

Homeland Projects Ltd.

Hydrological & Hydrogeological Assessment - Revision

Caheranardrish, Mungret, Co. Limerick



August 2026

Hydrological & Hydrogeological Assessment - Revision

Client: Homeland Projects Ltd.

Location: Caheranardrish, Mungret, Co. Limerick

Date: 4th August 2026

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1. INTRODUCTION

IE Consulting was requested by Homeland Projects Ltd. to undertake a hydrological and hydrogeological study for a proposed Large-scale Residential Development (LRD) at Caheranardrish, Mungret, Co. Limerick.

The study is required to investigate the risk that activities associated with the proposed development, during construction and operation might impact the nearby proposed Natural Heritage Area (pNHA) of Loughmore Turlough.

This report is based on a desk review of available information, a site visit to observe the proposed site setting, and juxtaposition with the Groundwater Dependent Terrestrial Ecosystem (GWDTE) of Loughmore Turlough, and an interpretation of the findings in the context of the potential for impact on the GWDTE.

Since new information has become available from an adjacent development and further investigations undertaken by Limerick County Council, the assessment has been revised and updated. The revision has also been written to address the Request for Further Information issued by Limerick County Council on 29 May 2026 in respect of the planning application 26/60396.

The proposed development comprises:

- 180 no. residential dwellings as follows: 125 no. houses consisting of 24 no. 4-bed dwellings and 93 no. 3-bed dwellings; 16no. townhouses consisting of 10 no. 3-bed units and 6 no. 2-bed units; 2 no. triplex units each comprising of 2 no. 2-bed units and 1 no. 1-bed unit; and a five-storey apartment building consisting of 13 no. 2-bed units and 17 no. 1-bed units with a crèche with capacity to accommodate 58no. children at ground floor level.
- The provision for car parking, including EV charging points and bicycle parking.
- The provision of private, communal, and public open spaces; internal roads and pathways; pedestrian and cyclist routes; hard and soft landscaping and boundary treatments; waste storage; plant; signage; a new vehicular and pedestrian access onto the Mungret Park Road; public lighting; substations; all associated site development works; and all drainage and foul sewer infrastructure and network works connections to the existing networks and nature-based suds measures.
- Access to the proposed development via a proposed vehicular and pedestrian access to the existing Mungret Link Road.

2. STATEMENT OF AUTHORITY

IE Consulting is a Water and Environmental Consultancy based in Carlow.

This assessment / report has been prepared and reviewed by qualified professionals specialising in the fields of Hydrogeology, Hydrology, Geotechnics Flood risk, Drainage, wastewater, hydraulic modelling and SuDS design studies. The key staff members involved in this project are:

- Jerome Keohane – BSc, MSc, FCIWEM, MIEI, C.WEM, C. Geol Technical Director with 42 years' experience in ground engineering and hydrogeology.
- Maria Horstmann – BSc, MSc, Geographer, Hydrogeologist, specialised in hydraulic modelling, hydrology, biogeochemistry, hydrogeology and ecology.

3. DESK STUDY

3.1. Site Location

The proposed development site is located approximately 12 km south-west of Limerick city centre at Caheranardrish, Mungret, Co. Limerick. The site is bounded to the north, west, south, and east by adjacent agricultural lands and to the south-east by the Mungret Community College. It is accessible via the Mungret Park Road and the Mungret Link Road. The total area of the proposed development site is approximately 5.67 hectares.

Located approximately 440m to the south-east of the site is the Loughmore Common Turlough.

Due to its significant hydrological and ecological importance within the wider area, the Turlough is given particular consideration throughout this assessment and is included in all figures.

The location of the proposed development site is illustrated below in *Figure 1*.

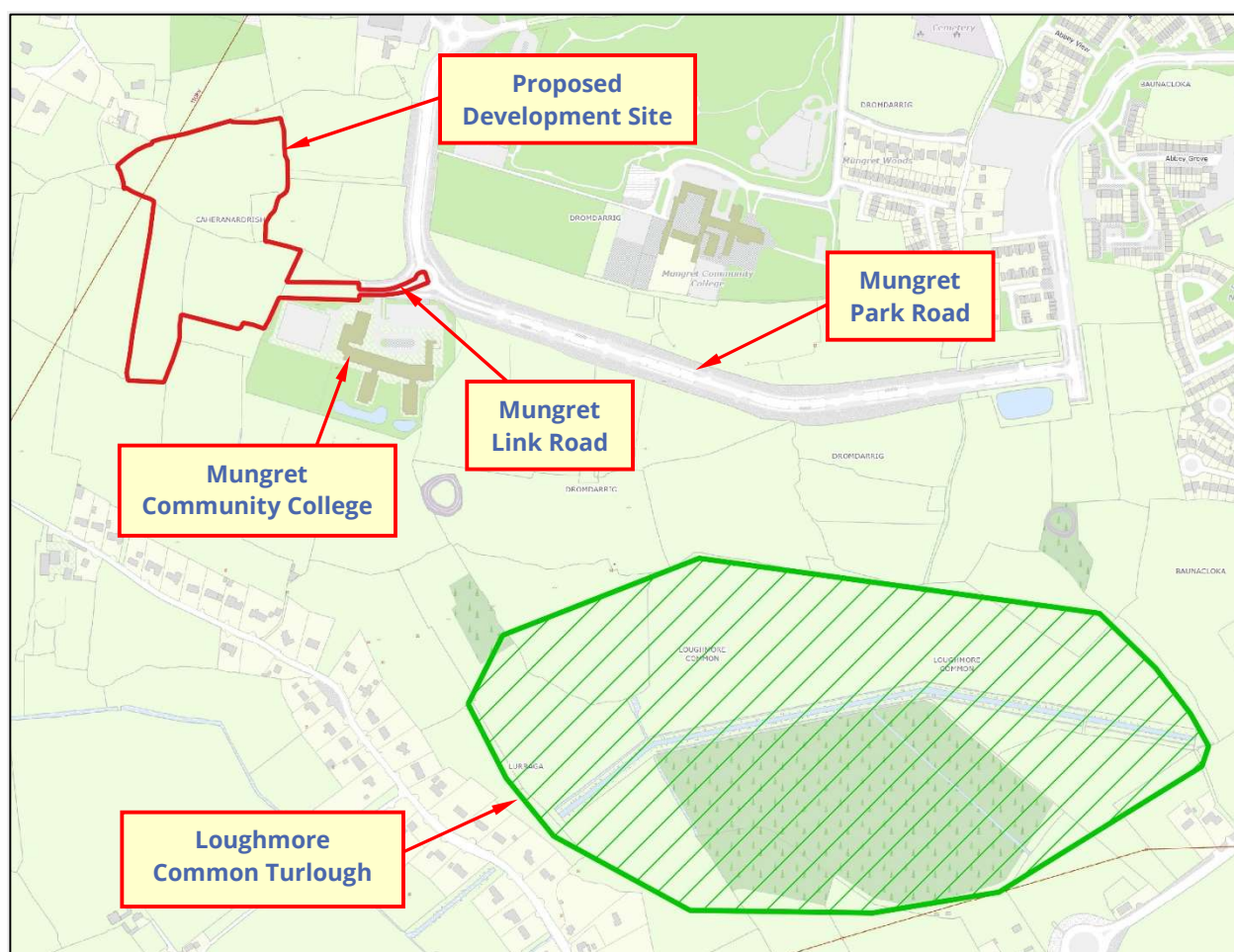


Figure 1 – Site Location

3.2. Topography

LiDAR data for the area was procured to inform the study.

The topography of the proposed development site is generally undulating and uneven, with a local high point located in the central northern part of the site and a saddle depression situated in the centre, immediately to the south of the high point.

Existing ground elevations range from approximately 18.3 m OD in the northern part to approximately 13.7 m OD along the south-western boundary of the site. The proposed development site slopes from the local high point towards the boundaries of the site at an average gradient of approximately 1.3 % (1 in 75).

The topography of the proposed development site and the environs is illustrated below in *Figure 2*.

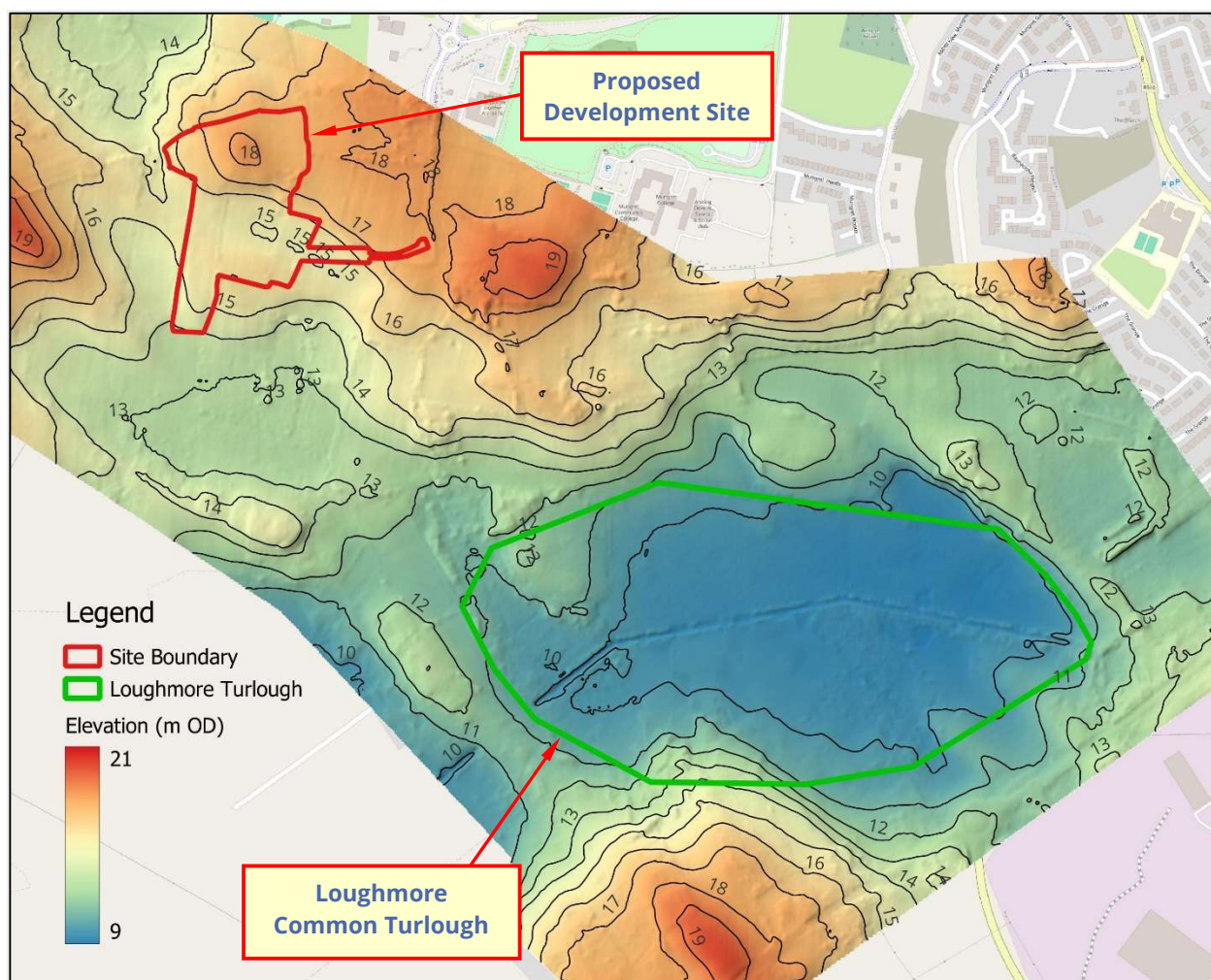


Figure 2 – Site Topography

3.3. Soils

The national datasets on soils produced by the Environmental Protection Agency (EPA) and the Geological Survey of Ireland (GSI) were consulted to assess the type, distribution and extent of soil layers in the vicinity of the proposed development site.

Figure 3 below illustrates the mapped soil types for the general area of the site.

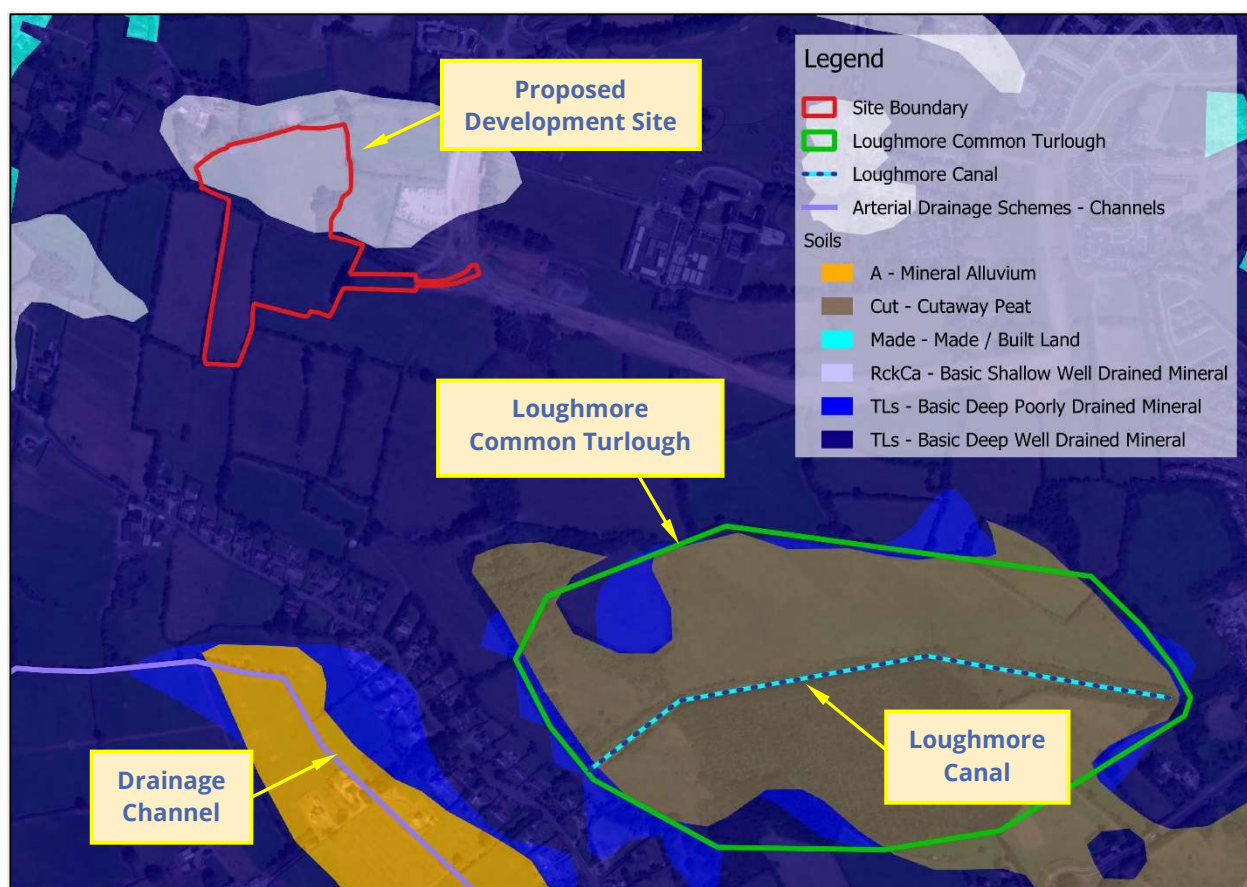


Figure 3 – Soils

The mapping indicates that the proposed development site is underlain by basic deep well drained mineral soils (dark blue) in the south and shows exposed bedrock at the surface (purple) in the north of the site.

The mapping indicates that Loughmore Common Turlough is almost entirely underlain by cutaway peat (brown) and smaller areas of basic deep poorly drained mineral soils (blue) and basic deep well drained mineral soils (dark blue). Peat soils are organic soils formed under high water saturation conditions, where the rate of organic matter accumulation exceeds the rate of decomposition. As a result, peat soils are characterised by a very high organic matter content, high porosity (high water

storage capacity), and low oxygen availability. Consequently, peat soils and subsoils often support shallow or perched water tables and respond rapidly to rainfall events once saturated.¹ Cutaway peat indicates a history of peat extraction. This will have modified the original character of the site, as will the growth of forestry on the site.

The wider area surrounding the proposed development site is dominated by well drained mineral soils, with limited occurrences of alluvium soils (orange) and man-made ground (light blue). Mineral soils are soil types in which mineral particles (sand, silt, and clay derived from the weathered rock underneath) dominate, as opposed to peat soils, which are organic in origin.

3.4. Subsoils

The national datasets on subsoils produced by the Environmental Protection Agency (EPA) and the Geological Survey of Ireland (GSI) were consulted to assess the type, distribution and extent of subsoil layers in the vicinity of the proposed development site.

Figure 4 below illustrates the mapped subsoil types for the general area of the site.

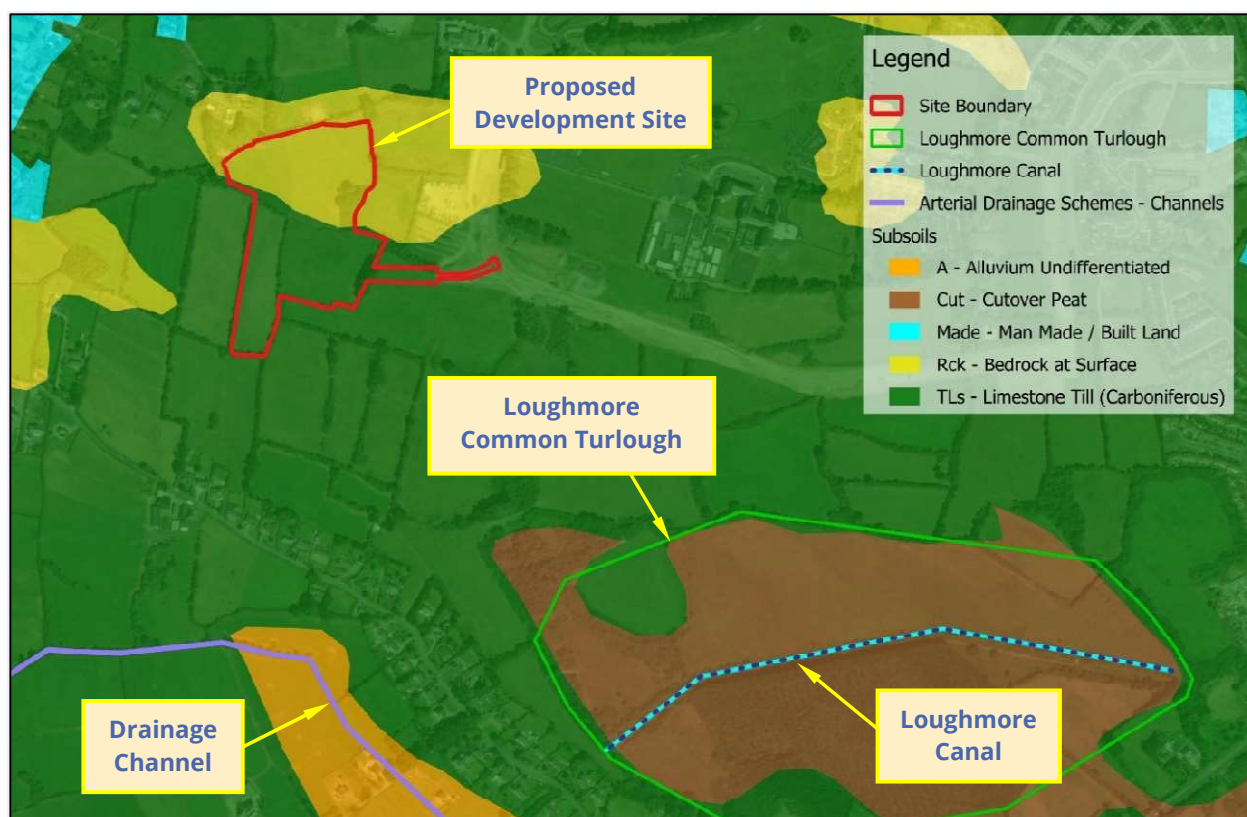


Figure 4 - Subsoils

¹ Price, J. S., McCarter, C. P. R. & Quinton, W. L. (2023): Groundwater in Peat and Peatlands.

The mapping indicates that the proposed development site is underlain by limestone tills (green) in the south and shows exposed bedrock at the surface (yellow) in the north of the proposed development site. Limestone tills are glacial deposits derived from Carboniferous limestone bedrock. These tills typically show a mixed matrix of fine and coarse materials and are generally associated with limited drainage when compared to more permeable granular deposits. Their presence in the wider area indicates that subsurface conditions are likely to be characterised by moderate permeability. Small areas of exposed bedrock indicate locations where subsoil cover is thin or absent.

The mapping indicates that Loughmore Common Turlough is almost entirely underlain by cutover peat (brown). There may however be a thin layer of till underlying the peat.

The wider area surrounding the proposed development site is dominated by limestone tills, with limited occurrences of alluvium subsoils (orange) and man-made ground (light blue).

3.5. Geology

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the type, extent and age of bedrock geology in the vicinity of the proposed development site.

Figure 5 below illustrates the mapped bedrock geology for the general area of the site.

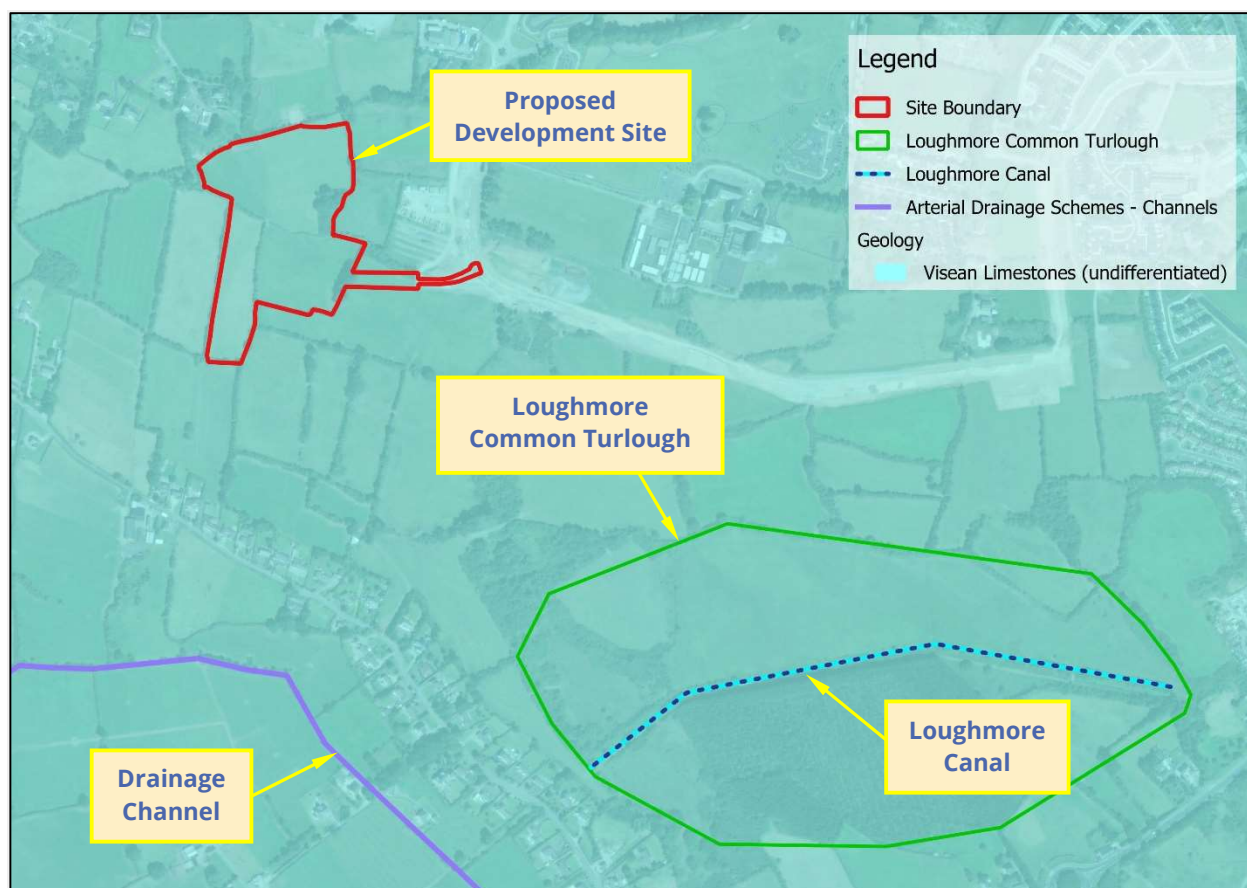


Figure 5 – Geology

The mapping indicates that all bedrock units in the area are of Carboniferous age (approximately 359–299 million years ago), more specifically assigned to the Mississippian (Early Carboniferous). During that period, much of Ireland was covered by shallow tropical seas, resulting in the deposition of fossil-rich limestone. The proposed development site and Loughmore Common Turlough is entirely underlain by Visean undifferentiated limestones (light blue).

3.6. Baseline Surface Water Conditions

3.6.1. Local Hydrology, Landuse & Existing Drainage

On the day of site survey and inspection (15th January 2026) the proposed development site appeared to be well-drained and free from any standing water. It was noted that soil infiltration tests had been conducted across the site, and site observations on the day confirmed the relative infiltration rates.

The infiltration tests were conducted by OSL-Butler in trial pits excavated to approximately 2m depth. The infiltration values were determined in accordance with BRE 365 and indicated f values in the range 2×10^{-5} m/s to 8×10^{-6} m/s, which demonstrate suitable ground for infiltration. The results are discussed in more detail in the Water Design Report-OSL-Butler 2025.

Important hydrological features in the vicinity of the proposed development site include the River Shannon and its tributaries, including the Ballincurra River, to the north and north-east of the site, Mungret Quarry, which is dewatered, the Barnakyle River to the west and the Loughmore Common Turlough with the Loughmore Canal southeast of the site, as illustrated in *Figure 6* below.

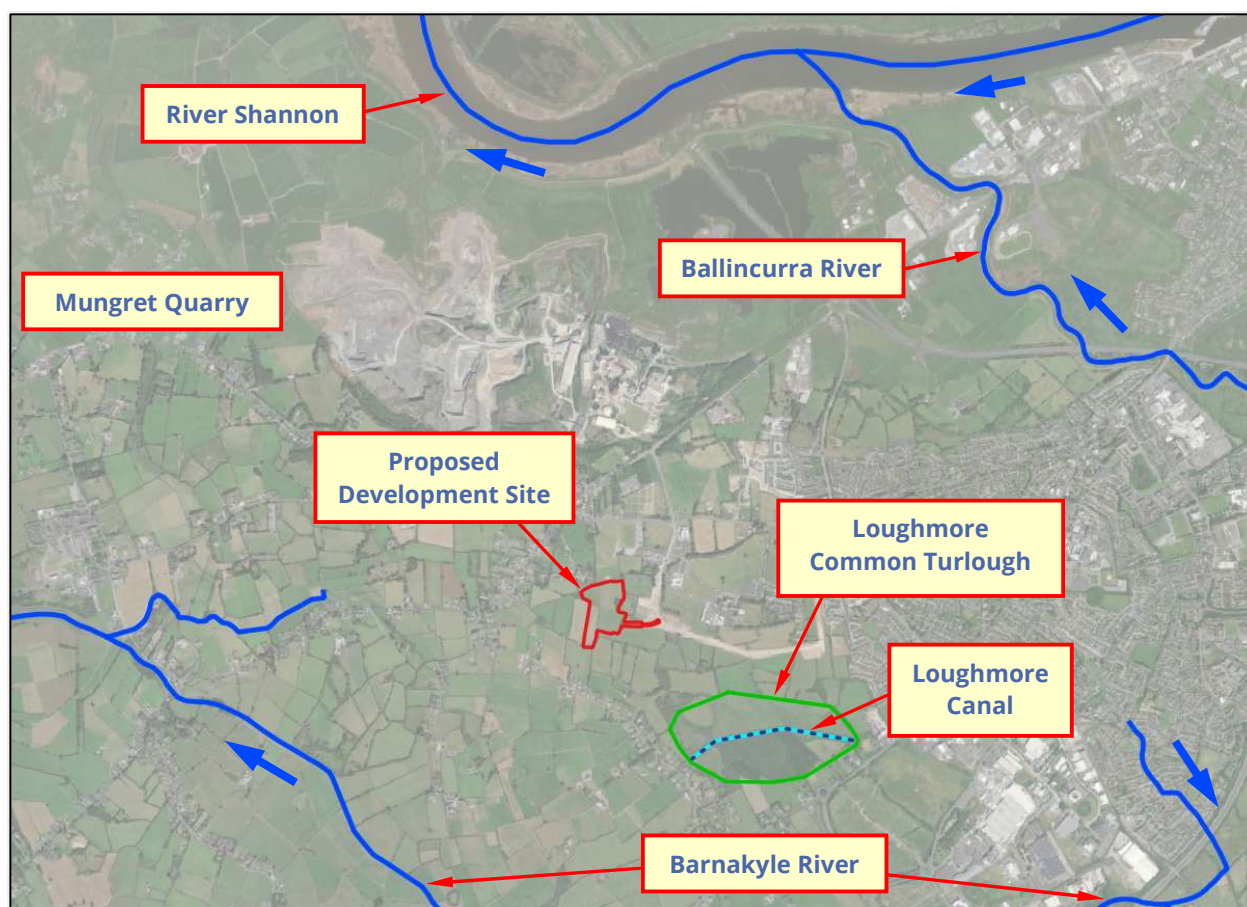


Figure 6 – Local Hydrology

An assessment of the existing landuse in the vicinity of the proposed development site indicates a predominantly rural area with some urbanised areas to the east (Raheen, suburb of Limerick) and to the north (Mungret village). Further to the north lies a cement factory with a quarry, which is owned by Irish Cement Ltd. The quarry is operating below sea-level facilitated by active dewatering, which will have created a cone of depression with groundwater flow to the north towards the quarry.

The Raheen Business Park in the south-east of the proposed development site comprises a series of commercial and industrial units.

3.6.2. River Shannon

The most significant hydrological feature in the vicinity of the proposed development site is the River Shannon which is located approximately 2.3 km beyond the northern boundary of the site. At this location the River Shannon generally flows in an east to west direction. The proposed development site is indicated within the catchment of the main River Shannon.

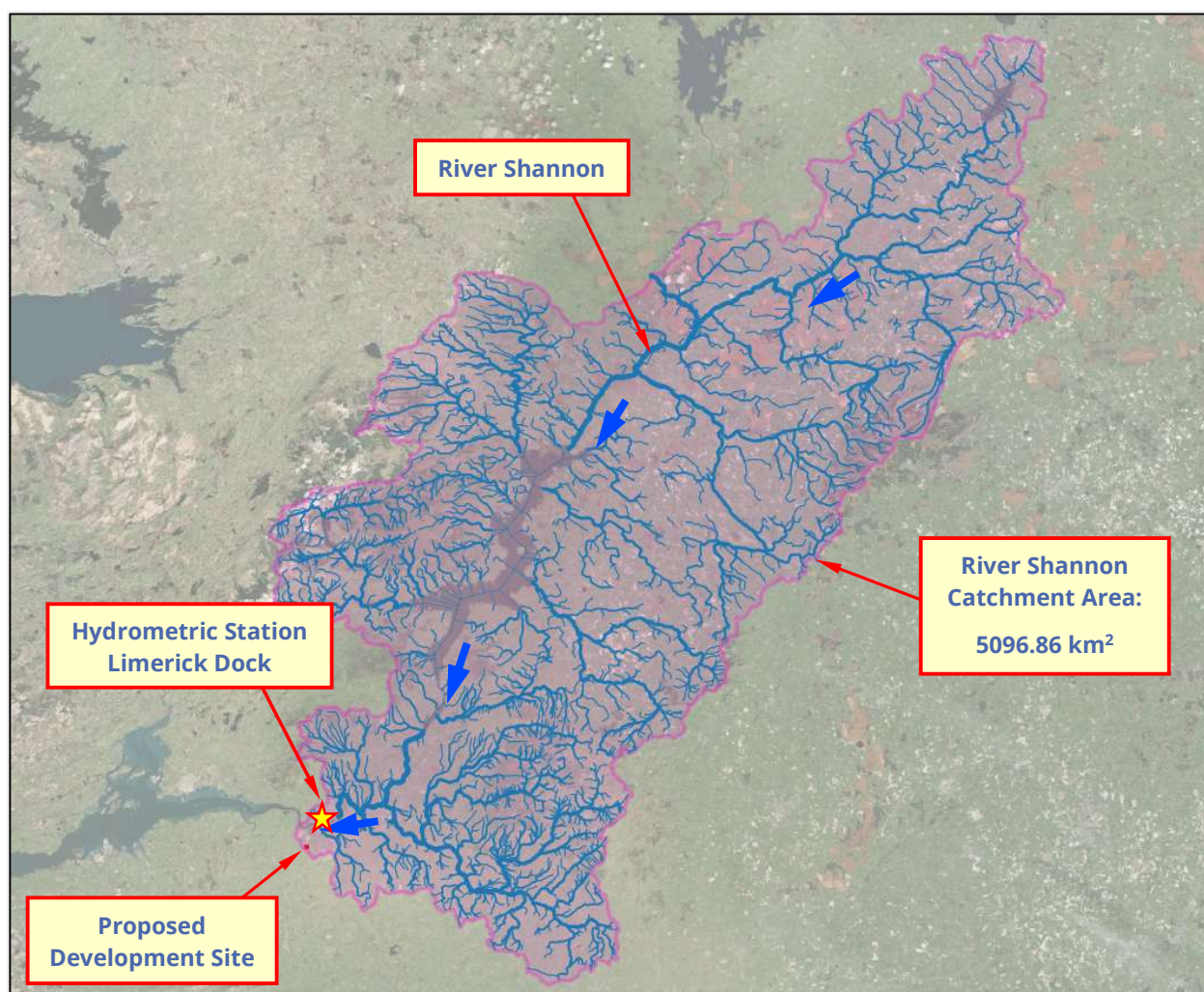


Figure 7 – River Shannon Catchment Area

Utilising the OPW FSU web portal and purchased topography, the catchment area of the River Shannon, to a point downstream of the proposed development site, was delineated and found to be approximately 5096.86 km² as illustrated in *Figure 7* above. With a catchment of this size, it can be assumed that flow rates are considerably high and that the River Shannon will receive groundwater as baseflow and will control regional groundwater levels. Water levels at the nearby upstream OPW hydrometric gauging station Limerick Dock (station number: 24063) show a tidal influence with daily fluctuations in water levels of several meters.² The flow rates of the River Shannon are not measured at this station.

3.6.3. Loughmore Common Turlough

The closest hydrological feature in the vicinity of the proposed development site is the Loughmore Common Turlough which is located in a topographical depression approximately 440 m to the south-east of the site. The turlough discharges via a man-made drainage channel and culvert (known as the Loughmore Canal) (reference: C1/10/3), as illustrated in *Figure 8* below.

² <https://waterlevel.ie/hydro-data/#/overview/Waterlevel/station/197286/Limerick%20Dock/stationInfo>

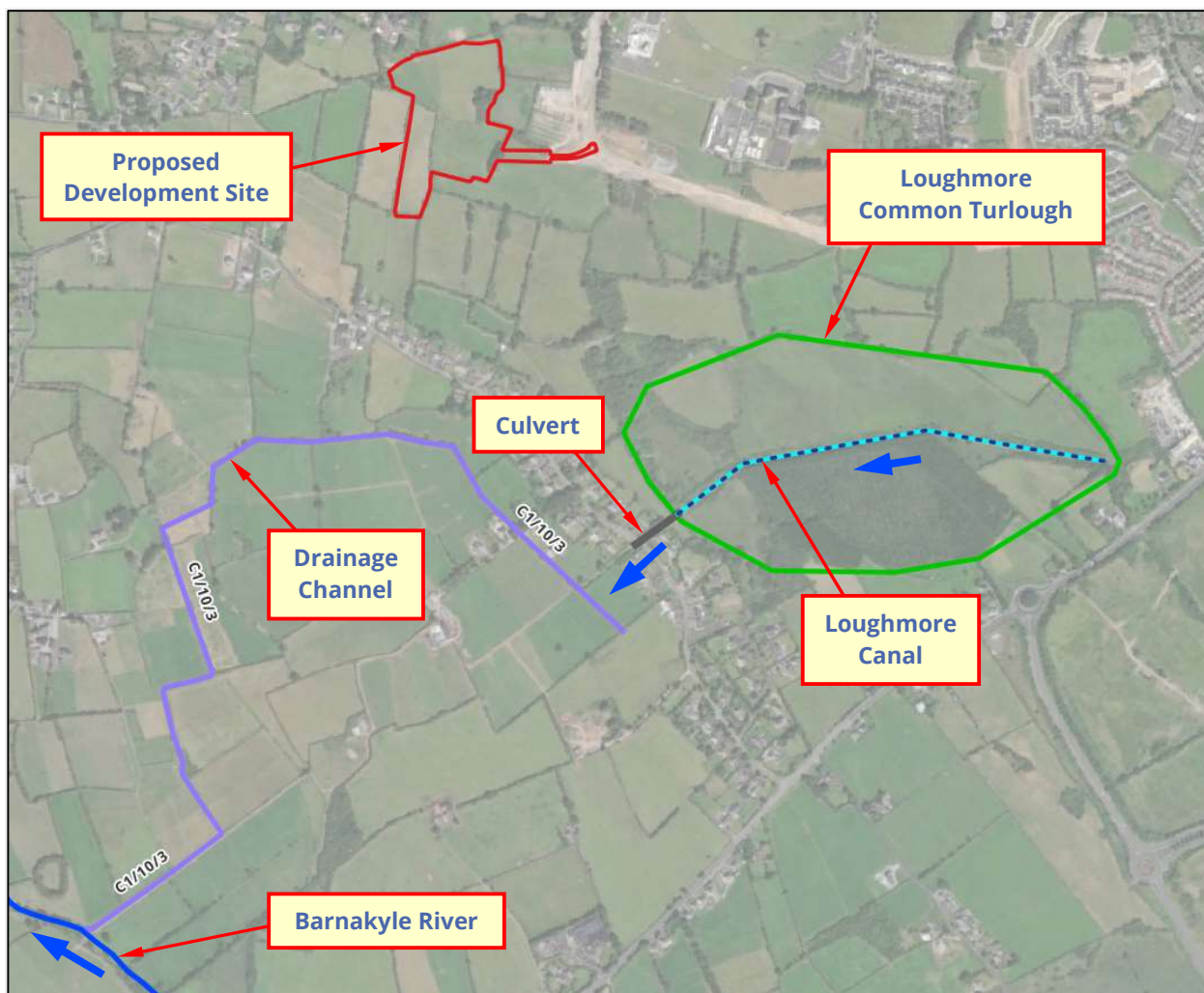


Figure 8 – Loughmore Common Turlough

A turlough is a Karst feature that is commonly found in limestone landscapes in western Ireland. Turloughs are intermittent waterbodies that occur in topographic depressions and recharge because of high rainfall and accordingly high groundwater tables. These ephemeral lakes often form during the winter months and can then dry up during drier periods in the summer. Due to their complex interaction between groundwater and surface water, turloughs have unique hydrological and ecological characteristics and are very sensitive to local changes of the water cycle and to pollution.³

The Loughmore Common Turlough is a proposed Natural Heritage Area (pNHA).

Previous studies have identified karst springs, which feed groundwater into the turlough, during high watertable periods.

³ Waldren, S. (2015): Turlough Hydrology Ecology and Conservation.

3.6.4. Indicative Surface Runoff Directions

Following the Request for Further Information, the indicative surface water catchment contributing to Loughmore Common Turlough was reviewed. Further information on hydrology and hydrogeology in the area was obtained and reviewed to improve the understanding of local surface water flow pathways within the vicinity of the proposed development site.

A surface water catchment for the turlough was delineated using purchased high-resolution topographic LiDAR data of the study area. Outside the extent of the LiDAR coverage, topographic interpretation was supplemented using the NASADEM Digital Elevation Model (30 m resolution), downloaded from OpenTopography⁴. Surface gradient vectors were derived from the digital terrain model to identify indicative overland flow directions. The final catchment boundary, as illustrated in *Figure 9a*, was manually delineated to account for local features like recently built roads that may intercept surface water runoff but are not represented within the available LiDAR data from 2011.

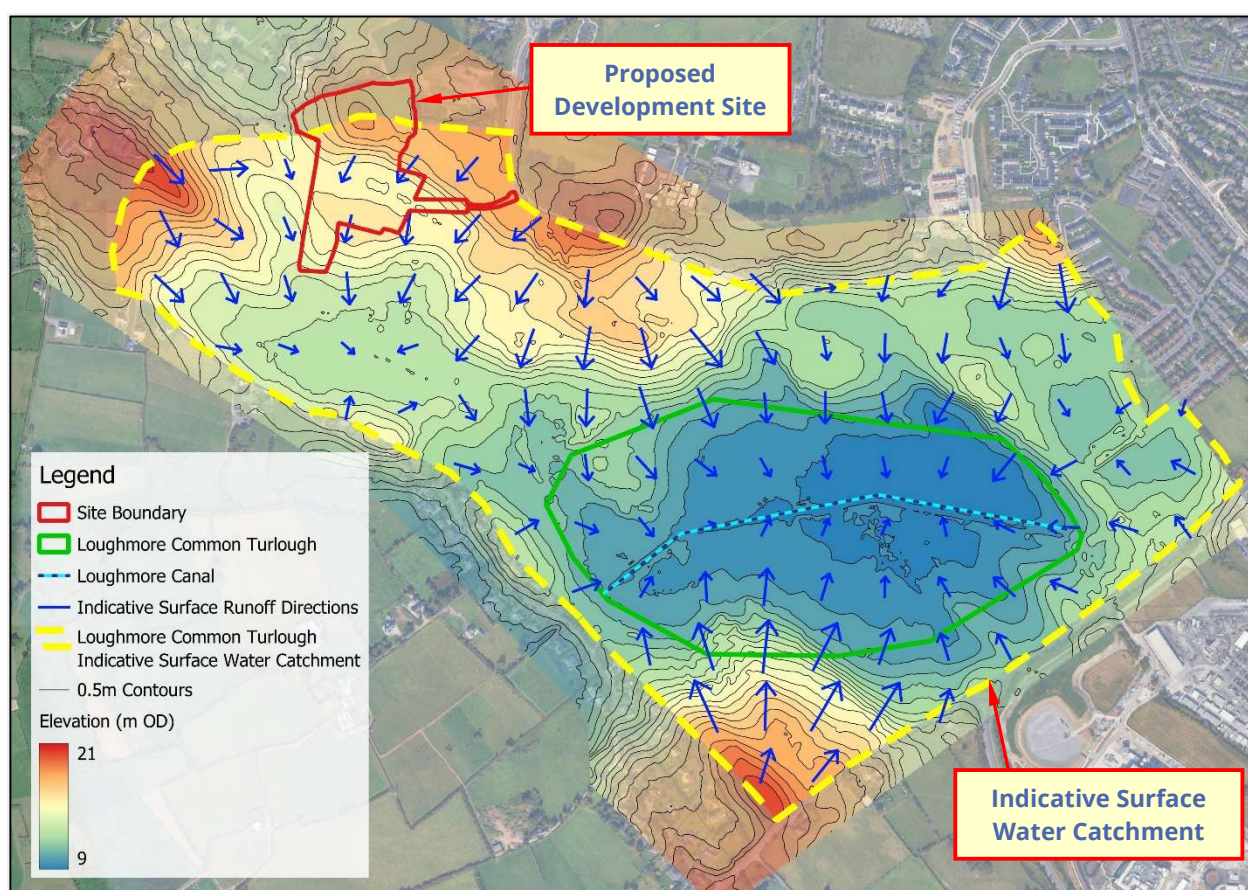


Figure 9a – Indicative Surface Water Catchment for Loughmore Common Turlough

⁴ NASA JPL (2021): NASADEM Merged DEM Global 1 arc second V001. Distributed by OpenTopography. <https://doi.org/10.5069/G93T9FD9>. Accessed 2026-07-24.

Based on this assessment, the indicative surface water catchment contributing to Loughmore Common Turlough is estimated to an area of approximately 1.302 km².

Approximately 0.044 km², which corresponds to 3.4% of the proposed development site, lies within this delineated catchment.

Surface water runoff from this area in its current undeveloped condition is considered to contribute to the turlough's hydrology. However, it should be noted that the quantity of overland flow from this area will be small due to possible interception along the flow pathways before reaching the Turlough.

The indicative surface runoff directions represent potential overland flow pathways derived from topography only. Actual runoff will vary depending on rainfall intensity, vegetation such as densely overgrown hedgerows and field boundaries, localised depressions and other natural or artificial features that may temporarily store, intercept or redirect surface water.

The northern portion of the proposed development site is interpreted to drain northwards, away from the turlough catchment, as illustrated in *Figure 9b* below.

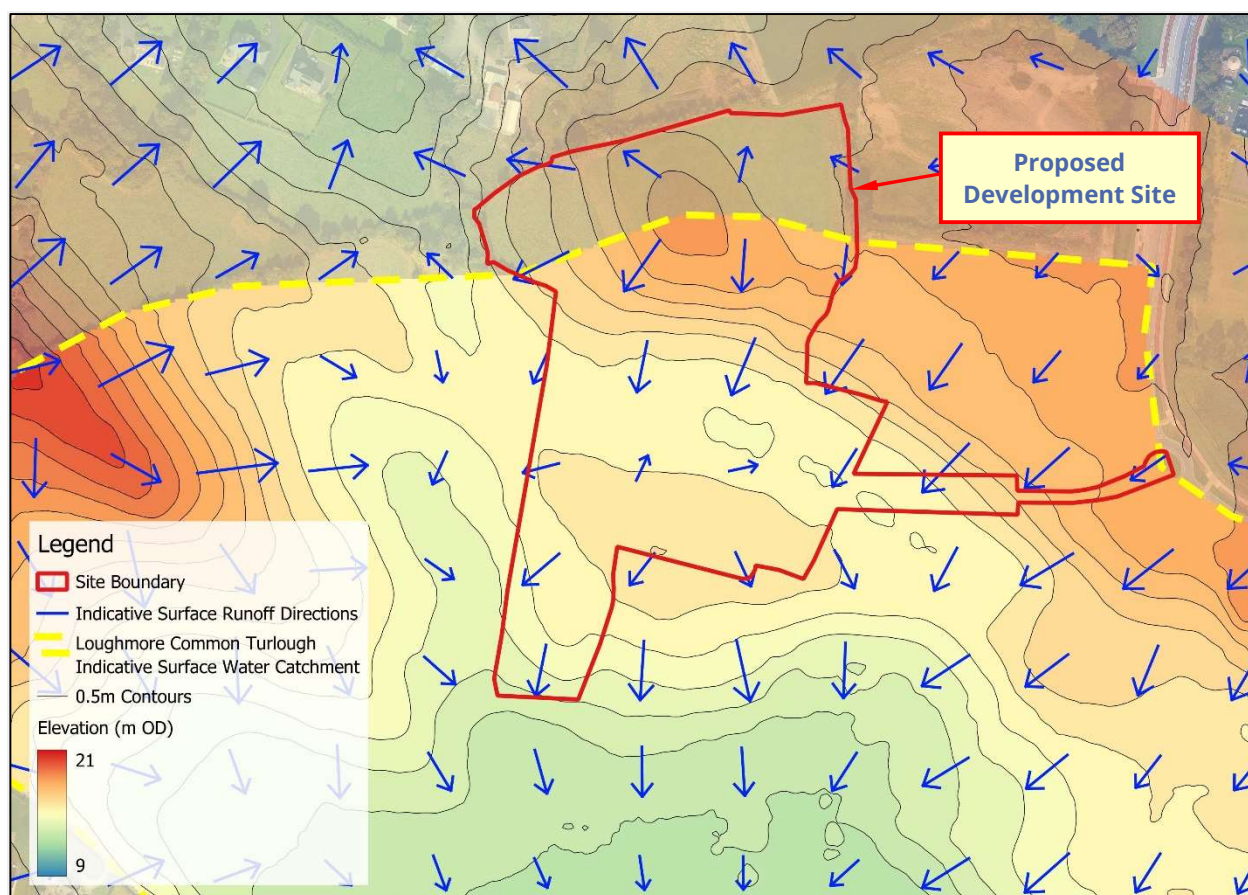


Figure 9b – Indicative Surface Water Catchment for Loughmore Common Turlough (Zoom)

3.6.5. Loughmore Canal

The turlough is crossed from east to west by the Loughmore Canal. The Loughmore Canal is a man-made drainage feature discharging into a drainage channel (reference: C1/10/3) and agricultural lands to the west via a long concrete triple-cell box culvert, as illustrated in *Figure 10* below. The Loughmore Canal receives run-off from some adjacent housing and commercial developments.

The canal is unlined and so is expected to be in hydraulic continuity with the wider Loughmore Common Turlough. This means that waters in the wider turlough area may drain towards the canal, or in particular conditions drain from the canal thus influencing the quantity of water in the turlough feature.

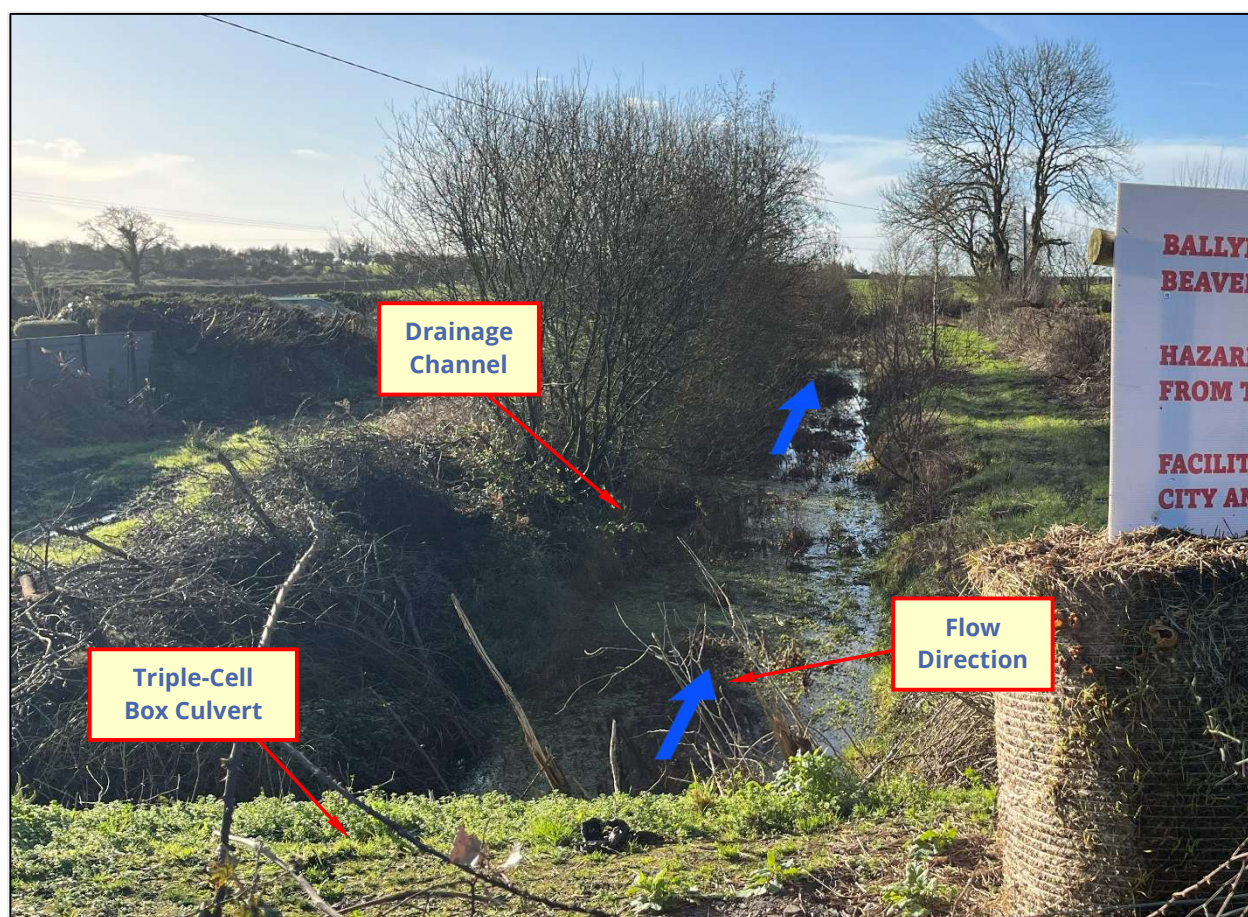


Figure 10 – Location of Culvert

The drainage channel is directly connected to the Barnakyle River, which discharges further downstream into the River Shannon.

There will be no direct discharge from the proposed development site to the Loughmore Canal. Currently there may be some run-off from a small portion of the southern section of the site in the

direction of the turlough. Development of the site will intercept 60% of the current run-off on whole the site and divert it towards infiltration.

3.7. Baseline Groundwater Conditions

3.7.1. Bedrock Aquifer

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the type, distribution and extent of bedrock aquifers in the vicinity of the proposed development site.

Figure 11 below illustrates the mapped bedrock aquifer for the general area of the site.

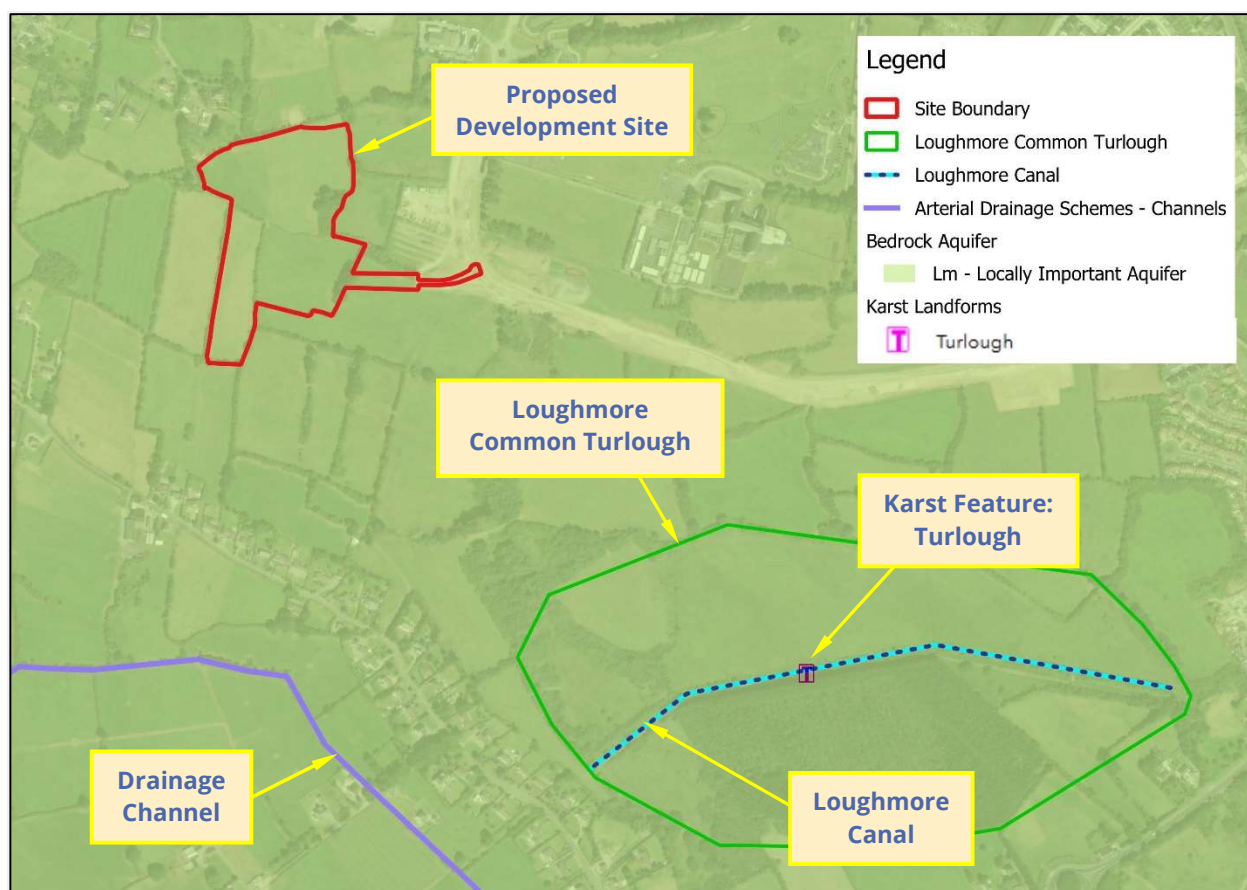


Figure 11 – Bedrock Aquifer

The entire area is underlain by a Locally Important **Lm** Aquifer, classified by the GSI as a bedrock which is “generally moderately productive”. Groundwater flow within this limestone aquifer occurs predominantly through fractures, joints, and locally developed karst features within the limestone bedrock.

Previous studies have identified karst features within the turlough, which may act as springs during high water table periods and may act as sinks during low water table periods. The main springs and sinkholes appear to be along the eastern flank of the turlough. A previous study by Tynan Environmental⁵ has identified several karst features in the turlough area such as springs, swallow holes and probable enclosed depressions, as illustrated in *Figure 12* below.

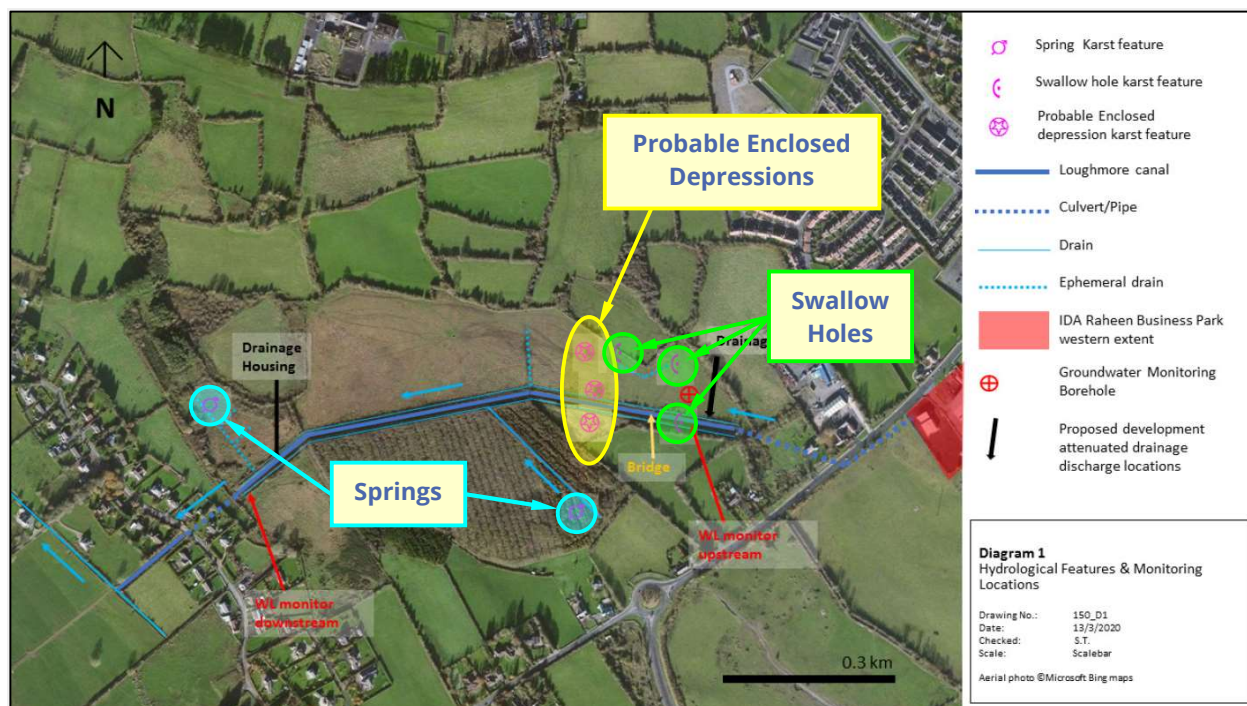


Figure 12 – Loughmore Common Turlough Karst Features

The general absence of other mapped karst features is related to the cover of subsoil over the bedrock. However, the epi-karst or original bedrock surface would have been typically uneven with depressions created by karst dissolution.

3.7.2. Subsoil Permeability

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the type, distribution and extent of subsoil permeability in the vicinity of the proposed development site.

Figure 13 below illustrates the mapped subsoil permeability for the general area of the site.

⁵ Tynan, S. (2018): DRAFT Flood Risk Assessment. Tynan Environmental, draft issue: 18/05/2018. Document Ref: E:\TEnv Projects\150 MMCD_LCC FRA Mungret 0318\REPORT\150 Stage 1_2 FRA Rev 140518.docx.

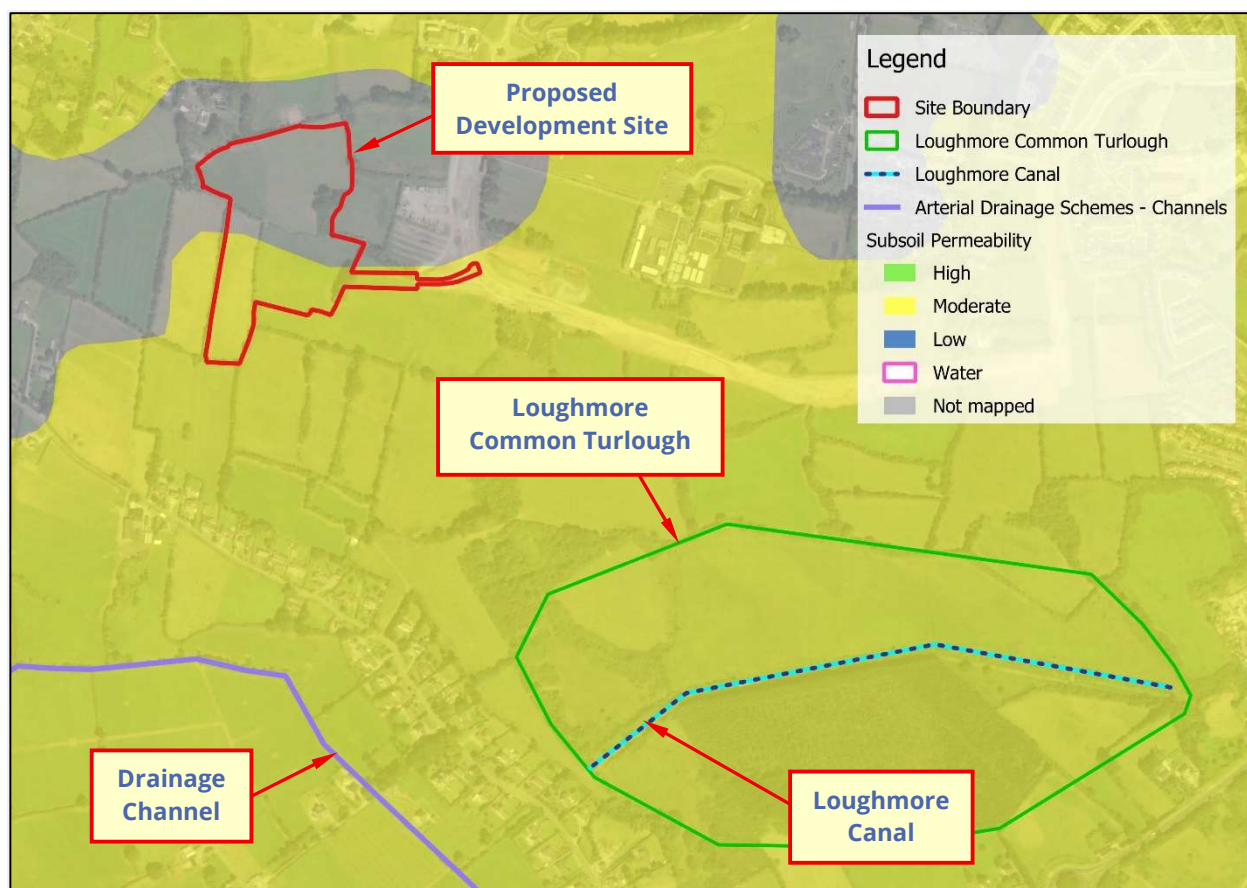


Figure 13 – Subsoil Permeability

The mapping indicates that the subsoil permeability in the south of the proposed development site, of Loughmore Common Turlough and of the wider area is **moderate** (yellow). The north of the site is not mapped (grey).

3.7.3. Groundwater Recharge

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the amount of groundwater recharge in the vicinity of the proposed development site.

Figure 14 below illustrates the mapped groundwater recharge for the general area of the site.

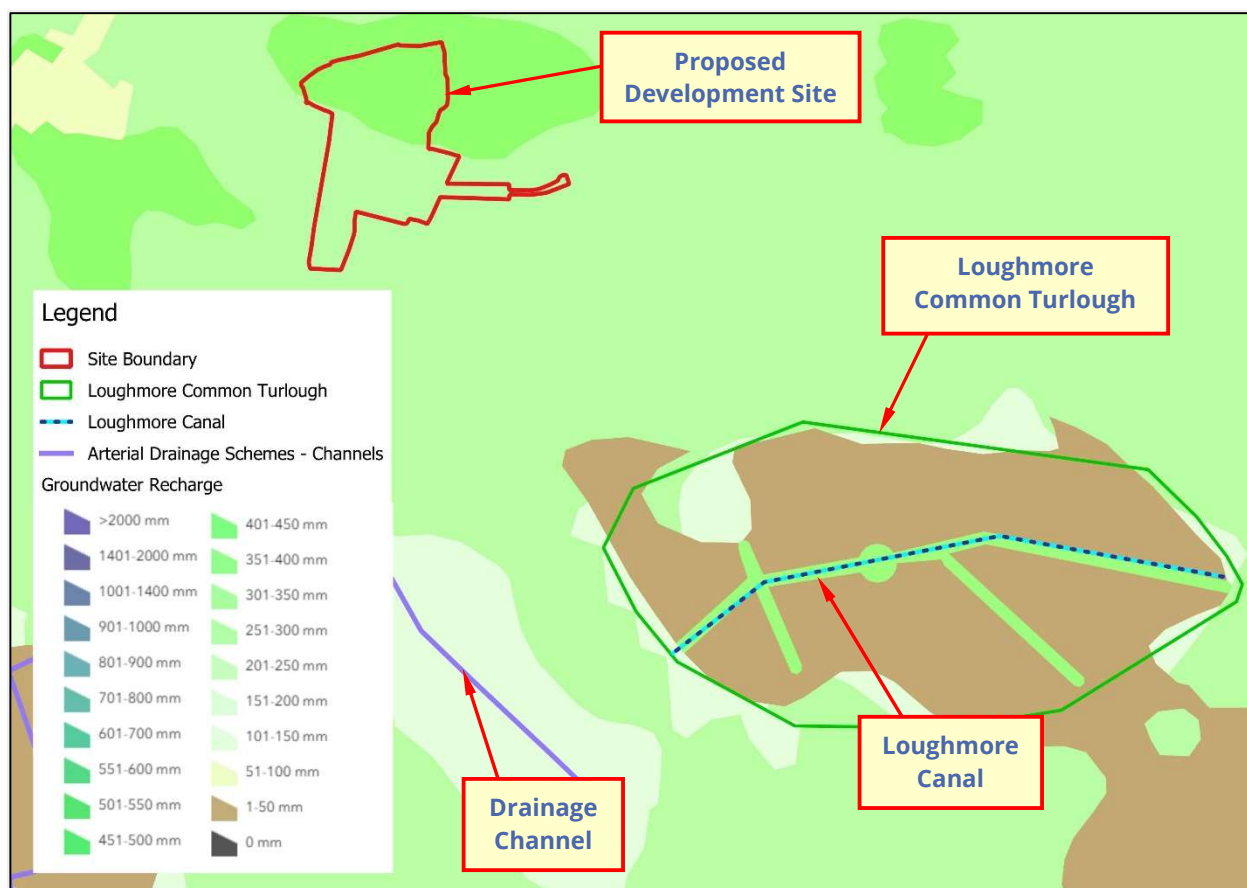


Figure 14 – Groundwater Recharge

The mapping indicates a high spatial variability in groundwater recharge across the area.

Average annual recharge rates are generally moderate, ranging from approximately 401–450 mm/yr in the northern part of the proposed development site to 251–300 mm/yr in the southern part. The effective rainfall at this location, defined as the proportion of total rainfall available for infiltration after evapotranspiration losses, is estimated at 488.9 mm/yr. Variations in groundwater recharge across the site are primarily controlled by different recharge coefficients, which are approximately 85% in the northern part of the proposed development site and 60% in the southern part. These coefficients determine the proportion of effective rainfall that contributes to groundwater recharge and explain the observed differences in average annual recharge rates between the northern and southern areas of the site. The GSI mapping further indicates that soils at the site are classified as well drained, which is consistent with the moderate recharge potential identified for the area.

The area of cutaway peat around Loughmore Common Turlough shows lower average annual recharge rates, which are generally moderate, in the range of approximately 1–50 mm/yr. Effective rainfall at this location is estimated at 454.8 mm/yr. However, the recharge coefficient is relatively low, at approximately 10%, explaining the reduced average annual recharge rates. The GSI mapping

further indicates that soils at Loughmore Common Turlough are classified as poorly drained. This reflects the presence of peat and seasonally waterlogged surface conditions associated with the Turlough system, where groundwater levels frequently rise to or above ground level.

3.7.4. Groundwater Vulnerability

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the type, distribution and extent of groundwater vulnerability in the vicinity of the proposed development site.

Figure 15 below illustrates the mapped groundwater vulnerability for the general area of the site.

The mapping shows that areas of bedrock outcrop in the northern part of the proposed development site as well as the channel of the Loughmore Canal are classified as having Extreme Groundwater Vulnerability, reflecting the absence or very limited thickness of protective subsoil cover in these locations. The remaining part of the proposed development site, together with Loughmore Common Turlough and the surrounding area, is classified as having High Groundwater Vulnerability, which suggests 3-5 m of subsoil over rock. This relatively thin subsoil layer provides only limited attenuation of potential contaminants.

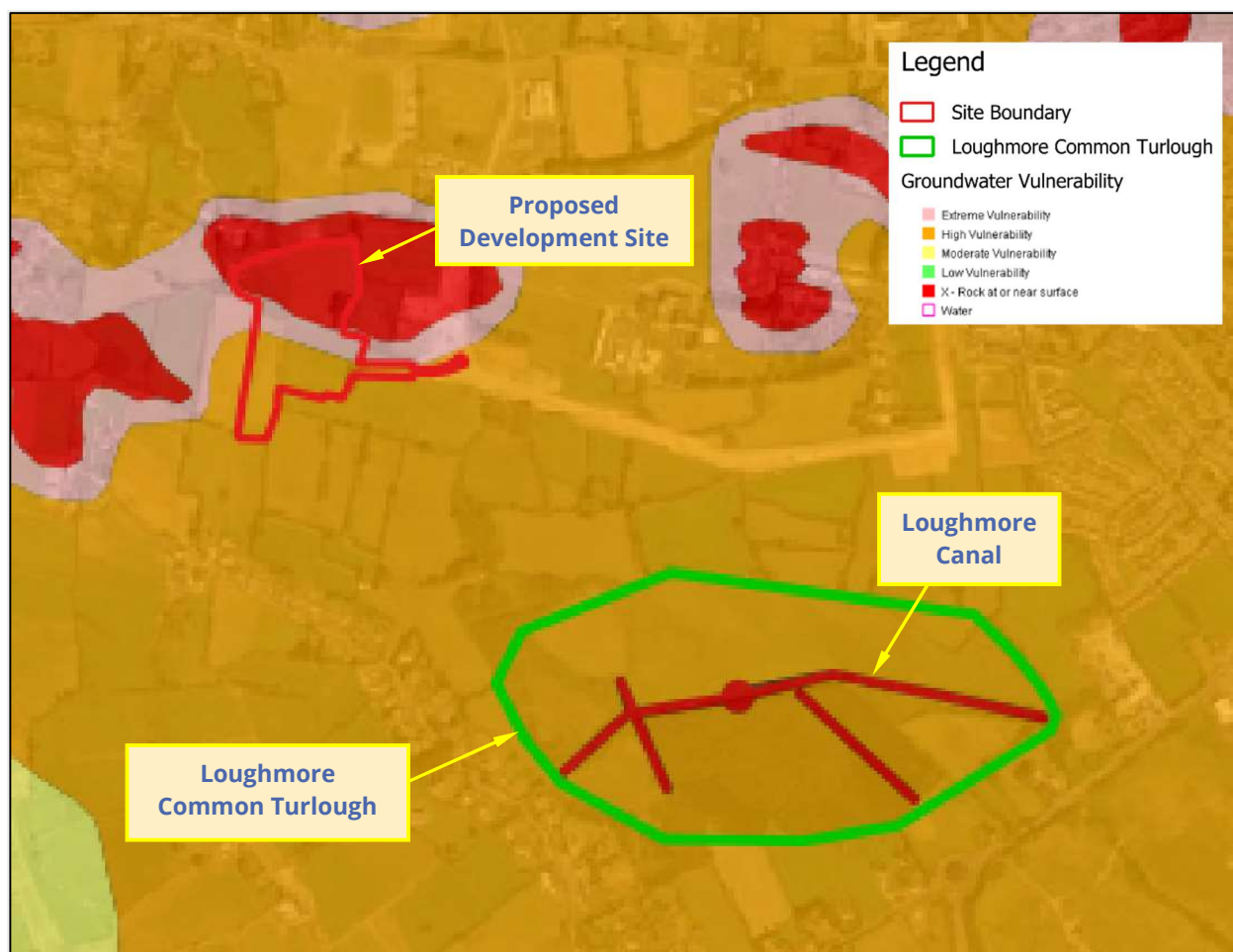


Figure 15 – Groundwater Vulnerability

The groundwater vulnerability highlights the sensitivity of the underlying limestone aquifer to surface-derived inputs. In particular, the presence of high to extreme vulnerability indicates that groundwater levels are likely to respond rapidly to sustained rainfall events and that seasonal fluctuations in groundwater levels can be expected. These characteristics are consistent with the hydrogeological setting of a karst-influenced limestone aquifer and are particularly relevant for the functioning of Loughmore Common Turlough, which is strongly controlled by groundwater level variations.

3.7.5. Turlough Hydrogeology

In addition to a component of surface water run-off from surrounding areas, the Turlough is a groundwater dependent terrestrial water environment.

The Turlough is in an area of low topography, that may have been created by collapse of an existing karst topography due to dissolution as discussed above. The peat developed in the ephemeral waterlogged fen conditions.

The base of the feature is close to the water table. During dry months, the base of the Turlough will sit above the watertable. However, in the winter because of rejected recharge into the aquifer the watertable will rise above the base of the turlough, creating a lake feature.

3.7.6. Indicative Groundwater Flow Directions

Following the Request for Further Information, indicative groundwater flow directions were reviewed using groundwater level monitoring data obtained from an adjacent site at Dromdarrig, Mungret, Co. Limerick, and from a Limerick County Council study. All relevant data and assessment details are presented in Document Ref. IE3324_Report_6916, which forms part of the planning application for the Dromdarrig development and is available on Limerick County Council's online planning portal.

Groundwater levels recorded at the monitoring locations were interpolated using the Inverse Distance Weighting (IDW) method to produce a continuous raster groundwater surface, as illustrated in *Figure 16* below. Owing to the limited spatial distribution of monitoring locations and the influence of seasonal groundwater level variations, the interpreted groundwater flow directions are indicative.

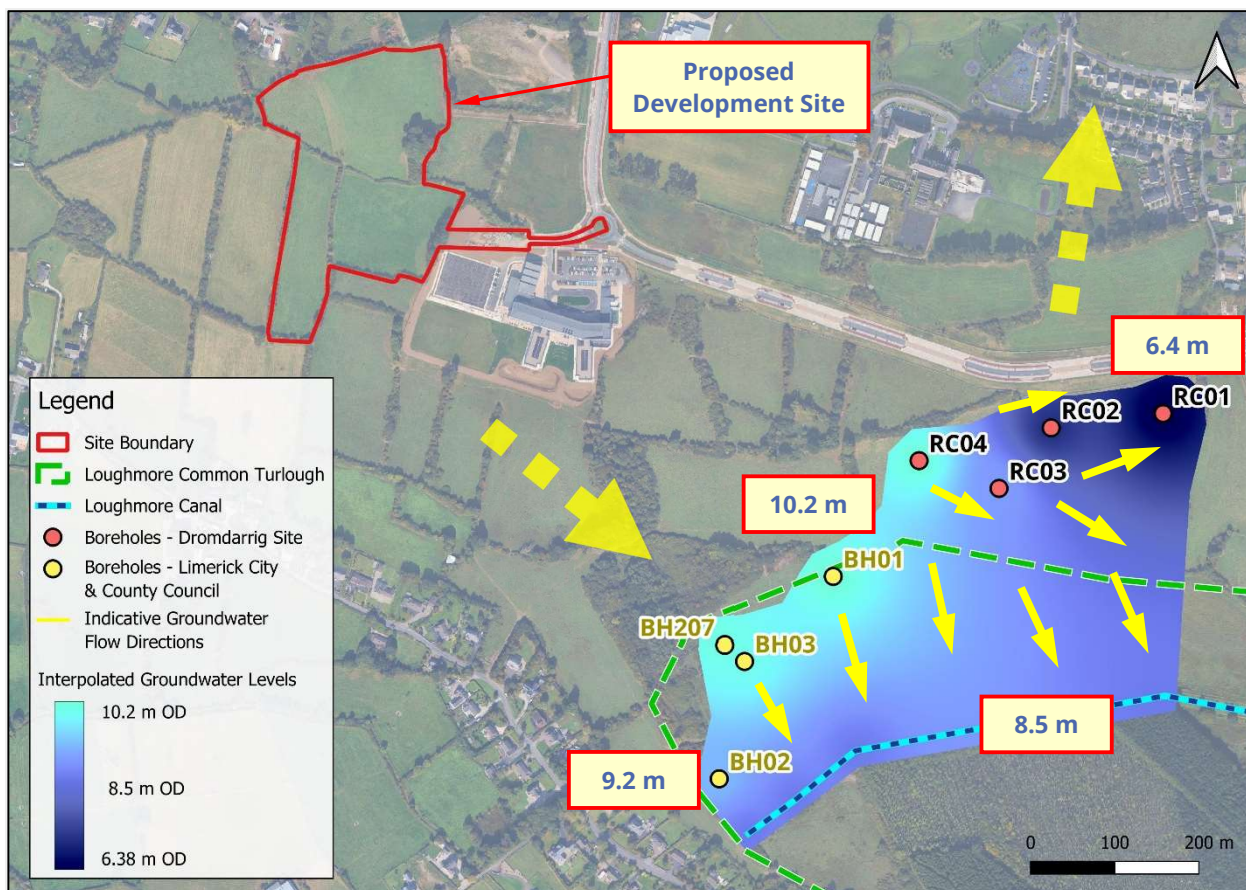


Figure 16 – Indicative Local Groundwater Flow Directions

Elevated groundwater levels observed at boreholes RC04, BH01, BH03 and BH207 indicate local groundwater gradients towards Loughmore Common Turlough. In this area, groundwater flow is directed southwards, broadly following the local topographic gradient from slightly elevated ground. This suggests that water infiltrating from the southern part of the proposed development site may contribute to the local groundwater flow system towards the turlough.

However, groundwater flow observed at boreholes RC02 and RC01 in the north-east is directed northwards. This could reflect the overall terrain decline towards the north and indicate a broader regional groundwater gradient towards the River Shannon. This regional groundwater flow pattern will be further influenced by the active dewatering Mungret Quarry, which is likely to promote groundwater flow in that direction, particularly during periods of lower groundwater levels such as the summer months.

The indicative groundwater flow directions in the wider area together with a revised approximate groundwater contribution zone to the turlough are shown in *Figure 17* below.

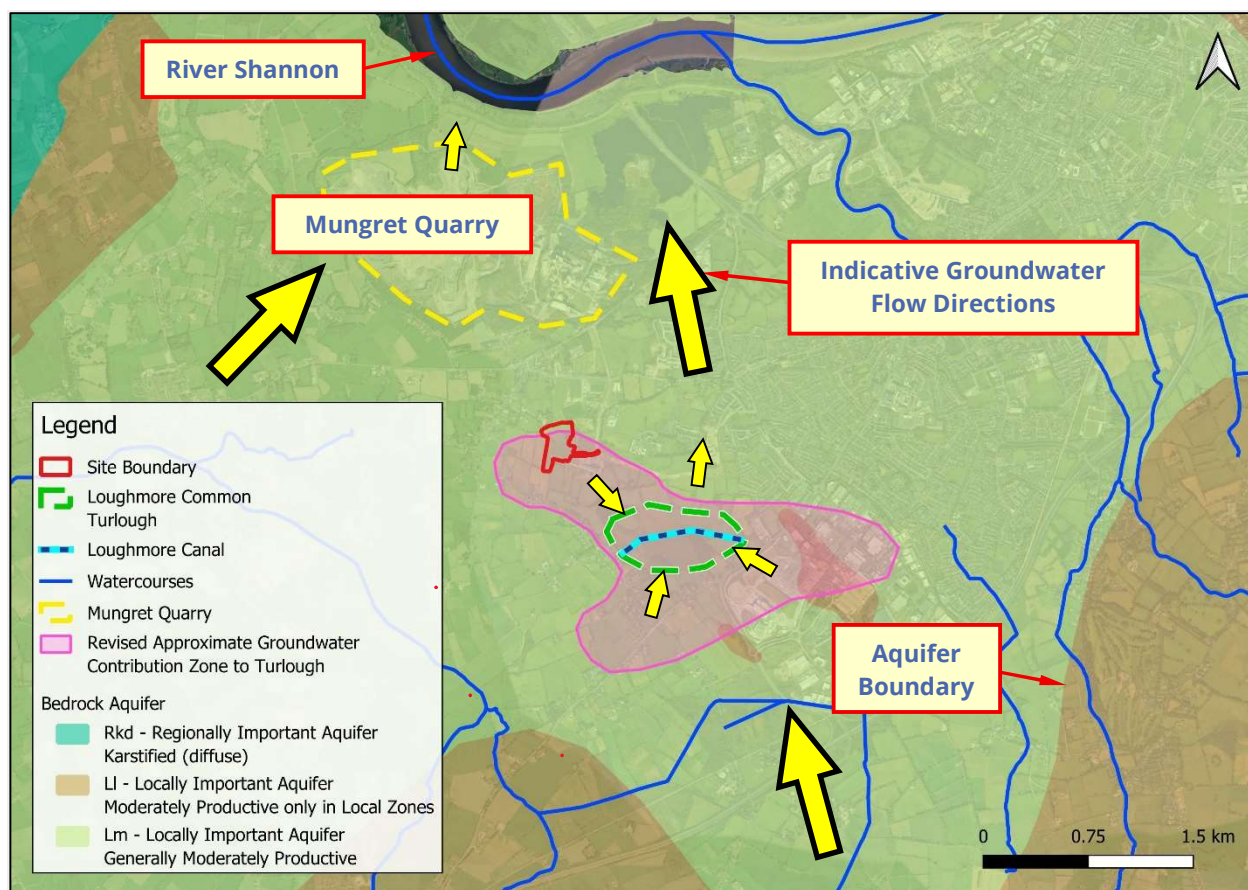


Figure 17 – Indicative Regional Groundwater Flow Directions

The turlough is interpreted to act as a local sink, capturing local groundwater from its immediate surroundings. Groundwater approaching from further south, east or west is assumed to be diverted or “captured” within the subsoil zone of cutover peat and karstified limestone of the turlough before it can continue along the broader regional flow path to the north.

The local groundwater flow towards the turlough is most likely influenced by local topography and the shallow nature of the aquifer. Infiltration from the southern part of the proposed development site most likely contributes to this local groundwater flow towards the turlough.

The regional groundwater flow from south to north is most likely influenced by discharge towards the River Shannon. The active dewatering in Mungret Quarry will increase this existing groundwater gradient. Infiltration from the northern part and possibly some infiltration from the southern part of the proposed development site most likely contributes to this regional groundwater flow towards the River Shannon.

4. ASSESSMENT OF THE PROPOSED DEVELOPMENT LAYOUT

4.1. Construction Related Activities

If planning is approved, construction of the development will proceed.

The construction activities will be subject to an approved CEMP, which will include the safe environmental management of excavated soils, run-off arising during construction, and the safe management of hydrocarbons and other products used as part of the construction process. Once the CEMP is adhered to, there will be no risk to the Loughmore Common Turlough.

4.2. Wastewater Management

Once the development is completed the key issues will be the management of foul and storm water.

Regarding the foul sewer, the full design details are provided in the accompanying Engineering Report. The following is a summary:

It is proposed that this development will be serviced internally by 150 mm and 225 mm diameter foul sewers and will include the provision of services connections, inspection chambers etc. throughout the site.

Due to the topography of the site and invert levels of the existing foul sewer infrastructure mentioned above, it is not possible to connect to the existing infrastructure by means of gravity. It is thus proposed to include a foul sewer pump station within the development to lift foul sewerage through pumping to the existing foul sewer on the LIHAF road.

The proposed foul sewer pumping station has been designed in accordance with Uisce Éireann's Code of Practice for Wastewater Infrastructure. The design incorporates dual submersible pumps operating on a duty/standby arrangement, with ductile iron pipework to IS EN 598. Adequate emergency storage has been provided in line with development scale, together with odour and septicity control measures.

A dedicated metered power supply, automated controls, and provision for telemetry/remote monitoring have been included, alongside appropriate alarm and call-out systems. Safe vehicular access for maintenance, tanker removal of wet well contents, and lifting/handling equipment have been integrated. Flood risk, site security, fencing, and odour setback requirements have also been addressed to ensure the pumping station is fit for purpose and fully compliant with Uisce Éireann standards.

Foul sewers have been designed in accordance with the Uisce Éireann 'Standard Details for Wastewater infrastructure' and 'Code of Practice for Wastewater Infrastructure'. In addition, foul sewers have been designed to the Building Regulations 1997, as amended, (referred to within as 'the Building Regulations') and specifically in accordance with the principles and methods set out in EN 752:2008 and DOE 'Recommendations for Site Development Works' (1998).

Foul sewer shall be constructed to comply with the requirements of the Building Regulations 1997 in accordance with the recommendations contained in the Technical Guidance Documents, Section H (revised 2005) and the Uisce Éireann Code of Practice and Standard Details for Wastewater Infrastructure.

The wastewater will effectively be fully contained with the foul sewer network, with adequate safeguards to eliminate the risk of release of any deleterious material to the environment.

The foul water system is being constructed to a high standard and there will be no significant risk to Loughmore Common Turlough from the proposed wastewater management because there will be no release of contaminants.

4.3. Stormwater Management

The design details for the stormwater management are provided in the Engineering Services Report submitted as part of this application. In summary:

Site tests have confirmed that there is infiltration capacity in the ground. In accordance with SuDS principles, this property will be utilised as part of the stormwater management approach.

A dedicated surface water drainage network will convey runoff to a series of underground attenuation/infiltration tanks distributed throughout the site, as illustrated in *Figure 18* below⁶. The tanks have been designed to predominantly facilitate infiltration to ground while also providing attenuation storage during storm events. Each tank is overlain by a detention basin, providing an additional level of storage and a visual indication of any reduction in infiltration performance.

⁶ OSL Butler Consulting Engineers (2025): Engineering Services Report, 24051-OSL-11-DR-C-1120.

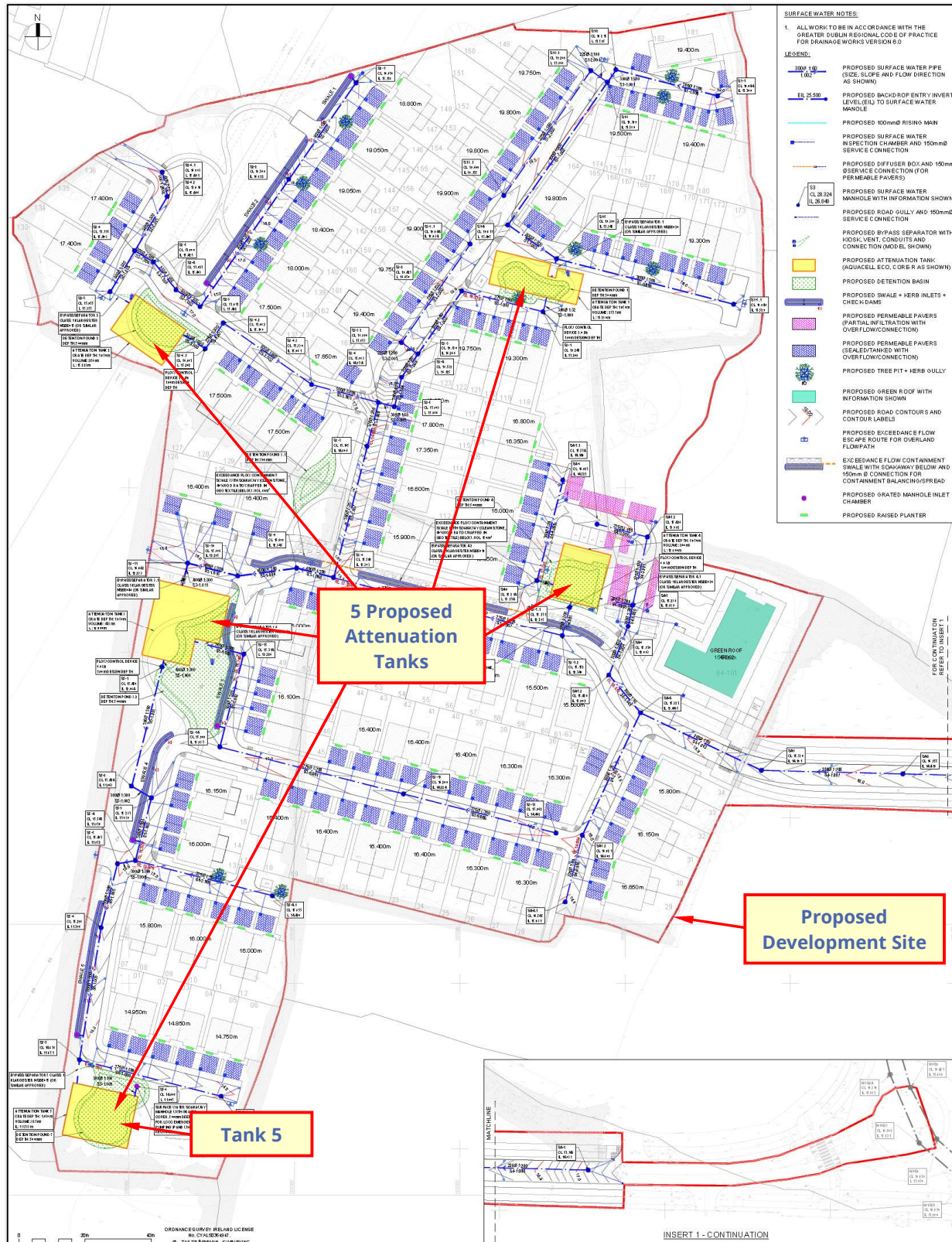


Figure 18 - Revised Surface Water Network of the Proposed Development Site

In response to the Further Information request, the surface water management strategy has been revised. The previously proposed surface water pumping station and rising main have been removed from the design.

As illustrated in *Figure 19* below, the final attenuation tank (tank 5) has been increased in storage volume from 157 m³ to 325 m³ and now incorporates a soakaway manhole with sump to facilitate emergency pumping if required. The overall surface water management strategy remains unchanged, with infiltration to ground continuing as the primary means of stormwater disposal mimicking the natural situation.

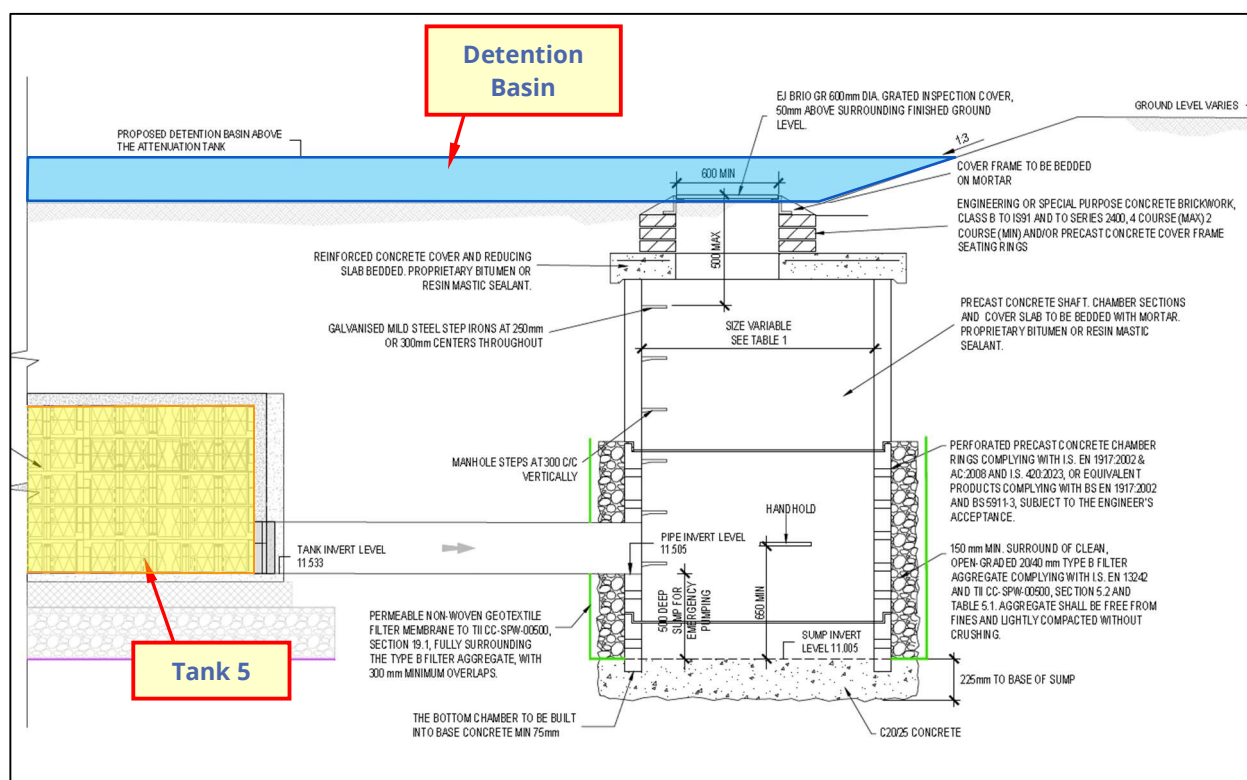


Figure 19 – Cross Section of Attenuation Tank 5 to Soakaway Manhole with Sump for Emergency Pumping

Surface water infiltrating to ground will recharge the local groundwater system. By promoting infiltration at source, the proposed drainage strategy will maintain the site's natural hydrological response and groundwater recharge processes. The northern part of the site naturally drains northwards, while the southern part of the site may contribute limited surface water runoff towards Loughmore Common Turlough under existing conditions, as described in *Section 3.6.3*. The proposed surface water management strategy has been designed to reflect these existing drainage characteristics by promoting infiltration across the site. Consequently, the proposed development is

not expected to result in a significant change to the existing hydrological regime or surface water drainage patterns.

4.4. Potential Disturbances to Groundwater Flow

The general groundwater flow direction from south to north across the site, as identified in *Section 3.7.6* above, is influenced by regional groundwater gradients and groundwater abstraction associated with dewatering at Mungret Quarry. As requested in the Further Information, consideration has been given to the potential influence of existing infrastructure and surface water features located between the proposed development site and the quarry, including the Mungret Link Road, as well as the Loughmore Canal and the Barnakyle Stream.

The Loughmore Canal is an unlined, man-made drainage feature that crosses Loughmore Common Turlough and is therefore expected to be in hydraulic continuity with both the turlough and the underlying aquifer. Consequently, the canal may locally influence groundwater levels and flow directions depending on the prevailing hydraulic conditions. During periods when canal water levels exceed adjacent groundwater levels, seepage from the canal may provide localised recharge to the aquifer. Conversely, when groundwater levels exceed canal water levels, the canal may act as a groundwater discharge feature, locally intercepting groundwater flow and contributing to drainage of the turlough. These interactions are expected to vary seasonally and in response to fluctuations in groundwater and surface water levels. However, given the distance of approximately 700 m between the proposed development site and the canal, any influence on groundwater flow beneath the site is considered to be negligible.

The Barnakyle Stream is located approximately 1.5 km southwest of the proposed development site at its closest point and has an associated catchment area of 41.56 km². Given this distance, together with the considerably larger regional influence of the River Shannon catchment, the Barnakyle Stream is not considered likely to exert a significant influence on groundwater flow directions beneath the site. It is therefore not considered to alter the conceptual groundwater flow model presented in this assessment.

The Mungret Link Road, which gives access to the site from the east, is not considered likely to represent a significant hydraulic barrier to groundwater movement within the underlying limestone aquifer. While the road construction may have resulted in localised modifications to shallow subsurface flow, any such effects are expected to be limited in extent and are not considered to alter the regional groundwater flow regime.

No detailed information on quarry dewatering is available. Nevertheless, groundwater abstraction associated with dewatering is likely to influence groundwater gradients and skew groundwater flow paths.

5. HYDROLOGICAL ASSESSMENT

The hydrological assessment considers the existing surface water and groundwater regime of the proposed development site and the wider area, with particular focus on the hydrological functioning of Loughmore Common Turlough.

The proposed development site and the surrounding area are located within the wider catchment of the River Shannon. While the River Shannon exerts a significant influence on regional groundwater conditions, it is sufficiently distant from the site that it does not directly influence local surface water processes. At a local scale, surface water hydrology is controlled primarily by the site topography, soil conditions and surface water drainage pathways.

Following the Request for Further Information, a conceptual cross-section has been developed, extending from the northern boundary of the proposed development site, across the southern part of the site, Loughmore Common Turlough and Loughmore Canal in the south-east (location shown in *Figure 20* below).

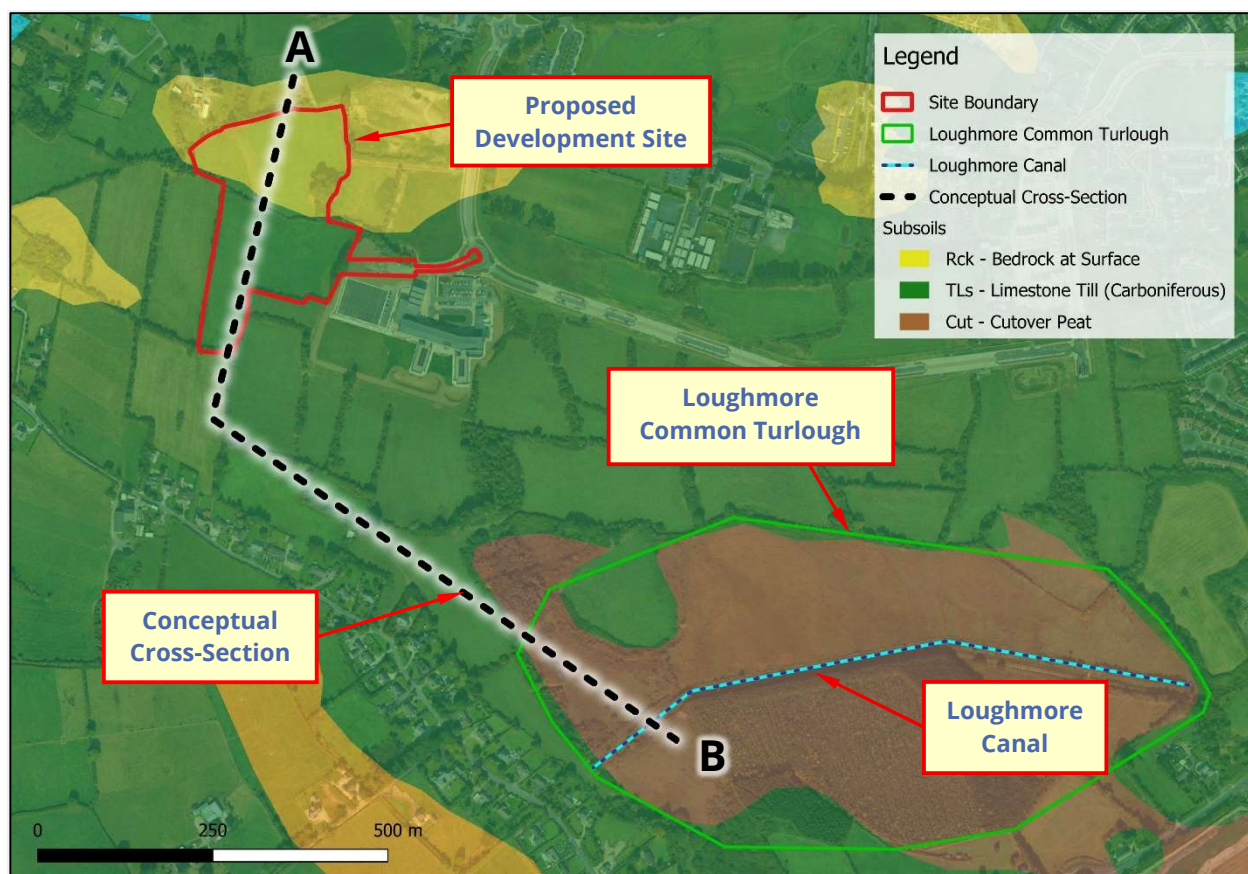


Figure 20 – Location of the Local Conceptual Cross-Section

The conceptual cross-section integrates topographic data, indicative surface water flow directions, borehole information, groundwater levels, and local geological interpretation, and is illustrated in *Figure 21* below.

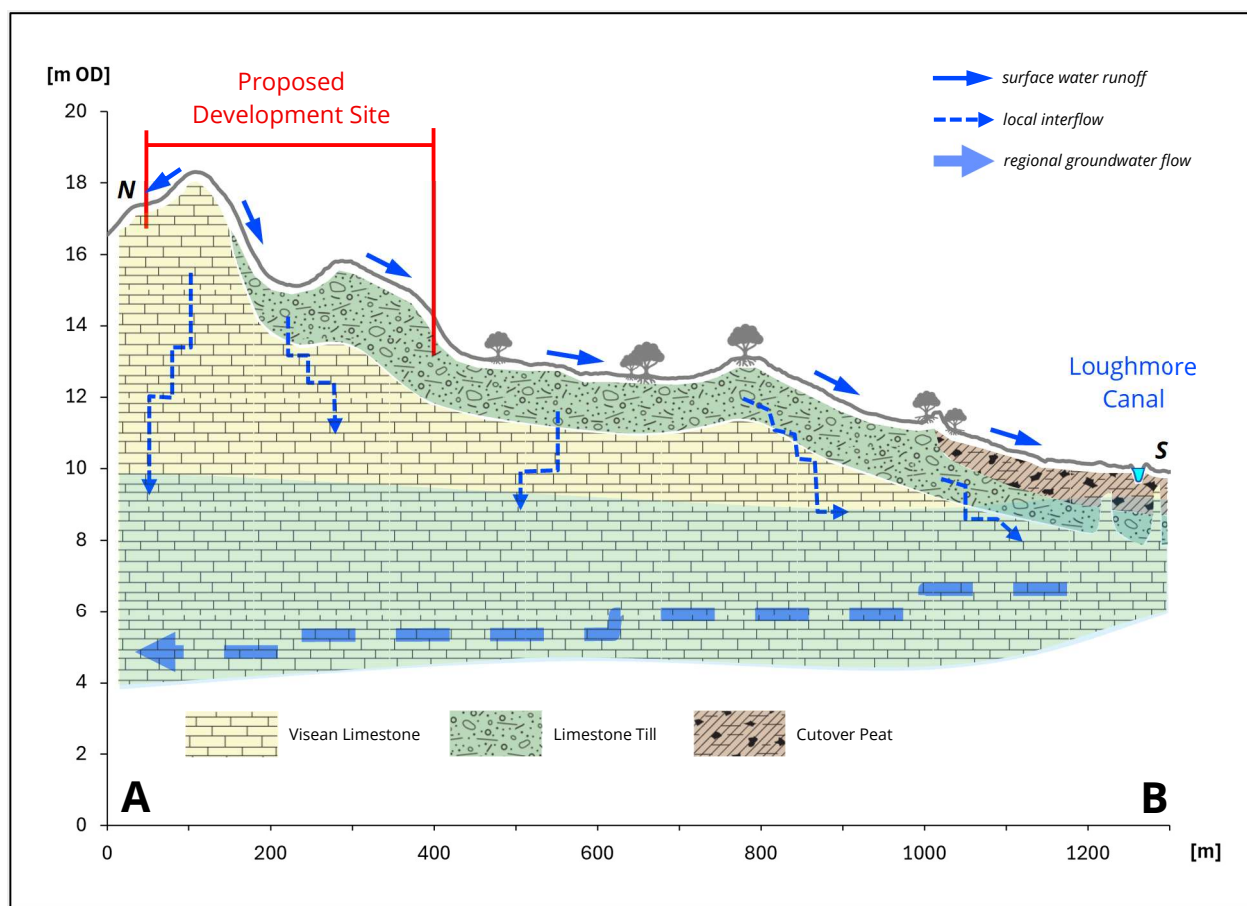


Figure 21 – Local Conceptual Cross-Section

The conceptual cross-section illustrates the principal hydrological and hydrogeological processes across the proposed development site and the surrounding landscape. In line with findings from the desk study, it comprises areas of exposed Visean limestone bedrock in the north, limestone till underlying the southern part of the proposed development site and cutover peat within the turlough basin. The interpreted flow pathways distinguish between three principal components of the local water balance: surface water runoff, shallow subsurface flow (interflow) and groundwater flow.

Indicative surface water runoff follows the local topographic gradient. The northern part of the proposed development site is interpreted to drain northwards, away from the turlough catchment, whereas runoff from the southern part of the site is directed towards the turlough. Along these flow paths, surface water is expected to be intercepted and temporarily stored by natural landscape features including field boundaries, hedgerows and local depressions before reaching the turlough.

A proportion of rainfall infiltrates into the shallow soils and subsoils. Within the areas underlain by limestone till, this interflow is interpreted to occur locally before gradually recharging the underlying

bedrock aquifer. In the northern part of the site, where bedrock is exposed or covered only by a thin soil layer, infiltration is expected to occur more directly into fractures within the limestone, with comparatively limited potential for interflow.

The interpreted groundwater flow system comprises both local and regional components. Local groundwater gradients suggest groundwater movement towards Loughmore Common Turlough from its immediate surroundings, whereas the broader regional groundwater system is interpreted to flow northwards towards the River Shannon, with this regional gradient likely to be enhanced by the ongoing dewatering of Mungret Quarry.

As part of the proposed development, the existing ground levels will be locally modified and areas of impermeable surface introduced. Consequently, the natural partitioning of rainfall between infiltration and surface runoff would be altered in the absence of appropriate mitigation. To maintain the existing hydrological regime as closely as possible, the proposed development incorporates a comprehensive surface water management strategy based on Sustainable Urban Drainage Systems (SuDS) including permeable paving, swales, tree pits, cellular attenuation, detention basins and other nature-based solutions. These measures are designed to attenuate surface water runoff close to source, promoting infiltration, evaporation and temporary storage, with infiltration to ground continuing as the primary means of stormwater disposal. By promoting infiltration at source, the proposed drainage strategy has been designed to maintain the site's natural hydrological response and groundwater recharge processes. Additionally, the SuDS measures provide water quality treatment and biodiversity benefits.

Groundwater beneath the site is expected to be at approximately 10 m OD based on the available monitoring data, which will be at least 4 m below ground level at the lowest point. This means that groundwater levels will not interfere with infiltration, even with winter groundwater levels.

The revised conceptual understanding indicates that groundwater recharge from the proposed development site may contribute to the local groundwater system associated with the turlough. However, the proposed drainage strategy has been designed to maintain existing groundwater recharge processes. Accordingly, there will be no adverse effect on the hydrological functioning of Loughmore Common Turlough because of the proposed development.

6. HYDROGEOLOGICAL ASSESSMENT

The hydrogeological assessment considers groundwater conditions beneath the proposed development site and within the wider area, with particular emphasis on groundwater flow directions and their relevance to the functioning of Loughmore Common Turlough. While the previous chapter describes local hydrological processes occurring at site scale, this chapter considers the broader hydrogeological setting controlling regional groundwater flow.

The proposed development site is underlain by Visian limestone bedrock, which forms a locally important aquifer. Groundwater flow within this aquifer is controlled primarily by hydraulic gradients and fracture networks rather than by topography alone. Consequently, local groundwater flow directions may differ from regional groundwater flow patterns.

At a regional scale, groundwater flow is directed towards the River Shannon, which represents the principal groundwater discharge zone in the area. The River Shannon, together with the large-scale quarry operated by Irish Cement Ltd. to the north of the site, exerts a strong hydraulic control on groundwater levels. The quarry, which extends to elevations of approximately -27 m OD, is likely to act as a localised groundwater sink, further reinforcing groundwater flow towards the north.

Loughmore Common Turlough responds to seasonal fluctuations in groundwater levels. During periods of high rainfall, groundwater levels rise and exceed ground level within the Turlough depression, resulting in seasonal flooding. During drier periods, groundwater levels decline, and water drains from the turlough via swallow holes and karst conduits, causing the turlough to partially or fully dry out.

A regional conceptual hydrogeological model, as shown in *Figure 22*, has been developed to illustrate the relationship between the proposed development site, Loughmore Common Turlough, the quarry, and the River Shannon. Following the Request for Further Information, the conceptual hydrogeological model has been revised to reflect the updated understanding of groundwater flow derived from the desk study and the available groundwater monitoring data.

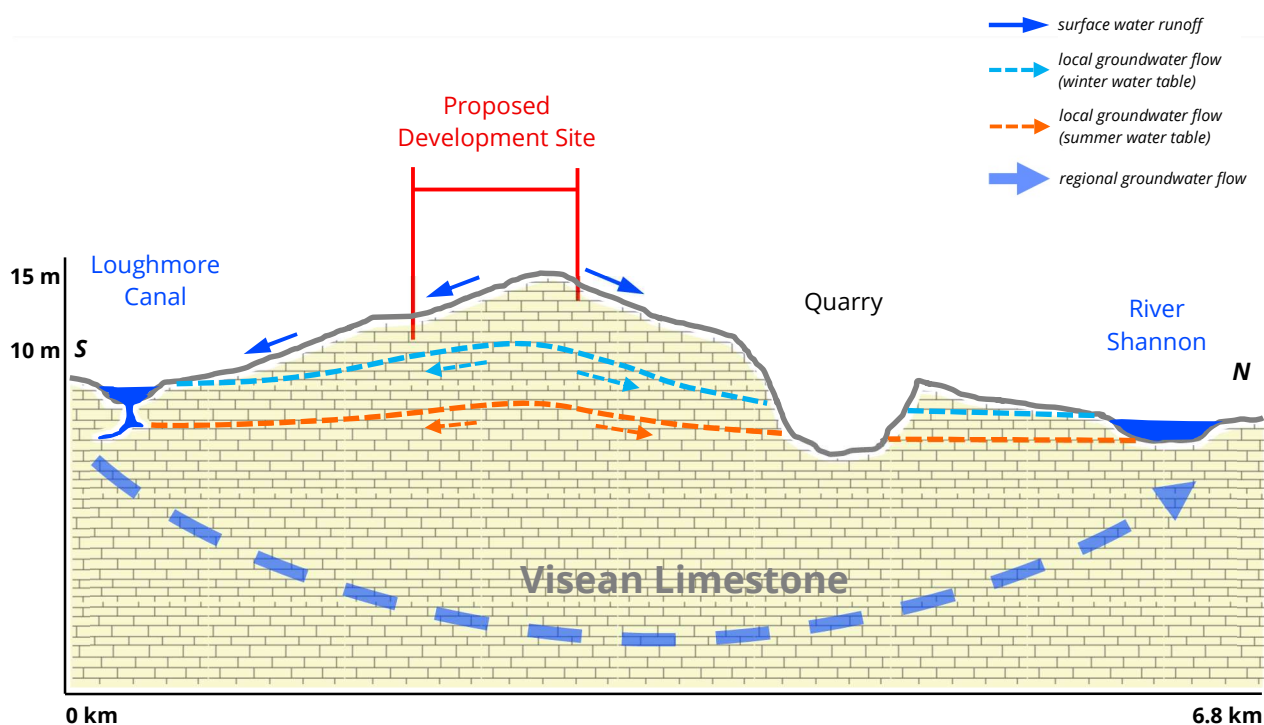


Figure 22 – Regional Conceptual Hydrogeological Model

The revised conceptual model illustrates the coexistence of local and regional groundwater flow systems beneath the proposed development site. Local groundwater gradients beneath the southern part of the site are interpreted to contribute towards Loughmore Common Turlough, reflecting the influence of local hydraulic gradients identified from the available groundwater level data. In contrast, the deeper regional groundwater flow system continues northwards towards the River Shannon, which represents the principal regional groundwater discharge area.

The proposed surface water management strategy has been designed to maintain groundwater recharge through infiltration as far as practicable. Consequently, while a proportion of infiltrated water may contribute to the local groundwater system associated with Loughmore Common Turlough, the broader regional groundwater regime is expected to remain unchanged.

On this basis, the proposed development is not expected to result in any significant alteration of groundwater flow patterns or groundwater recharge processes supporting the hydrological functioning of Loughmore Common Turlough.

7. CONCLUSIONS

The baseline hydrological and hydrogeological understanding of Loughmore Common Turlough and the surrounding environs has been revised following the Request for Further Information. The revised assessment incorporates

- a detailed delineation of the surface water catchment,
- an updated interpretation of groundwater flow directions based on available groundwater monitoring data,
- an assessment of potential disturbances to groundwater flow,
- an updated assessment of the stormwater management,
- and revised conceptual models describing the local and regional hydrological systems.

Loughmore Common Turlough exists because of its low-lying topographic setting and its hydraulic connection with the underlying karstified limestone aquifer. The revised assessment indicates that the turlough receives water through a combination of direct surface water runoff, shallow subsurface flow (interflow) and local groundwater inflow from its immediate surroundings. At a regional scale, groundwater is interpreted to flow generally northwards towards the River Shannon, with this regional groundwater gradient likely to be enhanced by the ongoing dewatering of Mungret Quarry.

Approximately 0.044 km² (3.4%) of the proposed development site lies within the delineated surface water catchment of Loughmore Common Turlough. Under existing conditions, this area contributes to the turlough through local surface water runoff and groundwater recharge. The proposed surface water management strategy has been designed to maintain the site's existing hydrological response by promoting infiltration at source through Sustainable Drainage Systems (SuDS), supplemented by attenuation storage where required. Consequently, the proposed development is not expected to result in a significant change to the quantity of surface water reaching the turlough.

Potential sources of contamination, that might affect the water quality in the Turlough, will be effectively managed by the CEMP during construction and by the sealed and contained wastewater network, which will pump wastewater to the public foul sewer to the north.