, along with the proposed mitigation measures and resulting residual impacts are summarised in **Table 7.16**.

The overall impact anticipated by the construction phase of the project following the implementation of suitable mitigation measures is considered to be ***neutral to negative***, ***slight to significant*** and ***temporary to permanen*****t**.

7.8.2 Operational Phase

A summary of the predicted impacts associated with the operational phase in terms of quality, significance, and duration, along with the proposed mitigation measures and resulting residual impacts are summarised in **Table 7.17**.

The overall impact anticipated by the operational phase of the project following the implementation of suitable mitigation measures is considered to be ***positive to neutral***, ***imperceptible to slight***, and ***temporary to long-term***.

Table 7.16: Summary of predicted construction phase impacts, mitigation measures and residual impact

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Topsoil Removal	**Topsoil** Soil structure, soil microorganism population, adjacent waterways	Erosion of stockpiles of exposed soils leading to migration of silt into surface water receptors via dust and run-off. Damage to soil structure	***Negative***	***Moderate***	***Reversible***	• Silt fencing and interceptor trench to be installed along the eastern extents of the site • Stockpiles of topsoil to be used in landscaping works as soon as is practicable • Silt fence erected along catchment lines • Silt fences to be installed around stockpile locations to reduce run-off rates and to prevent vehicles driving on stockpiles, damaging soil structure • Slight compaction of stockpiles to minimise run-off and airborne erosion • Running stockpiles in direction of prevailing wind, to reduce windborne erosion • Minimise handling of material • Keep stockpile heights low to minimise compaction and windborne erosion • Topsoil is to remain within the Proposed Development site • Wheel wash/ Power hose facility will be available on site to limit the migration of sediment off-site via vehicles • Machinery will be clean on arrival to site, and will undergo inspection • Site welfare facilities will be established prior to removal of topsoil	***Neutral, Slight, Reversible***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Excavations/ Subsoil Removal	**Subsoil** Adjacent waterways, Underlying Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Reduction in subsoil horizon by up to 9 m will increase groundwater vulnerability and threaten Aquifer. Migration of silt into adjacent lands and waterways via dust and run-off	***Negative***	***Moderate***	***Permanent***	• Stockpiling material in appropriate locations, away from water sources, with silt fencing surrounding it to retard the rate of erosion from hydraulic conditions. • Light compaction of stockpiles to minimise the rate of erosion from airborne and hydrological methods. • Stockpile heights should be kept to a minimum to ensure stockpile stability and minimise wind borne erosion. • Excavations will be postponed in high rainfall conditions to reduce the risk of excavation collapse and erosion to soil and subsoil profiles. • If extreme weather conditions are forecast high sediment stockpiles will be covered/ dampened to minimise erosion. • Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and bedrock. • Excavate and backfill temporary excavations within a short timeframe to minimise exposure to erosion and contamination • Installation of silt fencing to capture hydraulic erosion • Risk of contaminating underlying exposed material 'naturally' mitigated by the presence of the of the low permeability subsoil throughout the site • "Mole Plough" installation method for piping proposed where applicable.	***Neutral, Slight, Permanent***
	Bedrock Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Reduction of the protective soil overburden above the bedrock, Exposure of bedrock, and/or excavation of bedrock	***Negative***	***Significant***	***Permanent***		***Neutral, Moderate, Temporary***
Drainage Pipe and Gas Pipeline	**Topsoil and Subsoil** Underlying Geology Moderately Productive Aquifer only in Local Zones	Exposure and removal of soil and subsoil. Stockpiling of excavated and imported material. Migration of silt into adjacent lands Contamination of subsoil and underlying geology	***Negative***	***Slight***	***Permanent***	• "Mole Plough" installation method for piping proposed where applicable. • Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsoil	***Neutral, Slight, Long-term***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
						• Landscaping to take place as soon as possible to reduce weathering • Installation of drainage headwall to be undertaken outside of the closed season for instream works (October 1st to June 30th) • Ecological Clerk of Works will supervise the installation of the headwall and discharge pipe to the Ballinure River.	
Construction of Built Structures	**Topsoil, Subsoil and Bedrock**	Conversion of permeable soil into hard standing. Compaction of soil and subsoil from plant machinery Contamination of subsoil and bedrock from hydrocarbons, concrete, etc.	***Negative***	***Moderate***	***Long-term***	• Construction of access roads to confine plant machinery to designated routes • Construction of site car park to reduce traffic and compaction on site • Chemicals/ hydrocarbons to be stored and used in bunded areas. • Spill kits to be located throughout site • Scheduling and use of ready mixed concrete on site • Chutes of concrete trucks are only to be washed out into an impermeable lined (polythene) skip which will be located in the east of the site • Excess concrete is to be returned to the supplier here possible. If not possible it will be poured into concrete block moulds (Betonblock or similar) to minimise waste and reduce the risk of contaminants leaching into the surrounding environment • Best practice concrete handling measures will be employed • Temporary site welfare facilities will be established • All foul effluent from welfare facilities will be collected in a septic tank prior to disposal at a register waste facility	***Neutral, Slight, Long-term***
Attenuation Pond	**Subsoil and Bedrock**	Anaerobic soils. Percolation of contaminants	***Negative/ Neutral***	***Moderate***	***Permanent***	• No soils will be imported to site.	***Neutral, Slight,***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
		into the underlying locally important aquifer				• Any contaminated materials will be refused entry to site • Quarantine zone will be available to isolate any contaminated soils identified. The area will have an impermeable linear, cover and surrounded by silt fencing • The pond will be lined with an impermeable geotextile liner to limit percolation of the contents into the underlying groundwater	***Permanent***
Excavation of Contaminated Soils	**Topsoil, Subsoil and Bedrock**	Excavated materials, intended to be reused on-site for landscaping purposes and establishment of earth berms. Potential for soils to contain contaminants from accidental spillages or legacy contamination and leach into surface water receptors	***Negative***	***Significant***	***Temporary***	• Greenfield site with no previous industrial activities noted at the site meaning incidences of contaminated land unlikely • No contaminants identified during Site investigations • Procedure in place for incidence of contaminated land within CEMP • Contaminated soils encountered to be tested, quantified, segregated and transported for disposal by a licenced contractor • Quarantine zone will be available to isolate any contaminated soils identified. The area will have an impermeable linear, cover and surrounded by silt fencing	***Positive, Slight, Short-term***

Table 7.17 - Summary of predicted operational phase impacts, mitigation measures and residual impact

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Hydrocarbon Contamination	Topsoil	Accidental release from vehicular crash, leaks from hydraulics, fuel tanks, fuel stores, bunds into the surrounding soil	***Negative***	***Moderate to Significant***	***Long-term***	• Drainage systems will be designed to attenuate excess surface water runoff with suitable storage volumes • Reduction of outflow rate to below the existing greenfield runoff rate before discharging • Installation of Sustainable Urban Drainage Systems (SuDS) features such as Sumps in gullies and catchpits collect silts in run-off from roads, filter drains, discharge bypass separator and an attenuation pond. • Environmental Management System • Bunded production area • Regular inspection of bunds • TOC monitors and automated valve shut offs to avoid contamination accidentally being discharged from site.	***Neutral, Imperceptible, Long-term***
	Subsoil and Bedrock Moderate Productive Aquifer only in Local Zones	Accidental releases outlined above percolating downwards into lower soil horizon and bedrock aquifer	***Negative***	***Moderate to Significant***	***Long-term***		***Neutral, Imperceptible, Long-term***
Nutrient Leaks	Topsoil	Accidental discharges of high BOD demanding digestate/ feedstock/ sewage into soil. Poses threat to adjacent surface water	***Negative***	***Slight***	***Short-term***	• All sewage/ pipe/ tank infrastructure to be installed in accordance with the relevant industry standards and pressure tested/CCTV surveyed prior to commissioning to ensure absence of defects • Programme of inspection and maintenance to ensure any defects in tanks or bunds are repaired	***Neutral, Imperceptible to slight, Short-term***
	Subsoil and Bedrock Moderate Productive Aquifer only in Local Zones	Leakage of high BOD sources outlined above into lower soil horizon and bedrock aquifer	***Negative***	***Slight***	***Short-term***	• The process area on site will be completely bunded. This will catch and retain and spills preventing percolation into the lower horizons • TOC monitors and automated valve shut offs to avoid contamination accidentally being discharged from site	***Neutral, Imperceptible to slight, Permanent***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Land Spreading of Digestate	Topsoil, Watercourses Animal welfare	Application of processed digestate to agricultural land Transmissible diseases	***Negative***	***Significant***	***Temporary***	• Biobased fertilisers will be used in accordance with S.I. 113 of 2022 European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2022). • Nutrient management plans to avoid excess fertiliser application • Farmers to comply with the Nitrates Action Plan • "Lay-off" period of 21 days for grazing or harvesting following application • Biobased fertiliser will be pasteurised in accordance with Regulation (EU) 142/2011 on use of animal by products as organic fertiliser	***Positive, Imperceptible, Temporary***
Wetland	Subsoil and Bedrock Moderately Productive Aquifer	Discharge of contaminated materials into the wetland may have the potential to percolate into the underlying aquifer	***Neutral***	***Moderate***	***Permanent***	• Installation of Sustainable Urban Drainage Systems (SuDS) features such as Sumps in gullies and catchpits collect silts in run-off from roads, filter drains, discharge bypass separator and an attenuation pond. • Environmental Operating Plan • Impermeable membrane liner will be installed under the ponds to limit percolation of contents into the underlying Locally Important Moderate Productive Aquifer only in Local Zones	***Neutral, Moderate, Long-term***

7.9 Monitoring

The Construction Environmental Management Plan (CEMP) and Environmental Operating Plan (EOP) will include provision for the monitoring of construction and operational related activities including the following:

- Water Quality Monitoring of the surface water receptors adjacent to the site boundary and discharge point
- Daily inspections for housekeeping and site cleanliness
- Continuous noise, vibration and dust monitoring
- Dust Suppression on dry days or during concrete cutting
- Risk assessment for the prevention of fuel spillages
- Monitoring of stockpiles to determine if further measures are required to prevent erosion
- Daily inspection of concrete washout and waste management facilities

Daily site inspections to ensure procedures outlined within the CEMP are adhered through throughout the site.

7.10 Summary of Significant Effects

The receptors for this assessment are considered to be shallow soils, the underlying drift, bedrock geology and waters. Whilst the development proposals have the potential to cause detriment to the sensitive receptors identified, the recommended mitigation measures will ensure that the risk of potential impacts are reduced to ***slight to moderate***.

7.11 Statement of Significance

The significance of effect upon shallow soils, drift deposits, and bedrock geology have been assessed for both during the construction and operational phases. The results of the assessment are presented on **Table 7.14** and **Table 7.15**.

Where a potential effect has been identified, the significance of effect upon these receptors ranges from slight to moderate.

Where a potential effect has been identified, mitigation measures have been provided which if implemented reduces the effect of significance to ***imperceptible*** *to* ***moderate.*** The mitigation steps are presented in **Section 7.6** and summarised in **Table 7.16** and **Table 7.17**.