8 Hydrology & Hydrogeology

8.1 Introduction

This chapter comprises an assessment of the hydrological and hydrogeological environment (collectively known as the water environment) within the site and the surrounding environs. The potential effects posed by the construction and operational phases of the Proposed Development are investigated, and suitable mitigation measures are recommended to minimise effects on the local water receptors.

In terms of Environmental Impact Assessment (EIA):

- "Hydrology" is the study of surface water features.
- "Hydrogeology" is the study of groundwater features.

The objectives of this chapter are.

- To provide a baseline assessment of the receiving water environment in terms of surface water (hydrological) and groundwater (hydrogeological) receptors.
- To identify any potential negative effects 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 effects posed by the Proposed Development.

8.2 Consultation

ORS have been commissioned to assess the potential impacts of the Proposed Development in terms of hydrology and hydrogeology during the construction and operational phases.

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

- **Project Scientist & Author:**
  Bianca Severgnini – B.Eng. (Hons) (Environmental).
  Current Role: Environmental Consultant. Experience *ca.* 3 years.

- **Project Scientist & Reviewer:**
  Luke Martin – B.A. (MOD) (Natural Sciences), M.Sc. (Sustainable Energy and Green Technology), CEnv, MIEnvSc. Current Role: Chartered Environmental Consultant. Experience *ca.* 12 years.

- **Project Coordinator & Reviewer:**
  Oisín Doherty – B.Sc. (Geography with Environmental Science), MSc. (Environmental Management), CEnv, MIEnvSc. Current Role: Chartered Environmental Consultant. Experience *ca.* 14 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 hydrology and hydrogeology.

8.3 Assessment Methodology & Significance Criteria

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, (2013). *Land spreading of Organic Waste – Guidance on Groundwater Vulnerability Assessment of Land*.
- 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 & Hydrogeology Chapters in Environmental Impact Statements*.
- NRA, (2008). *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*.
- CIRIA, (2001). C532 - *Control of Water Pollution from Construction Sites – Guidance for consultants and contractors*.

8.3.1 Desktop Study

A desk-based assessment method was used to assess baseline water quality for the receiving environment of the proposed site. The baseline information that is detailed in this section of the assessment was obtained from publicly available information.

The following documents and sources were referenced:

- Aquifer classification and vulnerability identification from the Geological Survey of Ireland (GSI web page)
- Search of GSI and Kildare County Council files to determine the location of groundwater wells within a 2km radius
- 1:50,000 Discovery Series Maps and 6” maps (Geohive)
- Water Quality in Ireland 2010-2015 (EPA)
- Water Quality in Ireland 2013-2018 (EPA)
- Water Quality in Ireland 2016-2021 (EPA)
- Water Action Plan 2024: A River Basin Management Plan for Ireland.
- Meteorological data from Met Eireann and hydrometric data from the Office of Public Works (OPW)
- Strategic Flood Risk Assessment of the Kildare County Development Plan 2023-2029
- Kildare County Development Plan 2023 - 2029
- Reports, maps and data published by the Geological Survey of Ireland (GSI) and the National Soil Survey of Ireland
- General Soil Map of Ireland 2nd Edition, (1980), The National Soil Survey, An Fóras Taluntais
- An Foras Talúntais (1966). Soils of County Kildare
- Reports, maps and data published by the Environmental Protection Agency (EPA).
- UK CIRIA report C552 (2001). (Contaminated Land Risk Assessment: A Guide to Good Practice.
- IFI (2016), Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Watercourses.
- OPW and DoEHLG (2009), The Planning System and Flood Risk Management - Guidelines for Planning Authorities.

- EPA (2022), River Quality Surveys: Biological - Hydrometric Area 14
- Möller, K., & Müller, T. (2012). Effects of anaerobic digestion on digestate nutrient availability and crop growth: a review. Engineering in Life Sciences, 12(3), 242-257.

The following technical reports completed in support of the planning application for the Proposed Development were also consulted to further assess baseline water quality.

- Civil Engineering Design Report
- Site Specific Flood Risk Assessment
- Site Suitability Assessment for onsite domestic wastewater treatment system

8.3.2 Field Survey

Fieldwork commissioned in January 2025 consisted of the following elements:

- Trial Pit Excavations
- BRE Digest 365 Percolation/Soakaway Testing

A site walk-over was conducted by ORS geotechnical consultants on the 31st of January 2025 to identify hydrological features on site including:

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

8.3.3 Impact Assessment Methodology

Chapter 1: Introduction of the EIAR outlines the impact assessment rationale applied to each chapter of the study. This section describes some further criteria applied to the assessment of hydrological and hydrogeological 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. An approach based on this methodology has been adopted within this report. For each of the contaminant linkages, an estimate is made of:

- The potential severity of the risk.
- The likelihood of the risk occurring.

Hydrological and Hydrogeological Receptor Criteria

The level of sensitivity of hydrological and hydrogeological receptors are based on a number of factors which are summarised in **Table 8.1** overleaf.

Table 8.1: Criteria for rating importance of hydrological and hydrogeological attributes (NRA, 2008)

Importance	Criteria	Receptors	
		Hydrological	Hydrogeological
Extreme	Attribute has a high quality or value on an international scale	River, wetland, or surface water body ecosystem protected by EU legislation	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for wide range of leisure activities.	Regionally Important Aquifer with multiple wellfields Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source
High	Attribute has a high quality or value on a local scale	Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source Inner source protection area for locally important water source
Medium	Attribute has a medium quality or value on a local scale	Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding	Locally Important Aquifer Potable water source supplying >50 homes Outer source protection area for locally important water source
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding	Poor Bedrock Aquifer Potable water source supplying <50 homes

River Water Quality Assessment Criteria

Under the Water Framework Directive and SI 722 of 2003 European Communities (Water Policy) Regulations, the EPA carries out water quality assessments of rivers, transitional and coastal water bodies as part of a nationwide monitoring programme. Data is collected from physico-chemical and biological surveys, sampling both river water and the benthic substrate (sediment). **Table 8.2** overleaf summarises the quality classes used to assess the condition of rivers throughout the country.

Table 8.2: Biotic Indices Classification for River Water Quality

Biotic Indices	Community Diversity	Quality	Condition	Quality Status	Quality Class
Q5	High	Good	Satisfactory	Unpolluted	Class A
Q4	Reduced	Fair	Satisfactory	Slightly Polluted - Unpolluted	Class B-A
Q3	Low	Doubtful	Unsatisfactory	Moderately – Slightly Polluted	Class C-B
Q2	Very Low	Poor	Unsatisfactory	Seriously – Moderately Polluted	Class C-D
Q1	Little/None	Bad	Unsatisfactory	Seriously Polluted	Class D

'Biotic Indices' or Quality (Q) Values are indicative of specified groups of macro-invertebrates' sensitivity to pollution. Q-Values are assigned to a waterbody based on the presence or absence of particular species with the Q5 biotic index indicating the least polluted waters and the Q1 biotic index indicating the most polluted waters.

Quality Class relates to the potential beneficial use of a water body as summarised in **Table 8.3**.

Table 8.3: Quality Class Descriptions

Quality Class	Description	BOD (mg/l)	Orthophosphate (mg/l)	Dissolved Oxygen (% Sat)
A	Highest water quality with very high amenity value Suitable for abstraction Suitable for game fisheries	<3	~0.015	~100%
B	Variable water quality with considerable amenity value Potential abstraction issues Game fish 'At Risk'	Occasionally exceeds 3mg/l	~0.045	<80% or >120%
C	Doubtful Water Quality with reduced amenity value Advanced Treatment of abstracted water required Coarse fisheries – Fish kills likely	Regularly Exceeds 3mg/l	~0.070	v. unstable
D	Poor to bad water quality with no amenity value Low grade & limited abstraction Fish absent	Levels regularly far in exceedance of 3mg/l	>0.1	Low, approaching 0%

Groundwater Vulnerability Assessment Criteria

Groundwater Vulnerability is a term used to represent the intrinsic geological and hydro geological characteristics that determine the ease with which groundwater may be contaminated by human activities. It is usually dependent on the nature (sandy, gravely, clay, etc.,) and depth of soil/subsoil overlying an aquifer (i.e., its shallowness). The travel time, attenuation capacity of the subsoils (i.e., ability to filter contaminants) and the nature of the contaminants are also important elements in determining the vulnerability of groundwater.

In the context of groundwater protection, Groundwater Vulnerability is the most important factor in determining control measures in areas where potentially hazardous discharge to groundwater might take place. This is because the type, permeability and thickness of the soil and subsoil play a critical role in preventing groundwater contamination by acting as a protecting filtering layer over the groundwater.

The extent of site investigation works required to accurately assess the groundwater vulnerability at a site is determined by the sensitivity of hydrogeological receptors within the site vicinity. The extent of sampling requirements as defined by the hydrogeological sensitivity of the site is defined in **Table 8.4**.

Table 8.4: Summary of Sampling Requirements

Ground Water Protection Scheme (GWPS) exists	**Vulnerability**	**Sampling Requirements**
	LOW	Simple walkover survey to confirm what has been established in the GWPS, i.e., no evidence of outcrop, depth to bedrock information from wells, etc. [1] If walkover survey indicates that the lands do not have sufficient thickness of subsoil (i.e. rock outcrops) then site specific information may be required.
	MEDIUM	
	HIGH	
	EXTREME [2]	Regionally Important Aquifers - Prove that 2m depth of soil/subsoil cover exists. Minimum of 1 data point per hectare is required.
		Locally Important and Poor Aquifers – Prove that 1m depth of soil/subsoil cover exists. Minimum of 1 data point per 5 hectares is required.
Ground Water Protection Scheme (GWPS) does not exist	**Aquifer Type**	**Sampling Requirements**
	Locally Important / Poor Aquifers	Prove that 1m depth of soil/subsoil cover exists. Minimum of 1 data point per 5 hectares is required. Site investigation points can be based on existing information. New information only required where existing information is insufficient.
	Regionally Important Aquifers	Prove that 2m depth of soil/subsoil cover exists. Minimum of 1 data point per hectare is required. Site investigation points can be based on existing information. New information only required where existing information is insufficient.
Source Protection Areas [3]	**Source Protection Zone**	**Sampling Requirements**
	Outer	A minimum thickness of 3m of subsoil should be demonstrated at a minimum depth to rock data point frequency of one point per hectare.
	Inner	It is not generally acceptable to land-spread unless there is no alternative area available, and that the area has been defined as having moderate vulnerability (i.e. > 10m of moderate permeability subsoil or > 5m of low permeability subsoil) overlying the aquifer. The depth to rock should be demonstrated at a minimum frequency of one point per hectare.

[1] The classification to Low / Medium / High class as part of GWPS indicates that minimum of 3m soil/subsoil depth can be anticipated
[2] To give a rough picture of “extreme vulnerability” areas we can use: GSI Outcrop data & Teagasc Shallow Rock data
[3] In general land-spreading of organic wastes should not be carried out within the source protection area (SPA) of a water supply. However, there are cases where if the subsoil is sufficiently thick it may be deemed acceptable subject to conditions

8.4 Description of the Receiving Environment

8.4.1 Background

This section of the chapter provides the baseline information in relation to geology, hydrogeology and hydrology that exists in the vicinity of the Proposed Development. The Proposed Development occupies a total area of *ca*. 5.12ha and is situated in the townland of Ballyvass, Co. Kildare. The Proposed Development is situated to the west of the M9 motorway with agricultural lands to the north, west and south of the site. The road is adjoined to the east and north by a regional access road which adjoins a gravel pit located beyond the southern boundary of the site. The Proposed Development lies approximately 9.5km southeast of Athy town centre.

The underlying geology has a major influence on topographical, hydrogeological and hydrological features within the site vicinity, hence this chapter is closely linked to the previous chapter (**Chapter 7 – Soils & Geology**).

The receiving environment is described below under the following headings:

- Topography
- Drift (Quaternary) Geology
- Bedrock Geology
- Hydrology
- Hydrogeology

8.4.2 Topography

County Kildare's landscape consists of a central plain bordered to the east by the Kildare uplands, which lie at the base of the Wicklow and Dublin Mountains. This central plain includes the Curragh, the boglands of northwest Kildare, and the fertile lowlands in the south, with isolated hills such as the Chair of Kildare and the Newtown Hills adding variation to the otherwise flat terrain. Several rivers, including the Liffey, Barrow, and Boyne, along with the Royal and Grand Canals, traverse the county, contributing to its scenic and ecological features.

The county's varied landscape is shaped by its underlying geology. The central and western lowlands rest on easily eroded Carboniferous Limestone, while the more resistant Ordovician and Silurian rocks form the eastern uplands and the Chair of Kildare. The southern tip contains Leinster Granite, formed through geological intrusion 405 million years ago. The county's diverse terrain holds different capacities for development, with certain areas offering scenic views and natural features worthy of protection.

The Landscape Character Assessment undertaken to inform the review of the Kildare County Development Plan 2023-2029 has divided the county into 16 no. Landscape Character Areas based on the local landscape features which include:

1. Mouds Bog
2. Central Undulating Lands
3. Dun Ailinne
4. Chair of Kildare
5. Eastern Transition
6. Eastern Uplands

7. North-western Lowlands
8. Northern Hills
9. Northern Lowlands
10. Pollardstown Fen
11. River Barrow
12. River Liffey
13. South-eastern Uplands
14. Southern Lowlands
15. The Curragh
16. Western Boglands

The landscape character areas are further differentiated based on their landscape sensitivity, as shown in **Table 8.5**. The proposed site is located in the Eastern Transition Landscape Character Area (see **Figure 8.1**, overleaf), which falls under Class 2 – Medium Sensitivity.

Table 8.5: Landscape Sensitivity Classification of County Kildare landscape Character Areas, adapted from Kildare County Development Plan 2023-2029.

Sensitivity	Landscape Character Area	Description
Class 1 Low Sensitivity	North-Western Lowlands	Areas with the capacity to generally accommodate a wide range of uses without significant adverse effects on the appearance or character of the area
	Northern Lowlands	
	Central Undulating Lands	
	Southern Lowlands	
Class 2 Medium Sensitivity	Eastern Transition Lands	Areas with the capacity to accommodate a range of uses without significant adverse effects on the appearance or character of the landscape having regards to local*ise*d sensitivity factors.
	South-Eastern Uplands	
Class 3 High Sensitivity	Western Boglands	Areas with reduced capacity to accommodate uses without significant adverse effects on the appearance or character of the landscape having regard to prevalent sensitivity factors.
	Eastern Uplands	
Class 4 Special	Chair of Kildare	Significant adverse effects on the appearance or character of the landscape having regard to prevalent sensitivity factors.
	Northern Hills	
	River Liffey	
	River Barrow	
	Mouds Bog	
Class 5 Unique	The Curragh	Areas with low capacity to accommodate uses without significant adverse effects on the appearance or character of the landscape having regard to special sensitivity factors.
	Pollardstown Fen	
	Dun Ailinne	

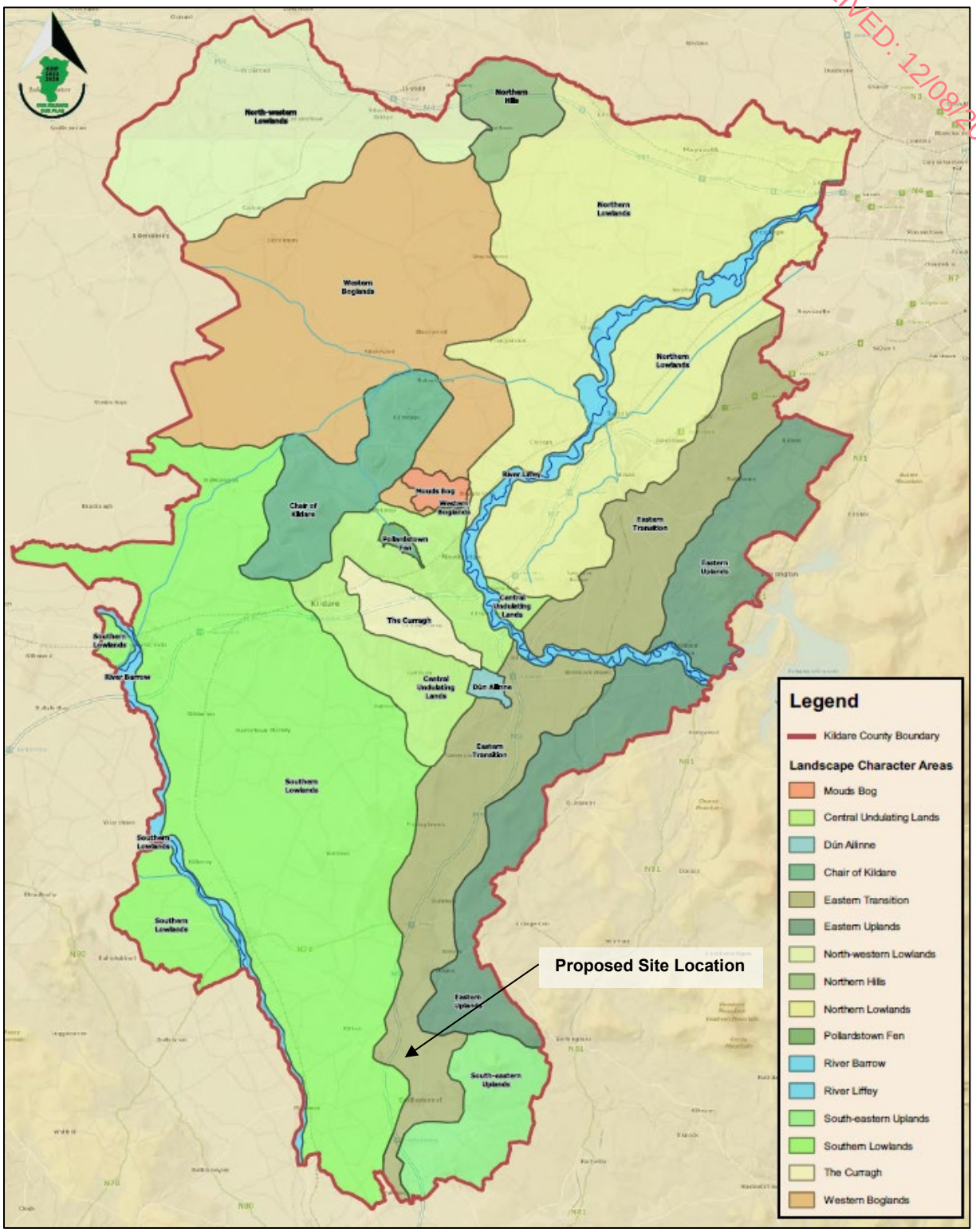

Figure 8.1: Landscape Character Areas (Map V1 – 13.1 of Chapter 13 of the Kildare County Development Plan 2023-2029)

According to the GSI Viewer the site is characterised as “Hummocky sediments”, in keeping with the Landscape Character Type description for the area.

The proposed site is located between two rivers, the Greese (approximately 1.6 km to the north) and the Graney (approximately 3.5 km to the south), which are distinct features in the landscape of southern Kildare. The site's topography exhibits a gradual upwards slope from north to south. A peak in the site's topography, at 89m OD, is situated along the southwestern boundary, with a gradual slope northward to a low of 81m OD along the northeastern boundary. The elevation at the proposed site entrance is 83m OD. The site topography is illustrated in **Figure 8.2**.

The access roads, the L8049 and an unnamed local road, remain relatively flat, ranging between 83m OD and 84m OD. To the west, a peak in the local topography reaches 140m OD, approximately 1 km from the site. Apart from this, the surrounding area does not show any considerable variation in terrain elevation.

Figure 8.2: Topographical map of the landscape surrounding the site (topographic-map.com)

8.4.3 Drift 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.

The drift geology of County Kildare is shaped by glacial deposits from the last Ice Age, consisting mainly of glacial till, fluvioglacial sands and gravels, alluvial sediments, and peat. Much of the county is covered by limestone-rich till, particularly in the central and northern

areas. Extensive sand and gravel deposits, formed by glacial meltwater, are found in areas such as Allenwood, Prosperous, and Rathangan, contributing to well-drained soils. Alluvial deposits, primarily along the rivers Liffey, Barrow, Greese, and Slate, consist of silt and clay-rich sediments that enhance soil fertility in the lowlands. Additionally, the Bog of Allen in western Kildare contains deep organic peat layers that developed over thousands of years in poorly drained conditions. These geological features influence the county's soil fertility, drainage, and land use.

The Proposed Development is located within landscape of hummocky sediments which extends to the north and southeast. To the east, this landscape gives way to rolling to gently undulating sediments which gradually transition to mountains / hills. The landscape to the west of the Proposed Development site is a lowland region forming a flat to undulating plain which extends to the foot of a mountain plateau region beyond the banks of the River Barrow, to which the River Greese adjoins as shown in **Figure 8.3.**

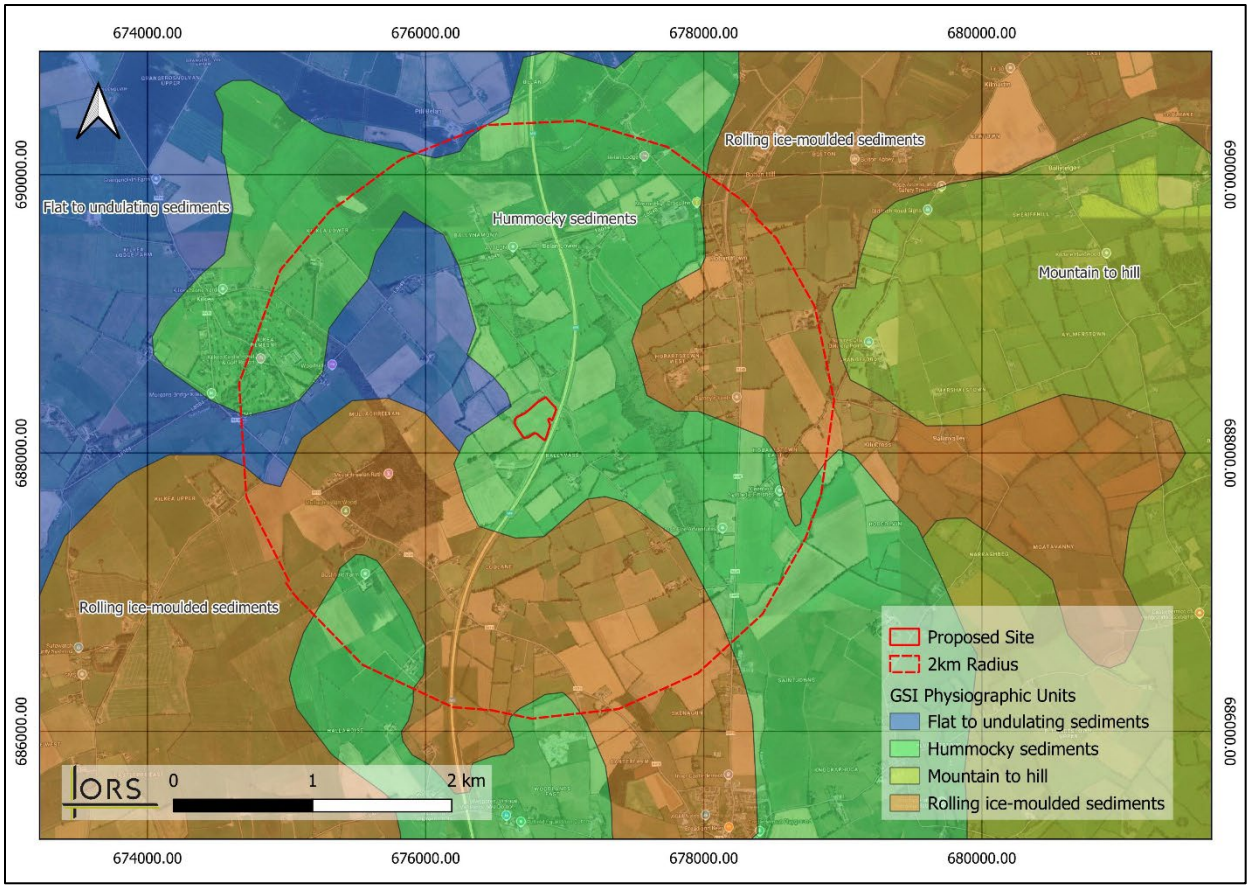

Figure 8.3: Physiographic Character of the site and surrounding landscape (GSI)

The Second Edition General Soil Map of Ireland describes this region as belonging to the "*flat to undulating lowland*" group of the broad physiographic divisions. The proposed site resides at the soil association denoted no. 35 which comprises grey brown podzolics (80%) with associated soils including Gleys (10%) and Brown Earths (10%). Parent material is proposed to consist of stony-limestone-glacial till. The majority of the proposed site overlays gravels derived from limestones.

8.4.4 Bedrock Geology

This sub-section deals with bedrock underlying the area. Bedrock is defined as a consolidated aggregate of minerals underlying the ground surface and any soils present. Above the bedrock is usually an area of broken and weathered unconsolidated rock in the basal subsoil. Sedimentary rock lies in beds which may comprise different rock types and which may be horizontal or inclined, so that the rock encountered at the ground surface may change over a short distance.

Kildare's geology is predominantly composed of sedimentary rocks, mainly Carboniferous limestone, which retain many of their original structures due to minimal folding. The county also contains minor igneous formations and the Tullow Granite Pluton, part of the larger Leinster Granite. The oldest rocks in Kildare, dating back to the Ordovician period (490–450 million years ago), are found in the Kildare Inlier, surrounded by younger formations. Silurian rocks (430 million years old) also appear in the southeast. Volcanic activity in the past formed islands at the Chair of Kildare and the Hill of Allen, which have since eroded into isolated hills, preserving volcanic rock and fossils from ancient marine life.

According to the Geological Survey of Ireland and the National Draft Generalised Bedrock Map, the bedrock within the 2km study area of the Proposed Development, which extends to the southwest is comprised of Silurian metasediments and volcanics. The region within the 2km study area of the Proposed Development is comprised of a variety of formations which consist of granites and other igneous intrusive rocks, early Dinantian period rocks as well as additional areas underlain by Silurian metasediments and volcanics.

The formation underlying the Proposed Development is known as the Tipperkevin Formation. The 1:100,000 Bedrock Solid Geology Map indicates that the bedrock type in this formation is greywacke and shale. The lithological description of the formation is "medium to fine grained greywacke sandstones or shales". Exposers of the formation can be found *ca.* 750m to the southwest of the Proposed Development site, towards the edge of the formation extending to the southwestern edge of the formation towards Mullaghreelan Wood.

The Quinagh Formation, located *ca.* 860m north of the proposed development, consists of mudstone, sandstone, and siltstone, with common dolomitisation and weathered granite clasts. Beyond this lies the Feighcullen Formation, composed of skeletal, oolitic, and micritic limestones, divided into four informal units. To the east, *ca.* 340m away, is the Glen Ding Formation, a chloritic, feldspathic greywacke, intersected by a fault running from northeast to southwest. Southeast, *ca.* 275m away, lies the Type 2 Equigranular Granite (Tullow Pluton) Formation, consisting of pale, fine to coarse-grained granite, positioned between the Glen Ding and Type 1 Granite (Tullow Pluton) formations. The Type 1 Granite Formation, about 330m south, contains fine-grained granodiorite to granite. Further west, *ca.* 990m from the site, is the Carrighill Formation, classified as calcareous greywacke, featuring greywacke, siltstones, and shales with a distinctive iron-rich dolomitic matrix.

The bedrock geology and linework on the 1:100,000 scale mapping from the GSI indicates that there are a number of geological linework (e.g. unconformity, faults etc.) within the 2km study area. The closest unconformity, a fault, is located *ca.* 250m east of the site and runs from northeast to southwest. The fault line which runs marks the beginning of the Glen Ding and Type 2 Equigranular Granite (Tullow Pluton) Formations to the east of the Proposed Development. The fault line also encroaches upon the Type 1 Granite (Tullow Pluton) Formation.

Local bedrock geology underlying and in the vicinity of the Proposed Development is illustrated in **Figure 8.4** overleaf.

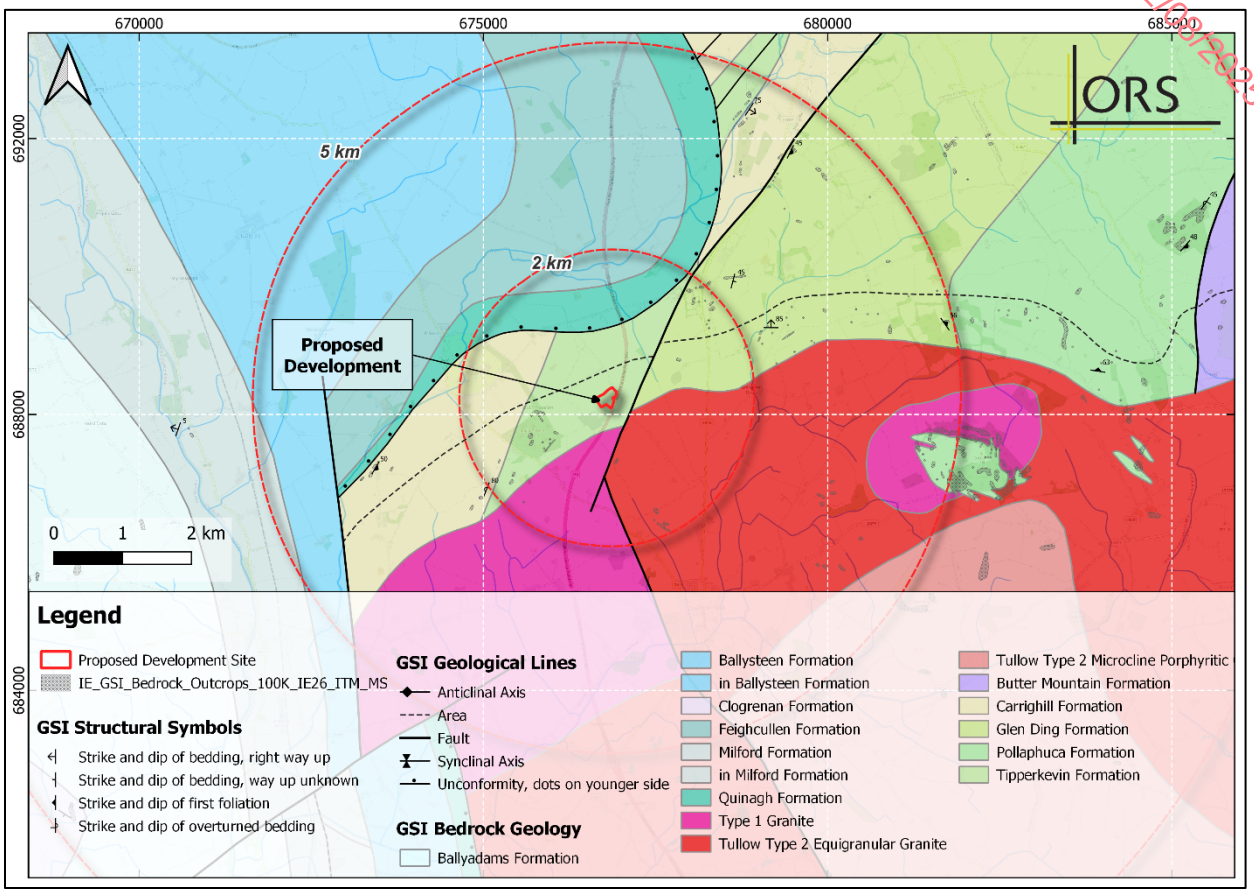

Figure 8.4: Local Bedrock Formations (GSI)

8.4.5 Hydrology

Regional Hydrology

A river basin is the area of land drained by a river, its tributaries, and their associated groundwaters and coastal waters. The Water Action Plan 2024, part of Ireland's third River Basin Management Plan, builds on lessons from previous initiatives and incorporates both immediate and long-term goals to meet EU and international environmental obligations. The plan outlines a comprehensive approach to restoring and protecting the country's water bodies, such as rivers, lakes, estuaries, coastal waters, and groundwater. This initiative aligns with the EU Water Framework Directive, aiming to achieve "good" ecological status for water bodies by 2027. The newly adapted Plan covers a single national River Basin District (RBD), which also includes two international RBDs shared with Northern Ireland.

The Irish RBD spans 70,273 km² and is divided into 46 catchment management units, further broken down into subcatchments. Agriculture dominates land use within the RBD, with 55% dedicated to pastures, 7% to agricultural land, 5% to arable land, and 1% to complex cultivation. Forestry makes up 6% of the land use, while Urban fabric represents only 2% of the area.

A catchment is a land area where all surface water converges toward a single point, such as a

river. The proposed site is located within the Barrow Catchment (Hydrometric Area 14), which spans an area of 3,025 km². This catchment encompasses the regions drained by the River Barrow upstream of the River Nore confluence and all streams entering tidal water between the Barrow railway bridge at Great Island and Ringwood, Co. Kilkenny. The largest urban centre in the catchment is Carlow. The other main urban centres in this catchment are New Ross, Graiguenamanagh, Athy, Portlaoise, Mountmellick, Portarlington, Monasterevin and Kildare.

The catchment features a complex geology, leading to a close interaction between surface water and groundwater. This geology supports a significant groundwater resource, as evidenced by the presence of 50 groundwater bodies. The catchment is further divided into 20 sub-catchments (illustrated in **Figure 8.5**) and includes 149 river water bodies and six transitional water bodies, in addition to the groundwater bodies.

The primary river in the catchment is the River Barrow, which has its source in the slopes of the Slieve Bloom Mountains. The river flows south through Monasterevin, where it meets the Stradbally and Kildoon Rivers. It continues through Athy, joining several tributaries, including the Greese, Lerr, and Burren Rivers near Carlow. Further south, it is fed by the Fushoge, Monefelim, and Gowran Rivers, with flood relief completed near Carlow in 2013. Near Borris, it receives waters from the Mountain, Ballyroughan Little, and Aughnavaud Rivers. The river meanders through a steep-sided valley, becoming tidal near Saint Mullin's before merging with the River Nore. It then flows through New Ross, entering the Suir Estuary at Cheekpoint.

The Nore flows east through Portarlington and is then joined by the Figile River from the north. The Figile River subcatchment includes the Cushina, Daingean and Slate Rivers. The area around Kildare Town is underlain by a highly productive gravel aquifer which discharges at Pollardstown Fen and into the River Slate.

Agriculture is the dominant land use throughout the Barrow Catchment, with farmland spread extensively across the catchment area. Wetlands and forested areas are also present, particularly in the northern part of the catchment.

The proposed development site, located in the townland of Ballyvass, Co. Kildare, falls within sub-catchment 14_9 of the Barrow Catchment, also known as the Greese_SC_010 sub-catchment, as shown in **Figure 8.5**.

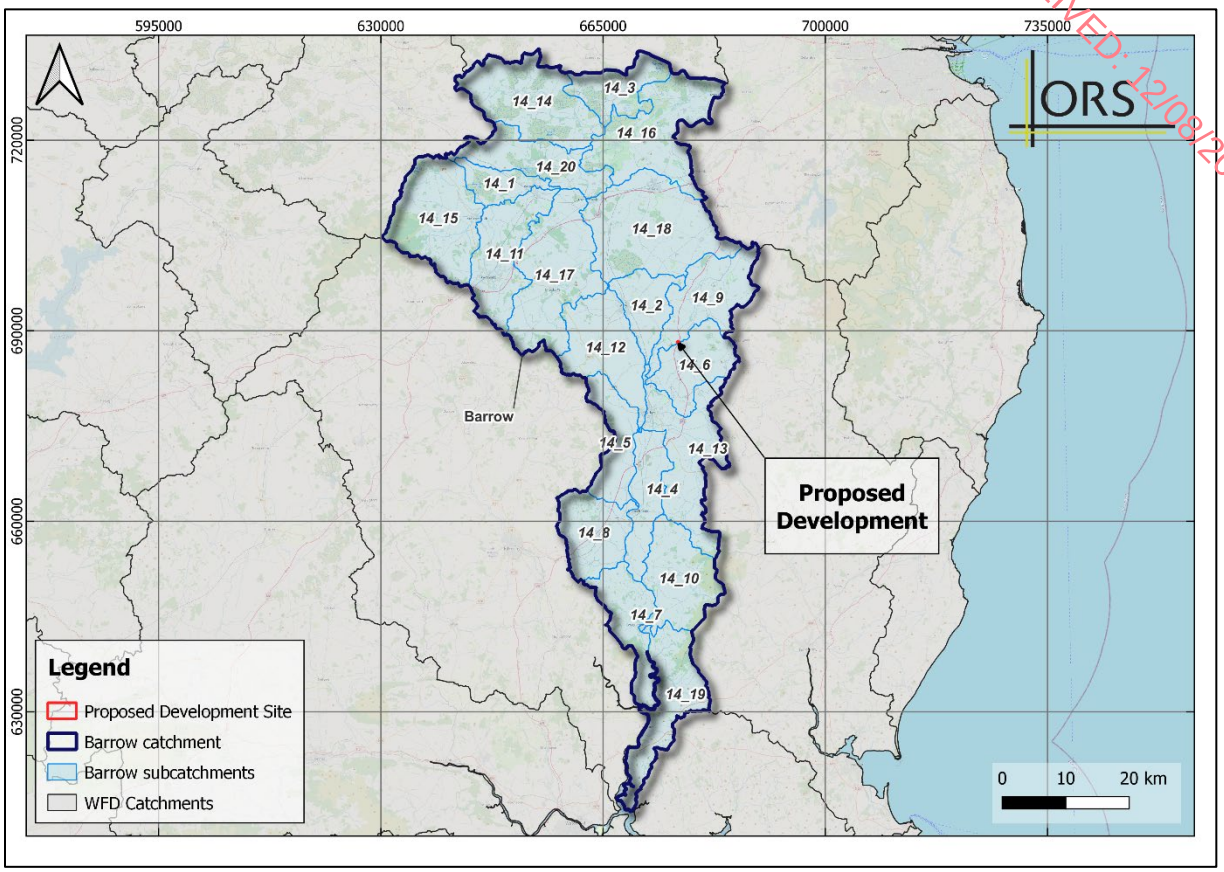

Figure 8.5: Barrow Catchment and Sub-Catchments (EPA maps).

Local Hydrology

The Ballynamony Stream (EPA name: BALLYNAMONY 14) is the primary hydrological feature near the site. The site naturally follows the surrounding topography and drains to this watercourse, which originates approximately 600m east of the site, as shown on EPA maps.

The Ballynamony Stream flows north for approximately 2.3 km before joining the River Greese, which moves west-southward and meets the River Barrow *ca.* 5 km upstream of Carlow. From there, the Barrow continues south for around 85 km before reaching the Suir Estuary at Cheekpoint. The total hydrological distance from the site to the confluence of the River Barrow and River Greese is *ca.* 14 km.

The site is bordered to the north by an existing watercourse that flows from west to east, this is not identified on EPA mapping but was noted during site visits and topographical surveying. The watercourse is likely a small tributary to the Greese River.

The site is also bordered by a drainage ditch along its western boundary. This ditch primarily serves to manage surface runoff from the site and surrounding areas, exhibiting irregular water flow patterns with intermittent dry periods due to limited or absent hydrological input. It functions solely as drainage feature, with no evidence of springs or significant water sources upstream.

Without proper mitigation measures, this ditch as well as the adjacent stream could potentially act as conduits for pollution from the Proposed Development, particularly during wetter conditions.

The area surrounding the site is primarily characterised by agricultural land, predominantly used as pastures and arable land. Scattered patches of forest and artificial surfaces areas are also present in the vicinity. The nearest wetland is located *ca.* 13 km northwest of the site, while the closest urban centre lies *ca.* 2.8 km to the south.

The subject site local hydrology is illustrated in **Figure 8.6** below.

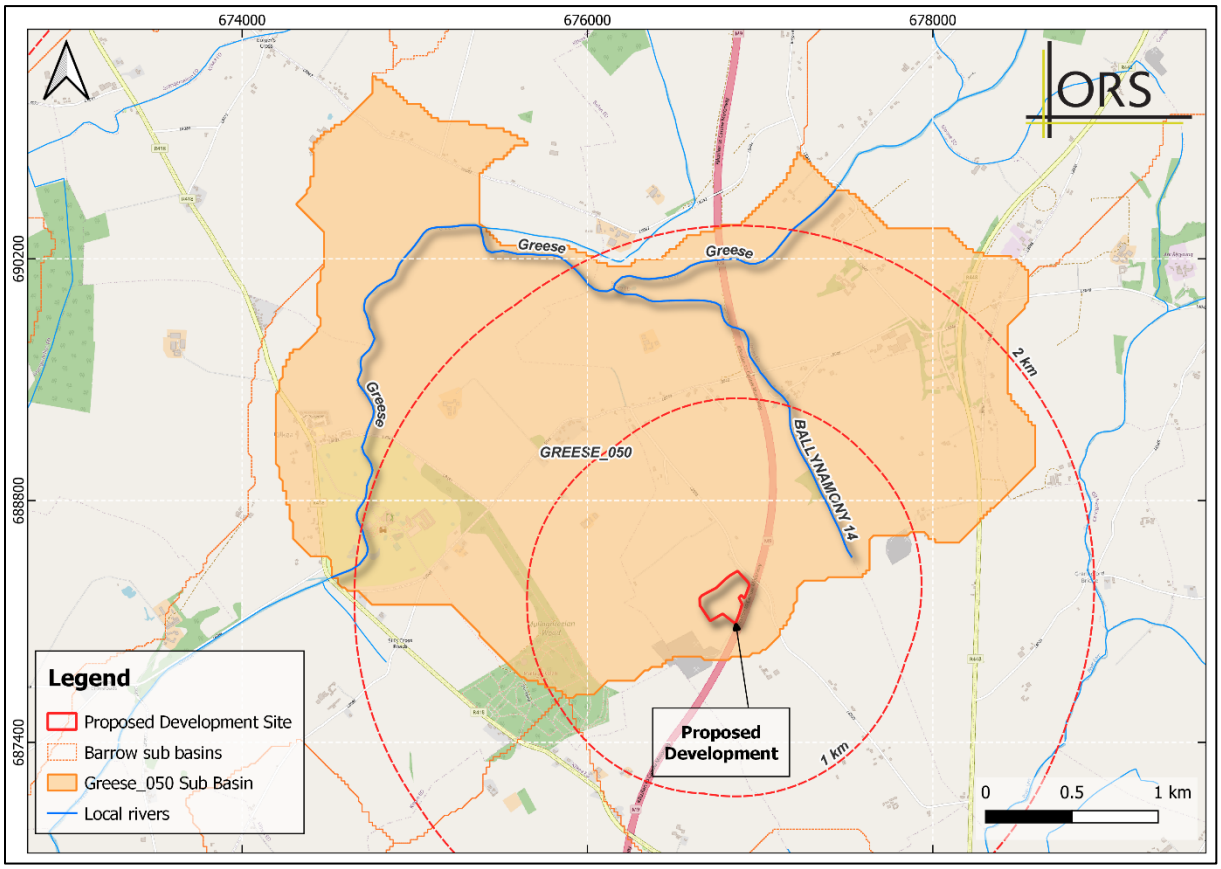

Figure 8.6: Local Hydrology (EPA).

Protected Areas

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 three Natura 2000 sites within the Zone of Influence of this Proposed Development site.

Figure 8.7 displays the spatial distribution of the Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Natural Heritage Areas (NHA) within the wider region. SAC are prime wildlife conservation areas in the country which are considered to be important on a country and European scale. Sites are selected and designated under the EU Habitats Directive and have been transposed into Irish law under EC (Birds and Natural Habitats) Regulation 2011 (S.I. No. 477/ 2011). Likewise, an SPA is an area selected for conservation due to its importance in the protection of rare or vulnerable bird species, migratory species, and wetlands. Sites are selected and protected under the EU Birds Directive.

The closest designated sites to the Proposed Development include the River Barrow and River

Nore SAC (Site Code: 002162) located *ca.* 1.9km southeast of the site. There are no additional designated sites within 2km of the site.

Taking into consideration the 'Source-Pathway-Receptor' model, the closest waterbody is the Ballynamoney stream located *ca.* 600m northeast of the Proposed Development. The stream runs from south to north, eventually crossing the M9 motorway and adjoining the River Greese *ca.* 2.3km downstream. The river Greese continues flowing to the west, eventually turning southwest and adjoins the River Barrow and River Nore SAC *ca.* 10.8km downstream. Thus, there is no direct hydrologic connectivity between the proposed development site and any European Designated sites.

An appraisal of the potential effects of the Proposed Development on the constitutive characteristics of European sites identified within 15km of the Proposed Development is set out in the Natura Impact Statement which accompanies the planning application for this project.

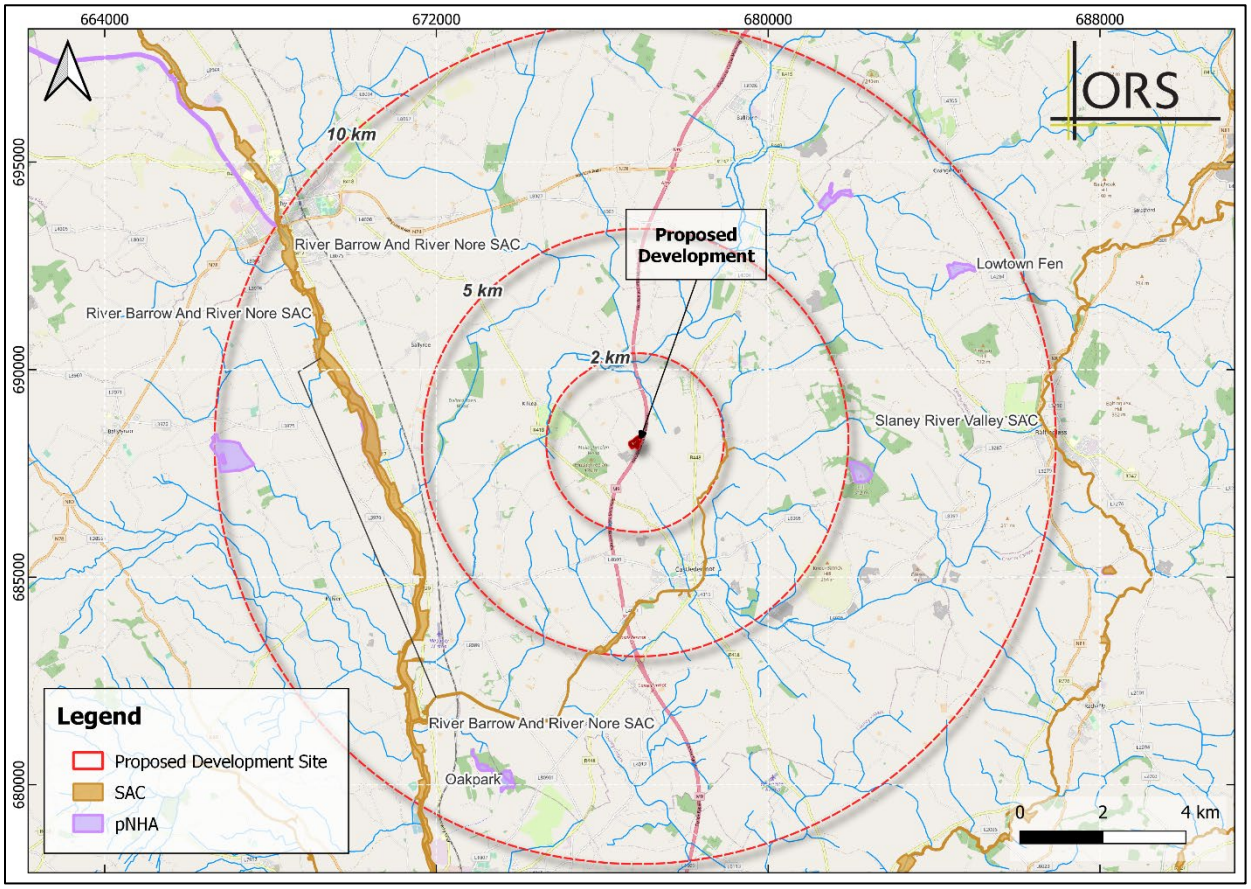

Figure 8.7: SPA, SAC and NHA sites within a 1km and 15km radius of site.

Site Drainage

Arterial Drainage Schemes are those that the Office of Public Works (OPW) is legally obligated to maintain. These schemes were established under the Arterial Drainage Act of 1945, primarily to enhance agricultural land and mitigate flooding. The works involved modifications to rivers, lakes, weirs, and bridges to improve water conveyance, the construction of embankments to control floodwater movement, and various other activities outlined in Part II of the Act. The main objectives of the schemes were to improve agricultural land, ensure that

flood levels up to a 3-year return period were contained within banks, and reduce waterlogging in adjacent lands (known as callows) by lowering water levels during the growing season. As a result, flood protection in the affected areas was significantly enhanced.

In addition, local authorities are responsible for maintaining Drainage Districts, with provisions for their management outlined in Part III and Part VIII of the Arterial Drainage Act, 1945.

According to the Arterial Drainage Scheme (ADS) and Drainage District (DD) maps, the proposed site is not located in close proximity to any drainage schemes or their benefitted lands. The nearest Drainage District channels, associated with the River Lerr, lie beyond a 3 km radius from the site and the site is not hydrologically connected to it. There is no Arterial Drainage Schemes in close proximity to the site.

Although the site is not immediately adjacent to these schemes, it is hydrologically connected to the Barrow Drainage Scheme's main channel, located along the River Barrow *ca.* 13.5 km downstream of the site. The locations of the schemes relative to the site are illustrated in **Figure 8.8** below.

Figure 8.8: Site drainage catchments (OPW)

The site's drainage system follows its natural topographical gradient, with surface water primarily flowing from southwest to northeast. During the site investigation, drainage ditches were identified along the northwestern and western boundaries, as shown in **Figure 8.9**.

A moderate flow of water was observed in the ditch along the northwestern boundary, which appeared to originate from nearby localised ponding on the site, as well as from subsurface runoff. Several instances of heavy rainfall prior to the site investigation likely contributed to soil saturation, leading to the ponding and water flow still observed during the works.

In contrast, the ditch along the site's western boundary showed no flow at the time of the investigation. The absence of flow, despite same weather conditions, can be attributed to the natural topography of the site, which directs water from southwest to northeast, resulting in water accumulation along the northern boundary.

Nevertheless, both ditches appear to function solely as a drainage channel during rainfall events and does not exhibit consistent or regular flow and thus does not meet the criteria to be classified as a watercourse.

Figure 8.9: On-site drainage ditches.

Surface Water Rate of Discharge

The permissible rate of discharge of surface water from the site is determined in accordance with criteria set out in the IH 124 report method (Institute of Hydrology). The IH 124 report found that Qbar can be estimated for small rural catchments (less than 25km^2) with the following equation:

$$Qbar_{rural} = 0.00108(AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$$

$Qbar_{rural}$ is the mean annual flood flow from a rural catchment (approximately 2.33-year return period).

AREA is the area of the catchment in hectares.

SAAR is the standard average annual rainfall.

SOIL is the soil index value based on the Winter Rainfall Acceptance Parameter (WRAP) as noted in the flood studies report. The SOIL index broadly describes infiltration potential and was derived by consideration of soil permeability, topographic slope and the likelihood of impermeable layers. The SOIL index value was determined as 0.4 based on onsite observations from the trial pits undertaken which categorised substrata as "Soil Type 3" – Intermediate Silty/Clay Soils.

Based on calculations for Qbar using the equation outlined above, the outflow from the sub catchments will be restricted to greenfield runoff rates as follows:

- Western service yard: 5.8 l/s
- Office and eastern service yard: 3.1 l/s
- Sump/Lower Level: 4.3 l/s

Kildare County Development Plan (2023 – 2029) – Flood Risk Management

A review of the Kildare County Development Plan was conducted to identify policies and objectives relevant to flood risk management across the region. Chapter 6, **Infrastructure & Environmental Services**, is particularly significant in this context. It highlights the importance of proactive land use planning and sustainable catchment management in minimising flood-related impacts. By identifying flood-prone areas and implementing measures to prevent developments from individually or cumulatively increasing flood risk, the plan ensures a responsible approach to flood management. Flood risk must be considered at every stage of the land use planning process and addressed in an environmentally sensitive manner.

The key sources of flood risk in Kildare are:

- **Fluvial:** Watercourse capacity is exceeded, or the channel is blocked and excess water spills from the channel onto adjacent floodplains.
- **Pluvial:** Resulting from high intensity rainfall which exceeds the infiltration capacity of the ground or drainage system to absorb it.
- **Groundwater:** Results when the level of water stored in the ground rises due to prolonged rainfall and flows out over the ground.

The County policies & objectives related to Flood Risk management are the following:

- ***IN O22:*** *Require the implementation of Sustainable Urban Drainage Systems (SuDS) and other nature-based surface water drainage as an integral part of all new development proposals.*
- ***IN O24:*** *Only consider underground retention solutions when all other options have been exhausted.*
- ***IN O28:*** *Ensure development proposals in rural areas demonstrate compliance with the following:*
    - *The ability of a site in an un-serviced area to accommodate an on- site wastewater disposal system in accordance with the County Kildare Groundwater Protection Scheme, and any other relevant documents and legislation as may be introduced during the Plan period.*
    - *The ability of a site in an un-serviced area to accommodate an appropriate on-site surface water management system in accordance with the policies of the Greater Dublin Strategic Drainage Study (2005), in particular those of Sustainable Urban Drainage Systems (SuDS).*

  - *The need to comply with the requirements of the Planning Systems and Flood Risk Management Guidelines for Planning Authorities, published by the Minister for the Environment, Heritage, and Local Government (2009).*
- ***IN P5:*** *Ensure the continued incorporation of Flood Risk Management and National Flood Risk Policy (2018) into the spatial planning of Kildare, to meet the requirements of the EU Floods Directive and the EU Water Framework Directive and to promote a climate resilient County.*
- ***IN O31:*** *Support and co-operate with the Office of Public Works (OPW) in delivering the Flood Relief/Alleviation schemes and measures contained in the Flood Risk Management Plans adopted by the Council in July 2018, and in other flood management works and schemes, as may arise, through the OPW Non-Coastal Minor Works Programme.*
- ***IN O32:*** *Support the implementation of the EU Flood Risk Directive (2007/60/EC) on the assessment and management of flood risks and the Flood Risk Regulations (SI No 122 of 2010).*
- ***IN O33:*** *Manage flood risk in the county in accordance with the sequential approach and requirements of the Planning System and Flood Risk Management Guidelines for Planning Authorities, DECLG and OPW (2009) and circular PL02/2014 (August 2014), when preparing plans, programmes, and assessing development proposals. To require, for lands identified in the Strategic Flood Risk Assessment, a site-specific Flood Risk Assessment to an appropriate level of detail, addressing all potential sources of flood risk, demonstrating compliance with the Guidelines or any updated version of these guidelines, paying particular attention to avoidance of known flood risk, residual flood risks and any proposed site-specific flood management measures.*
- ***IN O37:*** *Protect any implemented/constructed flood relief schemes from inappropriate development or otherwise.*
- ***IN O38:*** *Support Inland Fisheries Irelands' pilot projects to investigate the incorporation of habitat restoration measures into flood management schemes on the upper Barrow and its tributaries for native species such as salmon and to address invasive fish species, subject to all necessary planning and environmental assessments.*

Another key chapter of the Kildare CDP relevant to flood management is **Chapter 12 – Biodiversity & Green Infrastructure**. This chapter emphasises the role of natural ecosystems in mitigating flood risk and promoting sustainable water management. The following policies and objectives are particularly applicable to the proposed development.

- ***BI O47:*** *Ensure the protection, improvement or restoration of riverine floodplains and to promote strategic measures to accommodate flooding at appropriate locations including nature-based solutions, in order to protect ground and surface water quality and build resilience to climate change.*
- ***BI P8:*** *Ensure that Kildare's wetlands and watercourses are retained for their biodiversity, climate change mitigation properties and flood protection values and at a minimum to achieve and maintain at least good ecological status for all wetlands and watercourses in the county by, at the latest, 2027 in line with the Water Framework Directive and Ramsar Convention.*
- ***BI P15:*** *Promote and support the development of Sustainable Urban Drainage Systems (SuDS) to ensure surface water is drained in an environmentally friendly way by replicating natural systems.*
- ***BI O76:*** *Promote and support the development of Sustainable Urban Drainage Systems (SuDS) such as integrated constructed wetlands, permeable surfaces, filter strips, ponds, swales and basins at a site, district and county level and to maximise the amenity and bio-*

diversity value of these systems.

Kildare County Development Plan (2023-2029) – Strategic Flood Risk Assessment

Kildare County Council has conducted a Strategic Flood Risk Assessment (SFRA) as part of the County Development Plan (CDP), in accordance with the Flood Risk Management Guidelines (2009). The SFRA, a separate document intended to be read alongside the CDP, identifies and maps flood risks across the county, supporting a sequential approach to planning. It provides guidance for site-specific Flood Risk Assessments (FRA) and delivers a comprehensive evaluation of all flood risk types to inform strategic land-use decisions.

Given the subject site is not located within Flood Zones A or B, no further information is available for its specific location. For developments within Flood Zone C, the SFRA outlines the necessity of at least a Stage 1 FRA to screen for potential indirect flood risks. If risks cannot be ruled out, the assessment should progress to Stage 2 and/or Stage 3, as required. The screening should evaluate potential flooding impacts, including residual risks and climate change effects. Mitigation measures should be identified, such as:

- Setting finished floor levels above the 1% AEP fluvial event, accounting for climate change and freeboard.
- Installing trash screens, periodic channel maintenance, or flood relief pipes where necessary.
- Providing emergency ingress and egress routes in flood-prone areas.

All development proposals must assess surface water flood risks within drainage designs and include a Surface Water Management Plan with the following requirements:

- Prioritisation of Nature-Based Solutions for surface water management, with groundwater monitoring (if required) lasting at least six months, including a winter season.
- Submission of a detailed Surface Water Management Plan, including location, design, and future maintenance procedures.
- Compliance with Greater Dublin Drainage Strategy (GDSDS) – Volume 2, Chapter 6: Stormwater Drainage Design Criteria; CIRIA SuDS Manual (C753); and Nature-Based Solutions for Rainwater & Surface Water Runoff Best Practice Guidance (2021, DHLGH).
- If Nature-Based Solutions are deemed unfeasible, detailed justification must be provided. Traditional drainage systems will only be permitted in exceptional circumstances.
- Sustainable Drainage Systems (SuDS) should not form part of public open space unless they significantly enhance design quality. In such cases, SuDS can account for a maximum of 10% of open space provision.
- Underground attenuation storage structures will not be permitted under public open spaces, except in exceptional cases.
- Existing watercourses must be retained, and any culverted pipework should be "de-culverted" where feasible.

Agricultural developments must demonstrate that they do not significantly impact Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Natural Heritage Areas (NHAs), High Amenity Landscapes, Key Scenic Views & Prospects, Heritage & Cultural Sites, or areas at risk of flooding. Additionally, planning applications must include measures to prevent surface water runoff onto public roads.

Flood Risk

According to OPW, the main sources of flooding are rainfall (Inland flooding) or higher sea levels (Coastal Flooding). The principal pathways include rivers, drains, sewers, overland flow and river and coastal floodplains. The receptors may include people, their property, and the environment. To accurately determine the potential consequences of flooding, it is essential to assess these three elements – sources, pathways, and receptors - alongside the vulnerability and exposure of receptors.

The Office of Public Works (OPW) and Department of Environment, Heritage and Local Government (DoHLG) published 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' in 2009 (The Guidelines). The Guidelines define the likelihood of flooding is the probability or frequency of a flood of a specific magnitude or severity occurring or being exceeded in any given year. It is generally expressed as the chance of a particular flood level being exceeded in one year. This return period is described as the Annual Exceedance Probability (AEP). For example, a 1 in 100 or 1% flood is that which would, on average, be expected to occur once in 100 years, though it could happen at any time.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types or levels of flood zones defined for the purposes of the Guidelines:

- **Flood Zone A** – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- **Flood Zone B** – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
- **Flood Zone C** – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

In 2018, the Office of Public Works (OPW) launched a new online flood map viewer to provide information on the likelihood of flood risk and the extent of flooding across Ireland. This viewer includes flood risk data derived from several sources including:

1. ***Catchment Flood Risk Assessment and Management (CFRAM) Programme:*** 300 communities at potentially significant flood risk, referred to as Areas for Further Assessment (AFA's).
2. ***National Indicative Fluvial Mapping (NIFM):*** Predictive flood maps showing indicative areas predicted to be inundated during a theoretical fluvial flood event with an estimated probability of occurrence. Indicative flood maps have been produced for all watercourses that are on the EPA watercourse layers, have a catchment area greater than 5km^2 and for which flood maps were not produced under the National CFRAM Programme.
3. ***Geological Survey Ireland Groundwater Flooding:*** Probabilistic flood extent of groundwater flooding in limestone regions. These maps are focused primarily (but not entirely) on flooding at seasonally flooded wetlands known as turloughs.
4. ***Past Flood Events:*** A Past Flood Event is defined as the occurrence of recorded flooding at a given location on a given date or on a recurring basis. The event is derived from available flood information documentation including flood event reports, news articles, archive information and photos.

The Preliminary Flood Risk Assessment (PFRA) conducted a national screening exercise using available and easily derivable data to identify areas with significant flood risks, known as Areas

for Further Assessment (AFAs). The PFRA report does not identify any areas with significant groundwater or pluvial flood risks near the proposed site. In terms of fluvial flooding, the site is outside the flood mapping extents to the southeast, where Castledermot (located 3.3 km away) has a flood risk index of 1563 due to the River Lerr, and to the northwest, where Athy (located 10 km away) has a flood risk index of 7113 due to flooding from the River Barrow. These areas are assessed under the 1% AEP fluvial flood event, and given the site's distance from these locations, it can be concluded that the risk of fluvial flooding at the site is low. Coastal flooding is not a relevant consideration for this project.

Based on this assessment, Ballyvass is not designated as an Area or Potential Area for Further Assessment (AFA). As a result, no detailed flood data is available for the area. Given that the proposed development site is not identified as a high-risk flood zone in the PFRA, it can be concluded that the site lies within Flood Zone C, where the likelihood of flooding is considered low.

The National Indicative Fluvial Maps (NIFM) have been created to identify areas where further assessment would be required if development is being considered within or adjacent to the flood extents shown on the maps. These maps are ‘predictive’ flood maps showing indicative areas predicted to be inundated during a theoretical fluvial flood event with an estimated probability of occurrence.

The NIFM fluvial flood extents for the Present-Day scenario, covering annual exceedance probabilities of 0.1% and 1%, indicate areas prone to flooding *ca.* 1 km southwest and 1.3 km north of the site, respectively. The mid-range and high-end future scenario maps do not show a significant extension of these floods towards the site. Therefore, it can be concluded that the proposed site is situated in an area with less than a 0.1% probability of flooding, classifying it as Flood Zone C.

A summary of the above-noted surface flood risk data as derived from the OPW map viewer within the vicinity of the site is presented in **Figure 8.10**.

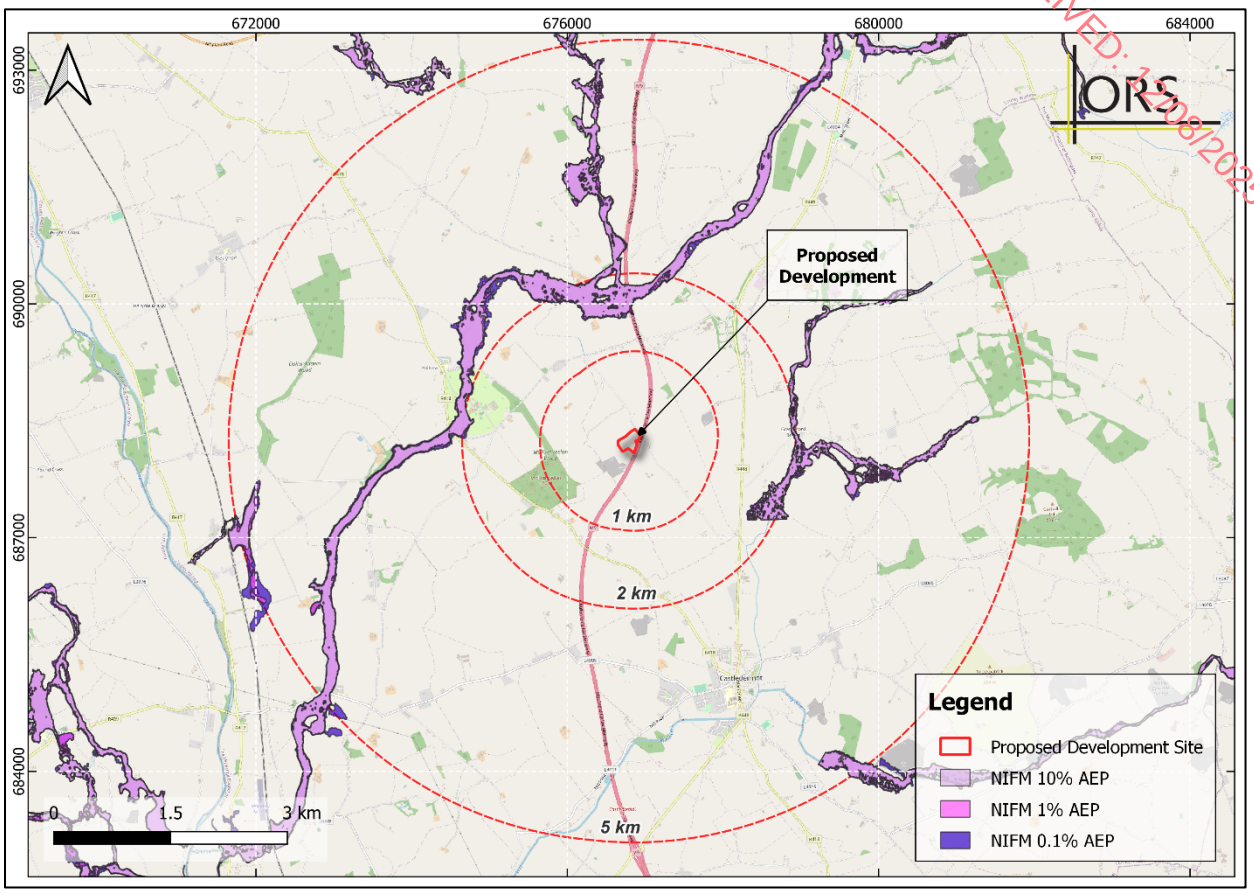

Figure 8.10: NIFM Flood extends in relation to the Proposed Development (Source: OPW).

The Synthetic Aperture Radar (SAR) Seasonal Flood Maps indicate historic groundwater flooding *ca.* 850m south of the site (Flood ID 18,522) with medium confidence. These maps show observed flood extents between Autumn 2015 and Summer 2021, created using SAR images from the Copernicus Programme Sentinel-1 satellites. The flood extents were generated using Python 2.7 algorithms developed by the Geological Survey Ireland and refined through post-processing filters. While the maps depict actual observed flood events, the absence of flooding in certain areas only means that flooding was not observed, not that it is impossible in the future.

Kildare County Development Plan (2023 – 2029) – Water Quality

A review of the Kildare County Development Plan was conducted to identify policies and objectives related to the preservation and protection of water quality across the region. The policies relevant to the proposed development are outlined below.

Chapter 6 – Infrastructure & Environmental Services:

- ***IN P2:*** *Ensure the protection and enhancement of water quality throughout Kildare in accordance with the EU WFD and facilitate the implementation of the associated programme of measures in the River Basin Management Plan 2018-2021 (and subsequent updates).*
- ***IN O3:*** *Promote water conservation and best practice water conservation in all developments, including rainwater harvesting and grey water recycling.*

- ***IN O5:*** *Manage, protect, and enhance surface water and groundwater quality to meet the requirements of the EU Water Framework Directive.*
- ***IN O10:*** *Work with the Local Authority Waters Programme (LAWPRO) to identify issues affecting water quality in Kildare.*
- ***IN O13:*** *Ensure that adequate wastewater services will be available to service development prior to the granting of planning permission and to require developers to provide evidence of consultation with Irish Water regarding capacity in the network prior to applying for planning permission.*
- ***IN O16:*** *Prohibit the discharge of additional surface water to combined (foul and surface water) sewers to maximise the capacity of existing collection systems for foul water.*
- ***IN P4:*** *Ensure adequate surface water drainage systems are in place which meet the requirements of the EU Water Framework Directive and the River Basin Management Plan in order to promote the use of Sustainable Drainage Systems.*
- ***IN O22:*** *Require the implementation of Sustainable Urban Drainage Systems (SuDS) and other nature-based surface water drainage as an integral part of all new development proposals.*
- ***IN O23:*** *Require new developments to reduce the generation of storm water run- off and ensure all storm water generated is disposed of on-site OR attenuated and treated prior to discharge to an approved water system, with consideration for the following:*
    - *The infiltration into the ground through the provision of porous pavement such as permeable paving, swales, and detention basins.*
    - *The holding of water in storage areas through the construction of green roofs, rainwater harvesting, detention basins, ponds, and wetlands.*
    - *The slow-down in the movement of water.*
- ***IN O28:*** *Ensure development proposals in rural areas demonstrate compliance with the following:*
    - *The ability of a site in an un-serviced area to accommodate an on- site wastewater disposal system in accordance with the County Kildare Groundwater Protection Scheme, and any other relevant documents and legislation as may be introduced during the Plan period.*
    - *The ability of a site in an un-serviced area to accommodate an appropriate on-site surface water management system in accordance with the policies of the Greater Dublin Strategic Drainage Study (2005), in particular those of Sustainable Urban Drainage Systems (SuDS).*
    - *The need to comply with the requirements of the Planning Systems and Flood Risk Management Guidelines for Planning Authorities, published by the Minister for the Environment, Heritage, and Local Government (2009).*
- ***IN P7:*** *Support the implementation of the Water Framework Directive, the River Basin Management Plan, and the Local Authority Waters Programme in achieving and maintaining at least good ecological status for all water bodies in the county.*
- ***IN O56:*** *Protect water quality from pollution by agricultural sources and to promote the use of good farming practices in accordance with the Nitrates Directive (91/676/EEC) and Ireland's Nitrates Action Programme 2017- 2021 (including any subsequent update).*
- ***IN O57:*** *Assess applications for developments, having regard to the impact on the quality of surface waters and any targets and measures set out in the River Basin Management Plan and any subsequent local or regional plans. Where developments have the potential to impact the water qualify of surface waters and/or any of the targets and measures set out in the RBMP, such a project should be subject to AA screening and where applicable, Stage 2 AA.*
- ***IN O58:*** *Require development proposals which may have an impact on water quality to*

undertake site specific assessments to determine localised pressures and demonstrate suitable mitigation measures to protect water quality.

Chapter 9 – Our Rural Economy:

- ***RD O10:*** *Encourage the development of environmentally sustainable agricultural practices, to ensure that development does not impinge on the visual amenity of the countryside and that the quality of the natural environment (watercourses, wildlife habitats and areas of ecological importance) is maintained and protected from the threat of pollution to support the achievement of climate targets.*

Chapter 12 – Biodiversity & Green Infrastructure:

- ***BI P7:*** *Recognise and promote inland waters, natural environmental assets and to protect rivers, streams and other watercourses and, wherever possible, maintain them in an open state capable of providing suitable habitats for fauna and flora while discouraging culverting or realignment.*
- ***BI O37:*** *Ensure the protection of rivers, streams and other watercourses and, wherever possible, maintain them in an open state capable of providing suitable habitats for fauna and flora while discouraging culverting or realignment. Endeavour to re-open previously culverted streams and watercourses through any future development/redevelopment proposals.*
- ***BI O45:*** *Ensure that any runoff from developed areas does not result in any deterioration of downstream watercourses or habitats and require that pollution generated by a development is treated within the development area prior to discharge to local watercourses.*
- ***BI O47:*** *Ensure the protection, improvement or restoration of riverine floodplains and to promote strategic measures to accommodate flooding at appropriate locations including nature-based solutions, in order to protect ground and surface water quality and build resilience to climate change.*
- ***BI P8:*** *Ensure that Kildare's wetlands and watercourses are retained for their biodiversity, climate change mitigation properties and flood protection values and at a minimum to achieve and maintain at least good ecological status for all wetlands and watercourses in the county by, at the latest, 2027 in line with the Water Framework Directive and Ramsar Convention.*
- ***BI O75:*** *Require multifunctional open space provision within all new developments; this includes provision for ecology and sustainable water management.*
- ***BI P15:*** *Promote and support the development of Sustainable Urban Drainage Systems (SuDS) to ensure surface water is drained in an environmentally friendly way by replicating natural systems.*

8.4.6 Biological Water Quality

National surveys of Irish rivers have taken place on a continuous basis since 1971. The National Rivers Monitoring Programme was replaced by the Water Framework Monitoring Programme from 22 December 2006. As part of the Water Framework Directive (WFD) Monitoring Programme approximately one third of our major rivers and their more important tributaries are surveyed and assessed each year by EPA ecologists. A complete survey cycle is completed every three years. The sites are scored on a five-point system developed by the EPA called the Biological Q-Rating system. Macroinvertebrate data is utilised to ascertain the biological quality of a given river or stream as detailed in **Table 8.2** at the beginning of this chapter.

Biological Q-values and physico-chemical data are unavailable for the Ballynamony Stream. However, the relevant EPA monitoring stations are located along the River Greese, both upstream and downstream of its confluence with the Ballynamony Stream. This data provides a sufficient basis for characterising the local hydrology. **Table 8.6** outlines the monitoring stations relevant to the proposed development, including their associated Q-Ratings, while **Figure 8.11** illustrates their locations relative to the site.

Table 8.6: Upstream and downstream Biological Q-Ratings for River Greese (EPA)

Station ID (EPA)	Station Name	Year								
		2000	2003	2006	2009	2011	2014	2017	2020	2023
RS14G040350	Br NE of Belan House	3	3	3	3	4	3-4	3-4	3-4	3-4
RS14G040400	Kilkea Br	3-4	3	3-4	3	3	3-4	3-4	3-4	3

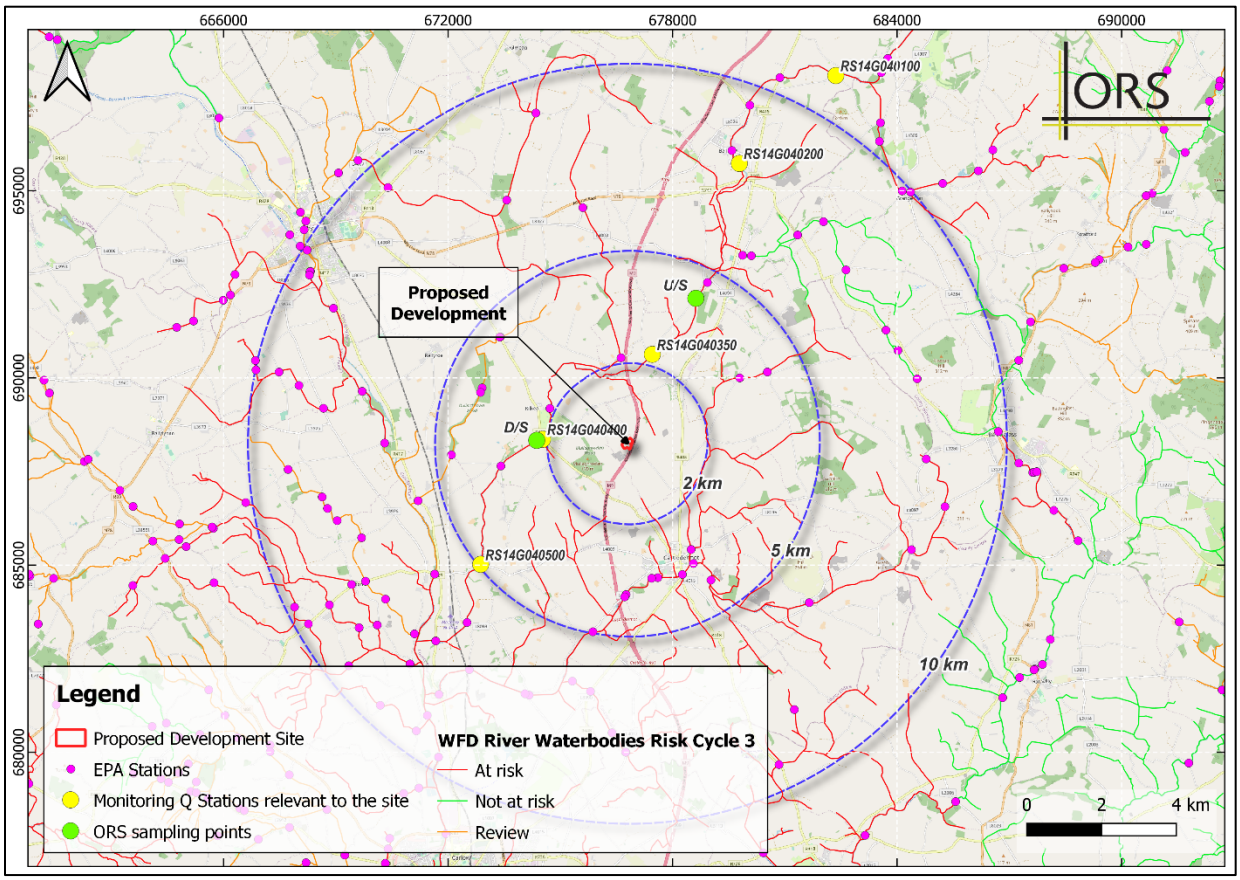

Figure 8.11: Water Framework Directive Risk and locations of water quality monitoring stations (EPA maps)

EPA water monitoring stations **RS14G040350** and **RS14G040400** are located on the River Greese, approximately 4.6 km upstream and 6.73 km downstream, respectively, from the site. Historical Q-value data from these stations indicate consistent trends, generally fluctuating between 3 and 4.

Since 2014, Station **RS14G040350** has recorded Q-ratings of 3-4, indicating stable water quality upstream of the Ballynamony Stream. This corresponds to a *Moderate* status under the Water Framework Directive (WFD) and is classified as *Slightly Polluted* by EPA standards,

reflecting unsatisfactory water quality.

Similarly, Station **RS14G040400** has maintained comparable Q-ratings, except for the most recent assessment (August–September 2023), which recorded a Q-rating of 3. This rating corresponds to a *Poor* status under the WFD and is classified as *Moderately Polluted* by EPA standards, indicating further deterioration in water quality.

The EPA River Biological Quality Survey concludes that, as of 2023, the River Greese remains in an unsatisfactory condition along its entire length. Water quality at stations **RS14G040100** and **RS14G040400** declined from Moderate to Poor, while **RS14G040200** showed improvement to Moderate. All other monitoring stations recorded no significant change.

The nearest section of the River Greese to the site (EPA designation: GREESE_050), along with its tributaries, including the Ballynamony Stream, is classified as having a *Moderate* status under the Water Framework Directive (WFD) and is considered *at risk*, according to EPA maps (River Waterbody WFD Status 2016–2021). The Cycle 3 HA 14 Barrow Catchment Report (published in May 2024) identifies agriculture as a significant pressure affecting this waterbody, with morphological issues and unknown impact types being the predominant concerns.

The 3rd Cycle Draft Barrow Catchment Report (HA 14) from 2021 highlights that the Greese is the most important salmon tributary of the Barrow system and a prime trout fishing location. However, fish passage restrictions and hydro-morphological issues exist throughout the catchment. As a result, in 2024, this area was designated as an Area for Action – Restoration (AFA**)** under the Local Authorities Waters Programme (LAWPRO) as part of the 3rd Cycle Barrow Catchment Study. This designation prioritises targeted restoration actions that complement existing measures, with multiple agencies collaborating to improve water quality. The key organisations leading this effort include LAWPRO, local authorities, and the National Federation of Group Water Schemes.

According to Catchments.ie, the program aims to restore 10 waterbodies within the Greese_SC_010 sub-catchment. Restoration efforts began in 2022 and are ongoing, though no official reports are available at this time.

Based on the available data, waterbodies near the site have exhibited considerable fluctuations in quality across multiple monitoring cycles, ranging from *Good* to *Poor* status, though predominantly maintaining a *Moderate* status over the past decade. The last monitoring cycle though have highlighted a decline in water quality, resulting in the waterbody being classified as "at risk."

8.4.7 Hydrochemistry Data

The nearest section of the River Greese to the site — designated by the EPA as GREESE_050 — along with its tributaries, including the Ballynamony Stream, is classified as having *Moderate* status under the Water Framework Directive (WFD) and is considered *at risk*, according to EPA mapping data (River Waterbody WFD Status 2016–2021). Detailed information specific to the Ballynamony Stream is not available. Instead, this stream is included as part of the broader GREESE_050 overview, as summarised in **Table 8.7.**

Table 8.7: Description of Receiving Waters – Greese_050 (Catchments.ie)

Characteristic	Classification	Status	Interpretation
Receiving Waterbody Name	Greese_050	At risk	Receiving Waterbody is the GREESE_060, which has a Moderate WFD Status. Inputting Surface Waterbodies include the GREESE_040 and BURTOWN STREAM_010, both of which are classified as having a Moderate, WFD Status.
Waterbody Type	River	-	-
WFD Status	SW 2016-2021	Moderate	The waterbody has shown consistent water quality since the SW 2010–2012 monitoring cycle, with an overall improvement from Poor to Moderate status when comparing with earlier cycles. However, the most recent data collected in 2023 suggests a decline in water quality, indicating a potential deterioration from the earlier improvement. As per past Catchment Reports, the stream is mostly impacted by agricultural activities in the surrounding area.
Resource	Not Classified		No drinking water abstractions and no abstractions pressures registered for Greese_050.
Hydromorphological Conditions	Not classified	N/A	Hydromorphological Conditions is not included in the Planned Monitoring for this station.
Chemical SW Status	Not classified	N/A	Chemical Surface Water Status is not included in the Planned Monitoring for this station.
Biological Status	Macrophyte Status or Potential	N/A	The monitoring programme for Greese_050 focuses solely on Invertebrate Status or Potential (Q-value). Historical data since 2010 indicate a consistently moderate water quality, with Q-values equal to 3-4. However, the most recent Q-rating, recorded in August 2023, reveals a decline in water quality compared to the previous monitoring cycle. Macrophyte, Phytobenthos, and Fish Status are not included in the Planned Monitoring for this station.
	Invertebrate Status or Potential	Moderate	
	Phytobenthos Status or Potential	N/A	
	Fish Status or Potential	N/A	
Supporting Chemistry Conditions	Oxygenation Conditions	N/A	Chemical monitoring is not included in the Planned Monitoring for this station.
	Nitrogen		
	Phosphorus		
	Other Nutrients		
	Specific Pollutant Conditions		

As hydrochemical data for GREESE_050 is currently unavailable, water quality information from other designated sections of the same river—GREESE_030 and GREESE_040 upstream,

and GREESE_060 downstream—was used to inform this analysis. The GREESE_030 section is monitored by station **RS14G040200**, located *ca.* 10.4 km upstream of the site. The GREESE_040 section is monitored by station **RS14G040350**, situated *ca.* 4.6 km upstream of the same confluence. Downstream, the GREESE_060 section is monitored by station **RS14G040500**, located *ca.* 10.9 km from the subject site. **Table 8.8** below presents the 10-year average background concentrations for these monitoring stations. The location of these stations in relation to the subject site can be seen in **Figure 8.11**.

Table 8.8: EPA Hydrochemistry data for both upstream and downstream points on River Greese (Source: Cacthment.ie)

Monitoring Station	Parameter	Unit	Average	River Waterbodies Risk	River Waterbody WFD Status 2016-2021
RS14G040200 (GREESE_030)	Ammonia-Total	mg/l as N	0.05	At risk	Poor
	BOD - 5 days (Total)	mg/l	1.71		
	Dissolved Oxygen	mg/l	10.88		
	Nitrate	mg/l as N	5.02		
	Nitrite	mg/l as N	0.02		
	Orthophosphate	mg/l as P	0.04		
	pH	pH units	8.09		
	Total Oxidised Nitrogen	mg/l as N	5.11		
RS14G040350 (GREESE_040)	BOD - 5 days (Total)	mg/l	1.50	At risk	Moderate
	Nitrate	mg/l as N	5.42		
	Nitrite	mg/l as N	0.02		
	Orthophosphate	mg/l as P	0.03		
	Total Oxidised Nitrogen	mg/l as N	5.39		
RS14G040500 (GREESE_060)	Ammonia-Total	mg/l as N	0.03	At risk	Moderate
	BOD - 5 days (Total)	mg/l	1.36		
	Dissolved Oxygen	mg/l	11.44		
	Nitrate	mg/l as N	5.13		
	Nitrite	mg/l as N	0.01		
	ortho-Phosphate	mg/l as P	0.04		
	pH	pH units	8.2		
	Total Oxidised Nitrogen	mg/l as N	5.21		

On 16th April 2025, ORS collected baseline water samples from the River Greese at locations upstream (U/S) and downstream (D/S) of the proposed development. The locations of the collection points relative to the site are illustrated in **Figure 8.11** and are indicated by green markers. The samples were analysed at an accredited laboratory (Fitz Scientific), with the results presented in **Table 8.9**.

Table 8.9: Hydrochemistry results (U/S and D/S of Proposed Development – River Greese)

Sampling Location	Parameter	Unit	Result
Site 2 – D/S	Ammonia	mg/l as N	0.03
	BOD	mg/l	5.5
	COD	mg/l	53
	Nitrogen (Total Oxidised)	mg/l as N	5.28
	Nitrate (surface water)	mg/l as N	5.26
	Nitrite (surface water)	mg/l as N	0.014
	pH	pH units	8.05
	Orthophosphate	mg/l as P	<0.01
	Total Suspended Solids	mg/l	147
Site 1 – U/S	Ammonia	mg/l as N	0.11
	BOD	mg/l	1.8
	COD	mg/l	10
	Nitrogen (Total Oxidised)	mg/l as N	5.16
	Nitrate (surface water)	mg/l as N	5.15
	Nitrite (surface water)	mg/l as N	0.017
	pH	pH units	8.22
	Orthophosphate	mg/l as P	0.04
	Total Suspended Solids	mg/l	12

The results indicate that the waterbody does not meet the criteria for achieving 'Good' status under the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019. This finding is consistent with EPA data presented above.

It is noted that the hydrochemistry results for the downstream sample suggest elevated values for all parameters measured relative to the upstream sample. The downstream (D/S) sampling point is located immediately beyond a small residential area, which includes a hotel and a golf course, which may contribute to the elevated concentrations observed in certain parameters, potentially due to surface runoff or localised discharges. However, it is important to recognise that this conclusion is based on a single measurement and may not fully represent the overall or current condition of this surface waterbody.

Furthermore, as the Proposed Development will not involve any process discharges, no adverse impact on local hydrology or downstream receptors is anticipated.

8.4.8 Hydrogeology

Regional & Local Hydrogeology

Hydrogeology is the study of groundwater, including its origin, occurrence, movement and quality. Rocks which store and transmit groundwater are known as bedrock aquifers. Different bedrock types have differing abilities to store and transmit water, depending on their permeability and fracture intensity. The Geological Survey of Ireland has classified all aquifers

in Ireland in three main categories based on potential yield and extent:

- Regionally Important
- Locally Important
- Poor

Kildare County's hydrogeology is primarily shaped by its underlying limestone bedrock, which supports productive aquifers supplying groundwater for domestic, agricultural, and industrial use. The region is predominantly underlain by karstified limestone aquifers, particularly in the central and western areas, where groundwater movement is controlled by fractures, conduits, and dissolution features. These highly permeable aquifers serve as valuable water sources but are also highly susceptible to contamination from surface activities due to their rapid recharge rates.

In contrast, the eastern part of the county is dominated by poorly productive bedrock aquifers, composed mainly of shales and sandstones with lower permeability and limited groundwater storage capacity. Additionally, sand and gravel aquifers make an important contribution to the county's groundwater resources. These deposits serve a dual function: in some cases, they provide substantial water yields and are classified as aquifers, while in others, they act as storage reservoirs for the underlying bedrock aquifers. Their classification is determined by factors such as permeability, aerial extent, and the thickness of the unsaturated zone. Major river systems, such as the River Liffey and River Barrow, interact with these aquifers, shaping the overall groundwater-surface water dynamic.

The subject site is partially located above the New Ross Groundwater Body, which covers an area of 1,059 km², extending from just south of Newbridge in Co. Kildare to the Barrow Estuary in Co. Wexford. This groundwater body comprises two distinct lithologies: limestones and granites, both classified as poor aquifers, generally unproductive except for local zones (Pl). In limited instances, the bedrock is classified as moderately productive only in local zones (Ll).

Groundwater flow within this aquifer is likely confined to fractures, fissures, joints, and bedding planes, with recharge and discharge processes being localised. The flow is influenced by topography and is expected to mirror surface elevations. Groundwater levels are typically shallow, around 4–5 metres below ground level, and the aquifer is most likely to discharge into nearby rivers via baseflow through the riverbed.

In the northern part of the aquifer, sand and gravel deposits contribute to abstractions from the limestone bedrock and provide additional storage for the underlying aquifer, potentially helping to sustain water yields during dry periods. The River Greese and Glasna Stream are believed to be in close hydraulic connection with the groundwater, and given the shallow groundwater levels, surface water fluctuations are likely to have a strong influence on groundwater dynamics.

The western portion of the subject site lies above a poor bedrock aquifer, classified as generally unproductive except for local zones (Pl). In contrast, the eastern boundary of the proposed development is situated above the Coolane Sand and Gravel Aquifer, designated by the Geological Survey of Ireland (GSI) National Draft Bedrock Aquifer Map as a Locally Important Gravel Aquifer (Lg), as illustrated in **Figure 8.12** overleaf.

The Coolane Sand Gravel Aquifer, located west-northwest of Castledermot, extends approximately 6.5 km in length and 500 m in width, comprising predominantly hummocky

glaciofluvial sands and gravels. It is classified as a Locally Important Sand Gravel Aquifer (Lg), with around 37% of its area containing saturated gravels exceeding 5 m in depth. The aquifer supports significant groundwater flow, with a minimum estimated throughput of 1,351 m³/day. Recharge occurs mainly through diffuse infiltration of rainfall, averaging 265 mm/year. Groundwater discharges primarily into adjacent rivers and streams, with no known large-scale abstractions or springs. High connectivity between surface water and groundwater is anticipated due to shallow water tables and the geomorphological setting.

The aquifer is considered highly vulnerable where the water table lies within 3 m of the ground surface—this applies to a significant portion of the area, as 89% of the aquifer is exposed at the surface. Overlying sediments, where present, are thin (generally less than 3 m) and consist mainly of alluvium. Groundwater flow paths within the aquifer are short, typically not exceeding several hundred meters, with proven depths to bedrock ranging from 7.9 m to 16.5 m. The deeper sediments exhibit low fines content (under 8%), reflecting high permeability and favourable conditions for groundwater movement.

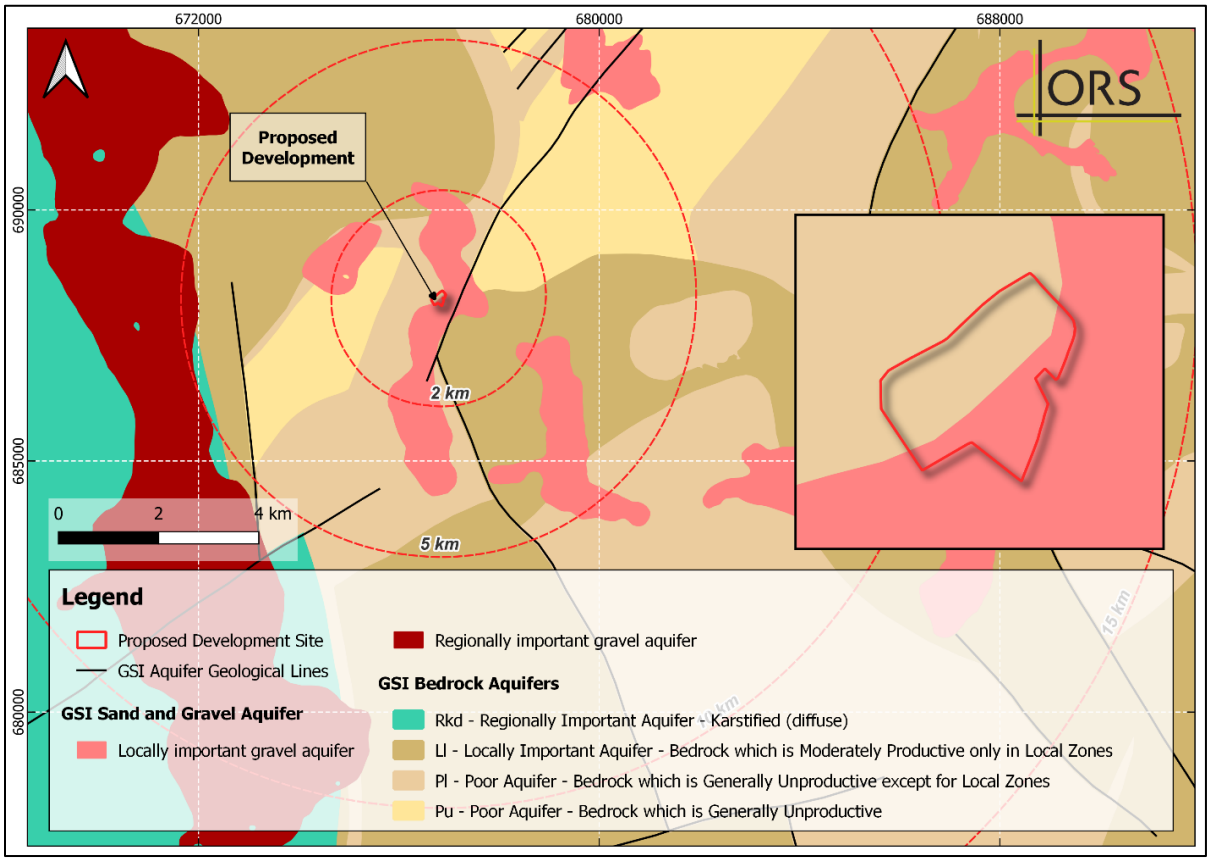

Figure 8.12: Groundwater Bodies in site locality. (GSI Maps)

The proposed site is underlain by high-permeability subsoil (sand & gravel) overlain by well-drained soil, classified as Hydrogeological Setting 2.ii. The average annual groundwater recharge in the area is estimated to range from 100 mm to 350 mm.

Groundwater vulnerability is influenced by factors such as subsoil, recharge type (point or diffuse) and thickness of the unsaturated zone, through which potential contaminants can move. The Geological Survey of Ireland (GSI) uses a matrix comprising four categories - extreme, high, moderate and low - for mapping purposes and in the assessment of risk to

groundwater. These categories are determined by the thickness of the overburden, as shown in **Table 8.10**, overleaf, which acts as a barrier to contaminants moving toward the groundwater table. For instance, when the overburden is less than 3 m thick, the vulnerability is classified as extreme, indicating a very high risk of contamination reaching the aquifer. Conversely, with an overburden greater than 10 m thick and low permeability, vulnerability is considered low.

In County Kildare, groundwater vulnerability varies from low to extreme, with the highest vulnerability occurring where rock is at or near the surface or where karst features are present. Majority of the County is classed as having either moderate or high vulnerability, while areas of low or extreme vulnerability are much less common. The proposed site is classified as having "High" vulnerability. Refer to **Figure 8.13** overleaf.

Table 8.10: Vulnerability Mapping Criteria

Subsoil Thickness	Hydrogeological Requirements				
	Diffuse Recharge (Subsoil Permeability & Type)			Point Recharge	Unsaturated Zone
	High (Sand & Gravel)	***Moderate (Sandy Subsoil)***	***Low (Clay & Peat)***	***Swallow Holes***	***Sand & Gravel Aquifers***
0-3m	Extreme	Extreme	Extreme	Extreme (30m radius)	Extreme
3-5m	High	High	High	N/A	High
5-10m	High	High	Moderate	N/A	High
>10m	High	Moderate	Low	N/A	High

There are no wells located within the boundaries of the proposed development site. However, according to the GSI database, a total of 64 groundwater wells are identified within a 2 km radius, based on available location accuracy. These comprise a mix of dug wells and boreholes, along with one spring recorded approximately 1.6 km southeast of the site. Yield classifications range from moderate to poor. Although the intended use is not specified for the majority of wells, the available data indicates that 4 are used for domestic supply, 3 for combined agricultural and domestic use, 2 for public supply, and 2 for other purposes. While depth-to-bedrock data is limited, existing records suggest depths typically range from 4.5 to 12.2 mbgl, which supports the site's classification as having high groundwater vulnerability.

A detailed summary of this data is provided in **Table 8.11** overleaf, and the locations of these wells in relation to the proposed site are illustrated in **Figure 8.13**.

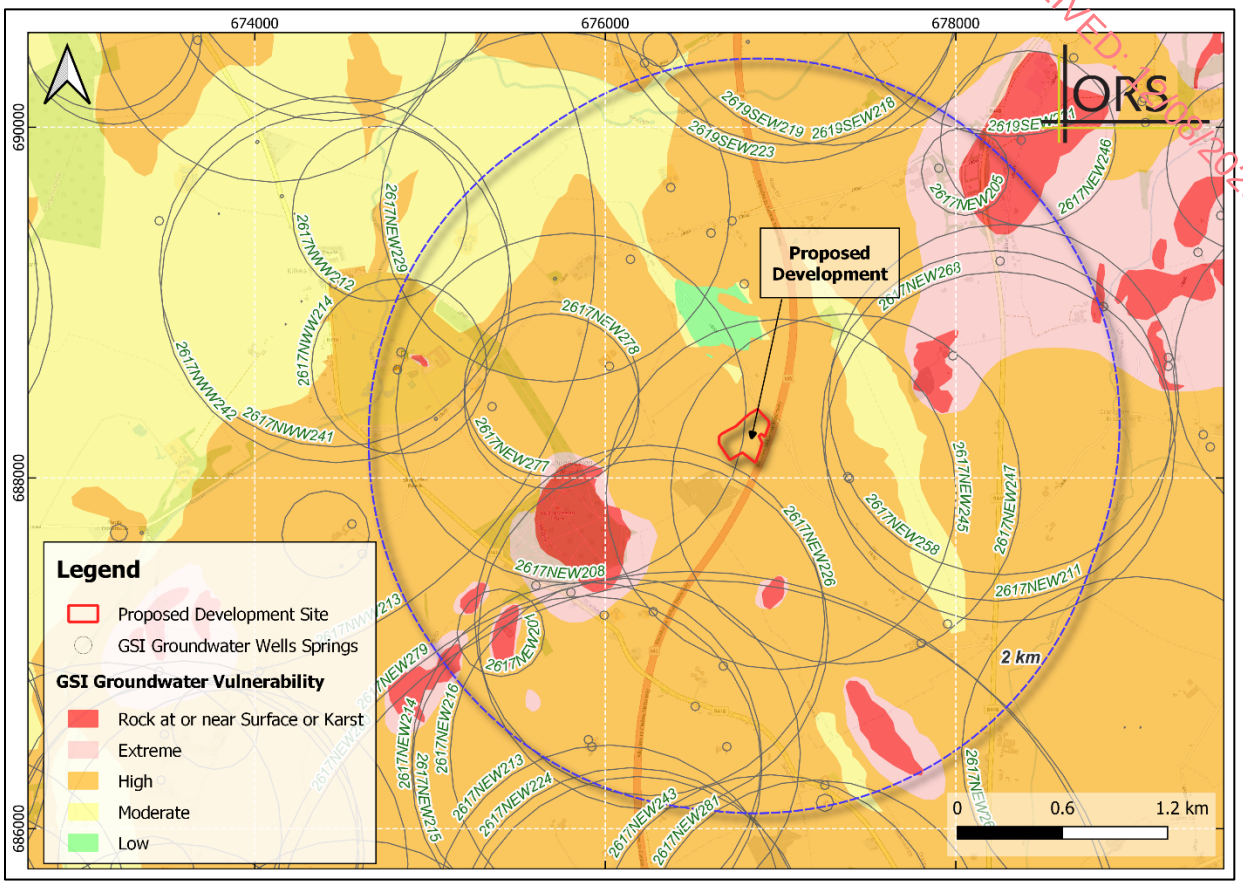

Figure 8.13: Groundwater Vulnerability and location of Groundwater Wells

Table 8.11: Groundwater Wells with 2km of the site (GSI Well Database)

GSI Reference	Easting	Northing	Well Type	Depth (m)	DTB[4] (m)	Well Use	Yield (m^3/d)	Location Accuracy	Proximity to site (km)
2617NEW258	278340	188410	B[5]	45.7	4.9	DOM[6]	31.6	2km	1.49
2617NEW298	277870	187020	B	12.8	U[7]	U	N/A	50m	1.55
2617NEW299	275970	186470	D[8]	4.9	U	U	N/A	50m	1.95
2617NEW301	276580	186660	D	4.1	U	PS[9]	N/A	50m	1.56
2617NEW212	276320	187150	B	31.4	4.5	U	21.82	2km	1.18
2617NWW212	274780	189470	D	9.8	0	U	10.91	1km	2.44

[4] DTB: Distance to Bedrock
[5] B: Borehole
[6] DOM: Domestic Use Only
[7] U: Unknown
[8] D: Dug Well
[9] PS: Public Supply

GSI Reference	Easting	Northing	Well Type	Depth (m)	DTB[4] (m)	Well Use	Yield (m^3/d)	Location Accuracy	Proximity to site (km)
2617NWW213	273510	189300	D	4.6	0	U	N/A	5km	3.53
2617NWW214	274890	188600	D	9.1	0	U	N/A	1km	2.02
2617NEW266	275870	187310	B	61	5.2	DOM	16.4	50m	1.33
2617NWW270	274900	188680	D	9.1	U	U	N/A	50m	2.02
2617NWW271	274880	188580	B	12.2	U	U	54.6	50m	2.02
2617NEW302	276760	186430	B	18.3	U	U	N/A	50m	1.77
2617NEW303	277320	186210	D	3.5	U	U	N/A	50m	2.04
2617NEW243	277010	185270	B	20.7	12.2	U	21.82	2km	2.93
2617NEW252	275670	187350	B	37.5	10.4	DOM	65.5	50m	1.47
2617NEW255	277320	186110	B	91.4	9.1	DOM	10.9	100m	2.14
2617NEW386	275780	189100	B	5	5	O[10]	N/A	20m	1.41
2617NEW387	275100	188300	B	14	BNM[11]	O	N/A	20m	1.77
2617NEW285	276440	189620	D	3.7	U	U	N/A	50m	1.48
2617NEW286	276210	189210	D	4.9	U	U	N/A	50m	1.21
2617NEW287	276670	189360	D	8.1	U	U	N/A	50m	1.18
2619SEW218	277130	190860	B	24.1	12.2	U	18.6	2km	2.68
2617NEW289	276860	189070	D	4.3	U	U	N/A	50m	0.87
2617NEW290	276090	188600	D	4.1	U	U	N/A	50m	0.87
2617NEW291	278050	188660	D	5.8	U	U	N/A	50m	1.27
2617NEW292	277460	187960	D	8.8	U	U	N/A	50m	0.64
2617NEW293	276060	187180	B	31.4	4.6	U	21.8	50m	1.30

[10] O: Other
[11] BNM: Bedrock Not Met

GSI Reference	Easting	Northing	Well Type	Depth (m)	DTB[4] (m)	Well Use	Yield (m^3/d)	Location Accuracy	Proximity to site (km)
2617NEW294	276340	187200	B	17.7	U	U	N/A	50m	1.13
2617NEW229	275780	189510	B	14	0	U	27.28	2km	1.70
2617NEW268	278320	188140	B	38.1	0	U	N/A	2km	1.45
2619SEW219	277370	190860	B	13.7	0	U	54.6	2km	2.71
2617NEW279	276540	184930	B	25.3	U	U	22.9	5km	3.28
2617NEW205	278120	189710	D	2.7	0	U	N/A	500m	1.96
2617NEW269	279100	186400	B	6.2	BNM	U	28	2km	2.87
2617NEW318	278320	189200	D	2.9	U	U	N/A	50m	1.77
2617NEW213	276090	185440	D	7.3	0	AD[12]	12	2km	2.86
2617NEW214	275960	186370	D	7.6	0	U	N/A	2km	2.04
2617NEW215	275960	186290	D	8.2	0	U	N/A	2km	2.11
2617NEW280	276600	184880	B	37.5	0	U	19.5	5km	3.33
2617NEW314	278910	188940	D	5	U	U	N/A	50m	2.17
2617NEW288	276790	189430	D	3.2	U	U	N/A	50m	1.23
2617NEW281	277270	185240	B	22.9	13.1	U	57.5	2km	2.98
2617NEW283	275420	188370	B	21.6	BNM	U	21.8	50m	1.46
2617NEW226	276340	187070	B	32	0	U	18.55	2km	1.24
2617NEW295	276740	186890	D	5.5	U	U	N/A	50m	1.31
2617NEW296	277450	187970	B	16.5	U	PS	N/A	50m	0.63
2617NEW297	278020	187130	S	0	U	U	N/A	50m	1.57
2617NWW241	274520	189140	B	49.7	0	U	43.64	2km	2.53
2617NWW242	274530	189050	B	13.4	0	U	87.3	2km	2.49

[12] AD: Agricultural & Domestic Use

GSI Reference	Easting	Northing	Well Type	Depth (m)	DTB[4] (m)	Well Use	Yield (m^3/d)	Location Accuracy	Proximity to site (km)
2617NEW201	275470	187080	D	3.7	0	U	N/A	500m	1.79
2619SEW221	278360	190910	D	2.4	1.8	U	21.8	2km	3.10
2617NEW277	275760	188470	B	21.6	0	U	21.8	1km	1.14
2617NEW278	275760	188400	B	42.1	0	U	40.8	1km	1.12
2619SEW223	277090	190760	D	6.4	6.4	U	17.5	2km	2.57
2617NEW220	276250	185260	B	11.6	0	AD	27.3	2km	3.00
2617NEW224	276210	185310	B	13.1	0	AD	27.3	2km	2.96
2617NEW307	277970	189730	D	2.7	U	U	N/A	50m	1.89
2617NEW245	277070	187870	B	37.5	7.6	U	32.73	2km	0.39
2617NEW246	278480	189900	B	50	0	U	38.19	1km	2.35
2617NEW247	277440	187900	B	49.7	0	U	16.37	2km	0.65
2617NEW216	276180	186390	D	5.8	0	U	N/A	2km	1.93
2617NEW300	275990	186430	D	5.2	U	U	N/A	50m	1.97
2617NEW211	278300	188260	D	7	0	U	N/A	2km	1.43
2617NEW208	275870	188360	B	17.1	12.2	U	43.64	2km	1.01

Karst areas, characterised by unique dissolution landforms, often contain aquifers that are highly susceptible to pollution and can contribute to flooding risks. There are no karstic features located within the proposed boundaries of the Proposed Development or within the immediate vicinity of the Proposed Development, as shown in **Figure 8.14**. A number of karstic features occur to *ca.* 10km south and *ca.* 13km west of the site, beyond the county Kildare border in county Laois, where the underlying bedrock consists of Dinantian Pure Bedded Limestones.

The closest Turlough can be found *ca.* 50.1km southwest of the proposed site. Tracing of underground flows from an enclosed depression to Bs has been undertaken by GSI and indicates interconnectivity between karst features *ca.* 30km to the northwest of the study area. This flow occurs in a northwest direction, away from the Proposed Development.

Groundwater sources are vital for public water supply, industry, agriculture, and domestic use, especially in rural areas. To safeguard these resources, Source Protection Areas (SPAs) have been established, enforcing stricter controls within the Zone of Contribution (ZOC). There are two main types: Group Water Scheme (GWS) Preliminary Source Protection Areas (PSPAs)

ZOCs and Public Water Supply (PWS) SPAs.

GWS PSPAs are designated around groundwater sources supplying community-run schemes, primarily in rural areas. These zones help landowners and stakeholders understand groundwater risks and are mapped using preliminary hydrogeological data, often without detailed field studies. Protection in these areas is largely voluntary and focused on risk assessment, rather than strict regulatory enforcement.

In contrast, PWS SPAs are formally designated for public water supplies managed by Irish Water or local authorities. These areas undergo scientific hydrogeological assessments, including groundwater flow modelling and contamination risk analysis, ensuring strict regulatory controls to prevent pollution from agriculture, wastewater discharge, and industrial activities. Their ZOCs are further divided into two zones: the Inner Protection Area (SI), which defends against immediate human and microbial contamination, and the Outer Protection Area (SO), covering the remaining ZOC to mitigate long-term risks.

The GSI Source Protection Area (SPA) map confirms that no SPAs are located in the immediate vicinity of the proposed site. The nearest Public Supply Source Protection Area, Kilkea PWS, is approximately 2.1 km northwest, while the closest Group Water Scheme Zone of Contribution (GWS ZOC), Ballyroe Leinster Lodge, is about 5 km northwest. No hydrologic connection is anticipated between the subject site and these water sources.

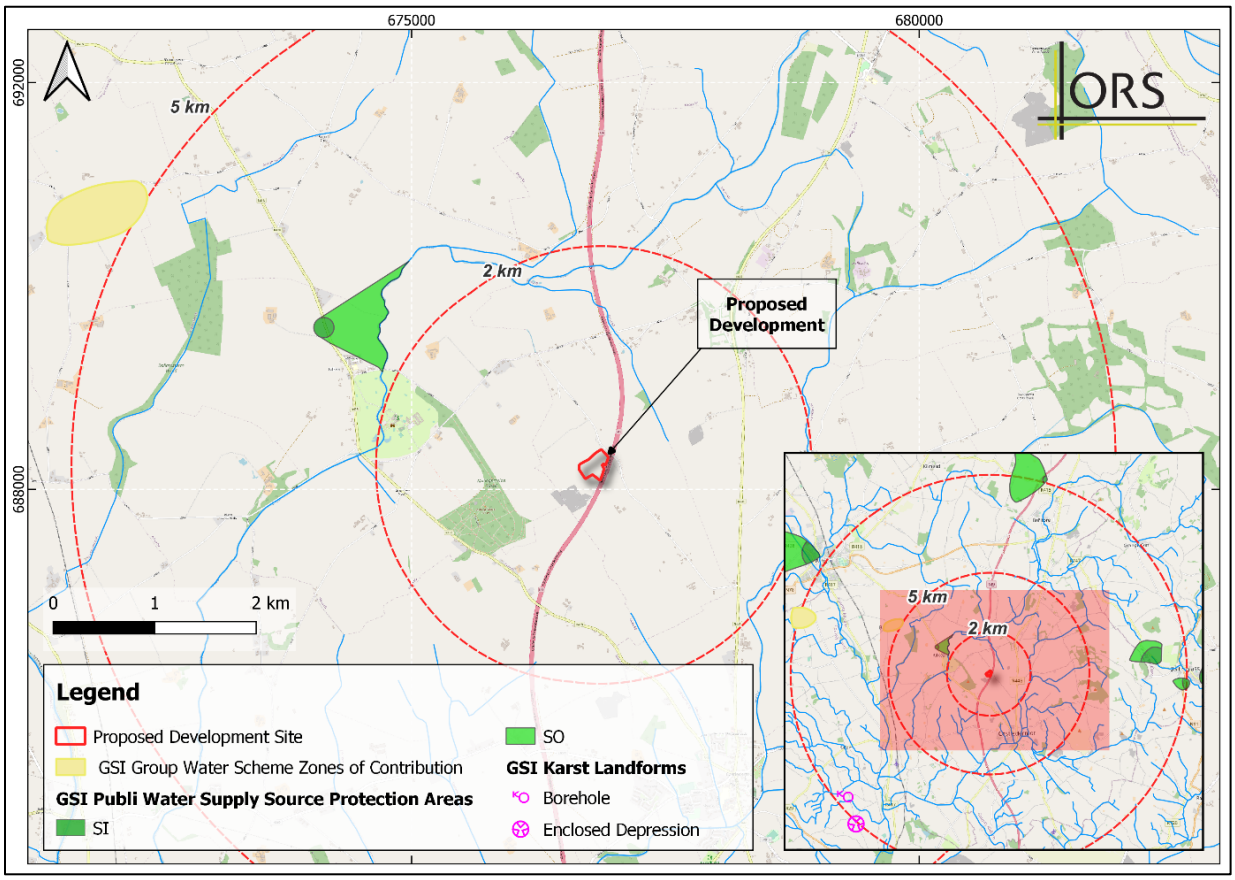

Figure 8.14: Karstic Features and Source Protection Areas (SPAs) location (GSI Maps)

Ground Investigations

Ground investigation works were carried out by an ORS environmental scientist for the Proposed Development at Ballyvass on the 31st of January 2025. These investigations revealed that the geology and subsoil conditions on-site were somewhat inconsistent with those indicated in the geological mapping. This is particularly evident in the presence of loamy soils (sand and clay) in some of the trial pits, which may have resulted from infilling during the construction of the adjacent M9 motorway.

The water table was observed to be high, with visible drainage towards the drainage ditch to the northwest of the site. High rainfall levels preceding the site investigations, combined with variations in soil permeability—from highly permeable in the southeast to less permeable in the northwest—likely contributed to high water table and consequently ponding along the northwestern boundary. Additionally, the eastern part of the site was observed to be boggy. The saturation of soils was evident from mottling and gleying across all trial pits.

The depths of the trial pits ranged from 1.9m to 2.8m below ground level (bgl), with no bedrock encountered in any of the pits. The site's topography peaks at 85.75m AOD along the southern boundary near TP02, gradually sloping northwards to a low of 79.31m AOD at TP04. The overall site gradient runs from south to north, becoming slightly more pronounced towards the southern and central areas, particularly in the vicinity of the gas pipeline.

Some variation was observed in the soil profile across all six trial pits. The site's soil composition generally consisted of loose, non-cohesive material, such as fine sand or silty sand. Unstable, collapsible soils exhibiting frequent sloughing and caving were encountered, particularly in areas where groundwater was struck.

The topsoil across all trial pits comprised a dark brown layer extending to depths between 0.2m and 0.4 mbgl, overlying horizons that varied between trial pits. In the lower horizons, loamy soils with gravels were identified in TP01 and TP02. In TP03, beneath the proposed bunded area, clay soils with gravels, minor mottling, and a high cobble content were present at the final pit depth. Similarly, impermeable clays with mottling and cobble content, albeit to a lesser degree, were observed at lower depths in TP02.

The topsoil in TP04 consisted of dark brown gravelly earths, with extensive gley soils beneath, a profile also observed in TP05. In contrast, TP06 exhibited gravelly, silty loamy soils, which showed signs of mottling and an extremely fragile structure.

The underlying bedrock across the site is Silurian dark grey slate; however, no bedrock was encountered in any of the six trial pits. Groundwater was encountered at 1.1 mbgl in TP-06 and at 1.5 mbgl in TP-01. The depths at which groundwater was encountered suggest a connection to surface drainage flow, given the flow observed at the northwest drainage ditch.

A site characterisation assessment (percolation assessment) was conducted by Coyle Environmental on the 31st of January 2025. The assessment was conducted in TP-01 and concluded that the Proposed Site has an R1 groundwater protection response, which is acceptable to normal good practice. The complete report is available in **Appendix 8.1**.

The location and depth of the trial pits is shown on **Figure 8.15** overleaf, and details of each investigation location is presented in **Table 8.12** overleaf.

Table 8.12: Ground profile for each Trial Pit

Location	Depth (m)	Ground Profile	Comments
TP-01	0.0 – 0.2 0.2 – 1.3 1.3 – 2.1 2.1	Topsoil – Dark Brown Earths. LOAMY/CLAY, gravel abundant, lighter brown colouring. – Site was likely infilled during construction of adjacent motorway. Dark LOAM mottling evident throughout layer, abundance of rounded large cobbles. GW observed @ 1.5mbgl, high recharge Unstable, collapsible soils. End of TP @ 2.1mbgl.	Trial Pit located at proposed entrance of the site, near to the proposed location for the WWTP. Site was likely infilled during construction of adjacent motorway. No Bedrock encountered. GW encountered at 1.5mbgl.
TP-02	0.0 – 0.2 0.2 – 0.9 0.9 – 1.9 1.9	Topsoil – Dark brown, slightly aggregated silty SAND with some organic content. Dry, with no significant cohesion. Very thin transition layer of light brown to yellow/orange material, possibly iron oxidised. Light Grey Gravelly Silt. Light grey to darker grey SILTY GRAVEL with high gravel content and some small to medium cobbles. Slightly wet, with excavation walls collapsing due to low cohesion. End of TP @ 1.9mbgl.	No Bedrock encountered. No GW encountered. Highly permeable soil, consistent with desk study indicating a gravel aquifer above a poor bedrock aquifer. Wet conditions likely due to recent rainfall infiltration.
TP-03	0.0 – 0.4 0.4 – 1.0 1.0 - 2.65 2.65	Topsoil – Dark Brown Earths, dry and loose silty SAND with some organic material. Light brown to grey compacted CLAY with sparse orange mottling, indicating some oxidation. Moist to wet conditions suggest reduced drainage and possible seasonal water table presence. Dark brown, moderately compacted silty GRAVEL with high gravel content and occasional cobbles. End of TP	No Bedrock encountered. Trial Pit located at the bunded area. No Bedrock encountered. No GW encountered.
TP-04	0.0 – 0.3 0.3 – 0.55 0.55 – 1.55 1.55 – 2.8 2.8	Topsoil – Dark Brown Earths, dry and loose silty SAND with some organic material. Transition Layer - Light brown to grey, compacted GRAVEL with clayey matrix. Presence of fines suggests poor sorting. Light brown CLAY with high orange mottling throughout. Compacted and dry with collapsing walls, indicating low cohesion and possible evidence of seasonal wetting and drying. Dark brown, compacted and wet GRAVELLY material with fine content. Impermeable sticky Groundwater Gley (characterised by grey colour and upper layers are oxidised & typical brown) End of TP	No Bedrock encountered. No GW encountered. High gravel presence and occasional small cobbles noted throughout all horizons. One side of the pit was noticeably drier than the other, suggesting variable drainage.

Location	Depth (m)	Ground Profile	Comments
TP-05	0.0 – 0.2 0.2 – 1.0 1.0 – 2.4 2.4	Topsoil – Dark brown, dry and loose silty SAND with some organic matter. Light brown, moderately compacted, wet GRAVEL with a mixed sand and clay matrix. Some orange mottling present, indicating minor oxidation and variable drainage. Dark brown to grey, compacted and wet GRAVELLY material with small to medium cobbles. End of TP.	No Bedrock encountered. No GW encountered.
TP-06	0.0 – 0.2 0.2 – 1.2 1.2 – 2.0 2.0	Topsoil – Dark brown, moderately dry and loose silty SAND with some organic matter. Unstable, collapsible gravelly lighter silty SAND, small signs of mottling. The sand matrix is poorly cohesive and saturated at depth, indicating groundwater influence. Groundwater strike @ 1.1mbgl. Unstable, collapsible darker brown soil, cobbles/ small boulders present End of TP.	No Bedrock Encountered. GW at 1.1mbgl. Water accumulation observed at the base of the pit confirms high permeability and shallow groundwater conditions.

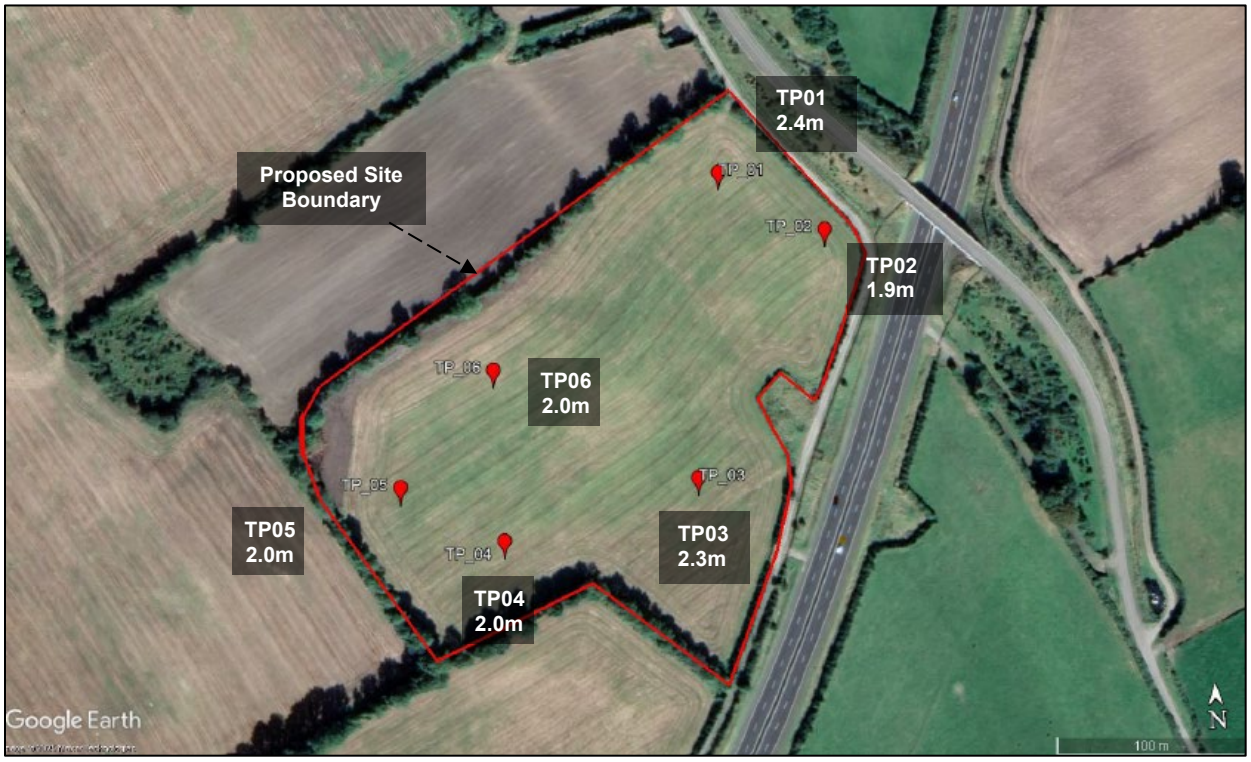

Figure 8.15: Location of Trial Pits (TP) and Site Characterisation Assessment

Kildare County Development Plan 2023 – 2029 – Groundwater Protection

A review of the Kildare County Development Plan was carried out to determine the policies and objectives relevant to the preservation and protection of groundwater quality throughout the region. The following objectives, taken from the CDP, were deemed to be relevant in the area of Groundwater Protection.

- ***IN P2:*** *Ensure the protection and enhancement of water quality throughout Kildare in accordance with the EU WFD and facilitate the implementation of the associated programme of measures in the River Basin Management Plan 2018-2021 (and subsequent updates).*
- ***IN O3:*** *Promote water conservation and best practice water conservation in all developments, including rainwater harvesting and grey water recycling.*
- ***IN O5:*** *Manage, protect, and enhance surface water and groundwater quality to meet the requirements of the EU Water Framework Directive.*
- ***IN O10:*** *Work with the Local Authority Waters Programme (LAWPRO) to identify issues affecting water quality in Kildare.*
- ***IN O18:*** *Discourage the provision of single house septic tanks and treatment plants in the plan area to minimise the risk of groundwater pollution. Where such facilities are permitted, full compliance with the prevailing regulations and standards, including the EPA's Code of Practice for Wastewater Treatment and Disposal Systems Serving Single Houses (pe≤10), (2021) as may be amended, will be required.*
- ***IN O28:*** *Ensure development proposals in rural areas demonstrate the ability of the site in an un-serviced area to accommodate an on- site wastewater disposal system in accordance with the County Kildare Groundwater Protection Scheme, and any other relevant documents and legislation as may be introduced during the Plan period.*
- ***IN P7:*** *Support the implementation of the Water Framework Directive, the River Basin Management Plan, and the Local Authority Waters Programme in achieving and maintaining at least good ecological status for all water bodies in the county.*
- ***IN O56****: Protect water quality from pollution by agricultural sources and to promote the use of good farming practices in accordance with the Nitrates Directive (91/676/EEC) and Ireland's Nitrates Action Programme 2017- 2021 (including any subsequent update).*

Kildare County Council Groundwater Protection Scheme (GWPS)

Groundwater protection schemes play a vital role in enabling planning and regulatory authorities to consider both geological and hydrogeological factors when determining the location of developments. As a result, they are a crucial tool in preventing groundwater pollution.

The Geological Survey of Ireland (GSI), the Department of Environment and Local Government (DELG) and the Environmental Protection Agency (EPA) have jointly developed a methodology for the preparation of groundwater protection schemes (DELG/EPA/GSI, 1999). The publication ***Groundwater Protection Schemes*** was launched in May 1999. A groundwater protection scheme has two main components, as illustrated in **Figure 8.16**.

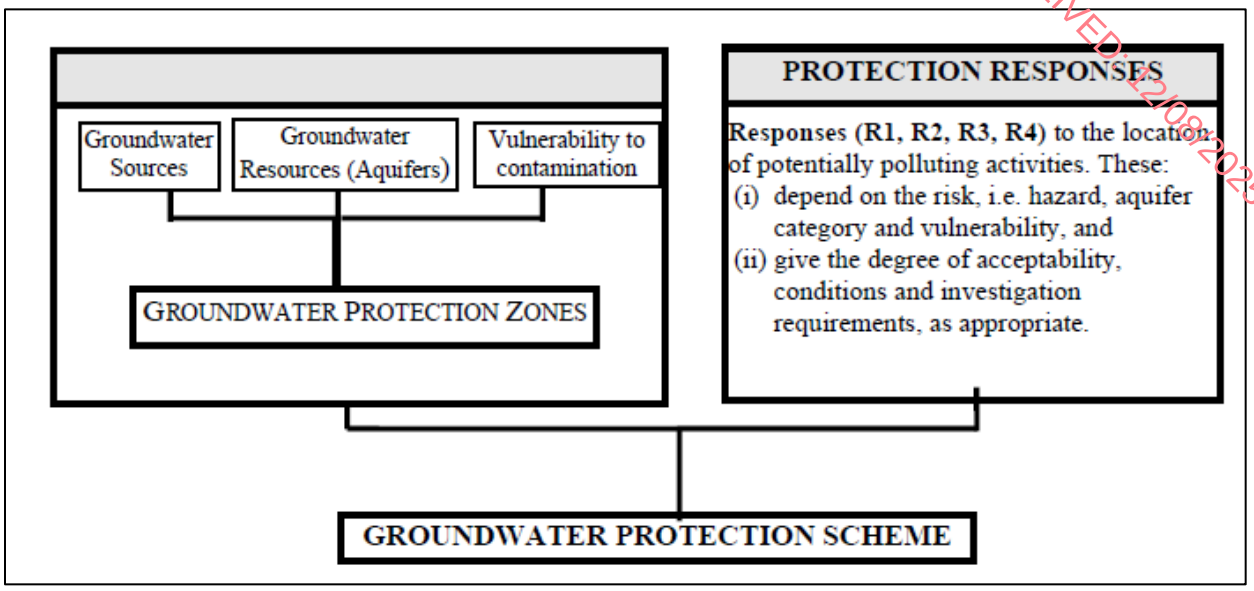

Figure 8.16: Summary of Components of a Groundwater Protection Scheme (KILDARE COUNTY COUNCIL GROUNDWATER PROTECTION SCHEME, Vol1, 2002).

Land surface zoning provides the general framework for a groundwater protection scheme. The outcome is a map that divides any chosen area into several groundwater protection zones based on the degree of protection required. There are three main hydrogeological elements to land surface zoning:

- Division of the entire land surface according to the vulnerability of the underlying groundwater to contamination.
- Delineation of areas contributing to groundwater sources (usually public supply sources), referred to as source protection areas.
- Delineation of areas based on the value of the groundwater resources or aquifer category, referred to as resource protection areas.

In December 2002, Kildare County Council, in collaboration with the Geological Survey of Ireland (GSI), published the County Groundwater Protection Scheme Main Report – 1st Draft. The scheme aims to safeguard the quality of groundwater in County Kildare for drinking water and other beneficial uses, ensuring its protection for present and future generations. The main objectives of the scheme are to:

- Assist statutory authorities in fulfilling their responsibilities for groundwater protection and conservation.
- Provide geological and hydrogeological data to support the planning process, ensuring that potentially polluting developments are managed in an environmentally sustainable manner.
- Integrate factors related to groundwater contamination risk, prioritising high-risk areas and activities while offering a structured approach to contamination control measures.

The techniques used to delineate source protection zones were applied to seven public supply wells in County Kildare: Lipstown/Narraghmore, Kilteel, Kilkea, Castlemitchell, Curragh Camp Wells, Athy, and Usk/Gormanstown. However, detailed hydrogeological investigations were limited to the areas surrounding these supply sources, resulting in a dataset that, while valuable, does not allow for a fully comprehensive assessment of County Kildare's

hydrogeology. Nonetheless, the report provides a robust foundation for strategic decision-making and site-specific investigations.

The Groundwater Protection Scheme integrates general protection guidelines with geological and hydrogeological land surface zoning data, culminating in two key mapping elements:

- The Groundwater Protection Map, created by combining vulnerability and aquifer maps. Each protection zone on this map is assigned a code representing both the vulnerability of groundwater to contamination and the aquifer category (groundwater resource value).
- The Source Protection Maps, which outline land surface zoning elements specific to groundwater protection.

Most hydrogeological settings are represented in County Kildare. The final stage of the scheme integrates groundwater protection zones with groundwater protection responses to provide an appropriate level of risk assessment. Since the level of response considers aquifer category, proximity to public supply sources, and vulnerability, relying solely on the vulnerability map may create a misleading perception of activity restrictions. **Table 8.13** offers a broad overview of the acceptability of various activities in Kildare concerning groundwater contamination risks.

Table 8.13: Site Suitability Response Levels in Kildare (adapted from County Kildare - Volume I: Main Report)

Activity	Percentage of Kildare Occurring within Each Response Level		
	Least restrictive Response Level ('R1')	***Intermediate response levels ('R2' and 'R3')***	***Most restrictive response level ('R4')***
Landfill	18%	57%	25%
IPC Landspreading	87%	13%	<1%
On-site Treatment Systems	83%	17%	-

Groundwater Vulnerability Assessment

The site is not located within a Source Protection Area. Given that a Groundwater Protection Scheme is in place for all of County Kildare, this vulnerability assessment will be carried out as outlined in **Table 8.4** in section 8.3, an excerpt is shown below:

Excerpt of **Table 8.4:** Summary of Sampling requirements for groundwater vulnerability assessments

	Vulnerability	Sampling Requirements
Ground Water Protection Scheme (GWPS) exists	LOW	Simple walkover survey to confirm what has been established in the GWPS, i.e., no evidence of outcrop, depth to bedrock information from wells, etc. [13] If walkover survey indicates that the lands do not have sufficient thickness of subsoil (i.e. rock outcrops) then site specific information may be required.
	MEDIUM	
	HIGH	
	EXTREME [14]	Regionally Important Aquifers - Prove that 2m depth of soil/subsoil cover exists. Minimum of 1 data point per hectare is required.
		Locally Important and Poor Aquifers – Prove that 1m depth of soil/subsoil cover exists. Minimum of 1 data point per 5 hectares is required.

[13] The classification to Low / Medium / High class as part of GWPS indicates that minimum of 3m soil/subsoil depth can be anticipated
[14] To give a rough picture of "extreme vulnerability" areas we can use: GSI Outcrop data & Teagasc Shallow Rock data

Groundwater resources protection zones are determined by combining the aquifer and vulnerability maps. The aquifer map boundaries, in turn, are based on the bedrock map boundaries and the aquifer categories are obtained from an assessment of the available hydrogeological data. The vulnerability map is based on the subsoils map, together with an assessment of relevant hydrogeological data, in particular indications of permeability and karstification.

The location and management of potentially polluting activities in each groundwater protection zone is calculated by means of a groundwater protection response matrix. The level of response depends on the different elements of risk: the vulnerability, the value of the groundwater (with sources being more valuable than resources and regionally important aquifers more valuable than locally important and so on) and the contaminant loading. By consulting the Response Matrix, it can be determined:

- Development's suitability of purpose
- what kind of further investigations may be necessary to reach a final decision; and
- what planning or licensing conditions may be necessary for that development.

The groundwater protection responses are a means of ensuring that good environmental practices are followed.

The matrix in **Table 8.14** gives the result of integrating the two regional elements of land surface zoning (vulnerability categories and resource protection areas) – a possible total of 24 resource protection zones. In practice this is achieved by superimposing the vulnerability map on the aquifer map. Each zone is represented by a code e.g. Rf/M, which represents areas of regionally important fissured aquifers where the groundwater is moderately vulnerable to contamination. In land surface zoning for groundwater protection purposes, regionally important sand/gravel (Rg) and fissured aquifers (Rf) are zoned together, as are locally important sand/gravel (Lg) and bedrock which is moderately productive (Lm).

Table 8.14: Matrix of Resource Protection Zones from EPA Guidance Notes on Groundwater Protection

Vulnerability Rating	Resource Protection Zones					
	Regionally Important Aquifers (R)		Locally Important Aquifers (L)		Poor Aquifers (P)	
	Rk	Rf/Rg	Lm/Lg	Ll	Pl	Pu
Extreme (E)	Rk/E	Rf/E	Lm/E	Ll/E	Pl/E	Pu/E
High (H)	Rk/H	Rf/H	Lm/H	Ll/H	Pl/H	Pu/H
Moderate (M)	Rk/M	Rf/M	Lm/M	Ll/M	Pl/M	Pu/M
Low (L)	Rk/L	Rf/L	Lm/L	Ll/L	Pl/L	Pu/L

Combining the proposed site vulnerability rating of High, and the underlying aquifer classification of 'Poor Aquifer generally unproductive except for local zones (Pl)' and 'Locally Important Gravel Aquifer (Lg)', the site is classified as Pl/H and Lm/H from northwest to southeast.

Groundwater Protection Responses

The Groundwater Protection Responses for the land spreading of organic wastes (DoE/GSI/EPA publication, 1999) are relevant to this study given the proposed nature and operational phase of the development. According to the DoE/GSI/EPA guidelines, a Locally

Important Gravel Aquifer or a Poor Aquifer with a high vulnerability rating is deemed acceptable for land spreading, provided standard best practices are followed.

Table 8.15: Vulnerability Rating Summary

Vulnerability Rating	SOURCE PROTECTION AREA		Resource Protection (Aquifer Category)					
			Regionally Important Aquifers (R)		Locally Important (L)		Poor Aquifers(P)	
	Inner	Outer	Rk	Rf/Rg	Lm/Lg	Ll	Pl	Pu
Extreme (E)	R4	R4	R3[2]	R3[2]	R3[1]	R3[1]	R3[1]	R3[1]
High (H)	R4	R2[1]	R1	R1	R1	R1	R1	R1
Moderate (M)	R3[3]	R2[1]	R1	R1	R1	R1	R1	R1
Low (L)	R3[3]	R2[1]	R1	R1	R1	R1	R1	R1

R1 Acceptable, subject to normal good practice.
R2[1] Acceptable subject to a maximum organic nitrogen load (including that deposited by grazing animals) not exceeding 170 kg/hectare/yr.
R3[1] Not generally acceptable, unless a consistent minimum thickness of 1 m of soil and subsoil can be demonstrated.
R3[2] Not generally acceptable, unless a consistent minimum thickness of 2 m of soil and subsoil can be demonstrated.
R3[3] Not generally acceptable, unless no alternative areas are available and detailed evidence is provided to show that contamination will not take place.
R4 Not acceptable

Site Vulnerability Assessment

Desktop and field investigations indicate that the site overlies two distinct aquifers: a Locally Important Gravel Aquifer in the southeastern portion and a Poor Aquifer - Bedrock, Generally Unproductive Except for Local Zones, in the northwestern portion. The Groundwater Vulnerability of the site is classified as ‘high. In relation to resource protection zones the site is classified as Lm/H and Pl/H. Based on the groundwater protection response matrix, the site is assigned a vulnerability rating of "**R1**," indicating that the development is acceptable from a groundwater protection perspective.

Given the existence of a Groundwater Protection Scheme for the County, a site walkover would be enough to confirm the information provided by GSI maps. Nevertheless, an intrusive site investigation was conducted by ORS in January 2025. This involved excavating six trial pits across the site of a minimum depth of 2.8 mbgl. Bedrock was not encountered in any of them. Groundwater was observed in two of the trial pits, TP-01 & TP-06.

The GSI well data has indicated a high density of wells within the immediate area are designated for domestic use & agricultural use as well as public supply. However, as no land spreading will occur on site, the Proposed Development will not have any detrimental impact on the underlying aquifer or more importantly any wells in the area. The farms of the customer farmers have been identified. All farmers will use the biobased fertiliser on lands that have an agronomic requirement for fertiliser.

The proposed facility’s operation is not expected to have any adverse effects on the underlying aquifer or nearby wells. However, additional trial pits are recommended before work begins, particularly along the northwest boundary and where the bunded area is to be located, to confirm the water table level.

8.5 Likely Significant Effects

Using data from the desk study, intrusive site investigation, and anecdotal evidence, a risk assessment was conducted to evaluate the predicted impacts on hydrology and hydrogeology during both the construction and operational phases of the development. This assessment identifies relevant sources, pathways, and receptors (pollutant linkages) and assigns a qualitative risk classification—'low,' 'moderate,' or 'high'—to each identified Potential Pollutant Linkage (PPL).

For a risk of surface water and groundwater 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'. The likely potential pollutant linkages identified as a result of this assessment and specific for the site have been provided in the initial 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 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 impact and the likely severity of impact in the context of the site setting and proposed future site use.

The criteria used for the risk assessment classifications as detailed in the CSM table are based on those presented in *CIRIA Report 552*.

The likely significant effects identified in this section do not take proposed mitigation measures into account, as these will be addressed in **Section 8.6**. The actual effects anticipated following the implementation of these measures are presented as Residual Effects and can be found in **Section 8.8.**

8.5.1 Do-Nothing Scenario

The proposed site is a greenfield area currently used for agriculture. If the proposed development does not proceed, surface water percolation and runoff would continue as part of the natural processes. The land would remain in its current agricultural use, which could potentially result in ongoing soil pollution and contamination of the local groundwater system, primarily due to suboptimal agricultural practices.

8.5.2 Receptor Sensitivity

The sensitivity of the receptors identified during the study of hydrological & hydrogeological features within the vicinity of the site are summarised in **Table 8.16** overleaf.

Table 8.16: Receptor Sensitivity

Receptor	Receptor Importance	Receptor Sensitivity	Rationale
Groundwater New Ross Groundwater Body & Coolane Sand and Gravel Aquifer	Locally Important & Poor Aquifers	Medium & Low	The northwestern portion of the site is underlain by the New Ross Groundwater Body, classified as a Poor Aquifer—Bedrock that is Generally Unproductive except for Local Zones. The southeastern portion is underlain by the Coolane Sand and Gravel Aquifer, which is a Locally Important Gravel Aquifer. This classification reflects local hydrogeological importance. According to the GSI map viewer, groundwater vulnerability across the site is rated as "High." Trial pits excavated to a depth of 2.8 mbgl did not encounter bedrock. The presence of ponding on-site suggests that the water table is highly responsive to rainfall and may exhibit seasonal fluctuations, particularly within the gravel aquifer. Groundwater was encountered at depths of 1.1 mbgl in TP-06 and 1.5 mbgl in TP-01, both located along the northwestern boundary. These groundwater levels, along with observed flow at the northwest drainage ditch, indicate a connection between groundwater and surface drainage. Based on the response matrix (**Table 8.**), the site is classified as "R1 Acceptable, subject to normal good practice," confirming that the proposed development is considered suitable in terms of groundwater protection.
Surface Water Ballynamony Stream and downstream receptor, River Greese.	Local Level	High	The Ballynamony Stream, along with downstream receptors—the River Greese (designated as GREESE_050 by the EPA) currently hold a “Moderate” status under the Water Framework Directive (WFD) 2016–2021 assessment and are considered to be at risk. Waterbodies near the site have exhibited considerable fluctuations in quality across multiple monitoring cycles, ranging from *Good* to *Poor* status, though predominantly maintaining a *Moderate* status over the past decade. The last monitoring cycle though have highlighted a decline in water quality, resulting in the waterbody being classified as "at risk." Although a hydrological pathway exists to the River Barrow and River Nore SAC, an area protected under EU legislation, significant effects from the Proposed Development are not anticipated. The considerable downstream distance (approximately 10 km) is expected to allow for dispersion and dilution of any potential pollutants, minimising the impact on this protected area.

8.5.3 Sources - Construction Phase

The construction phase is likely to yield the most potentially significant effects on the surrounding water environment. A summary of these potential effects is provided in **Table 8.17**, with a detailed analysis below.

Table 8.17: Construction Phase Effects (Unmitigated)

Receptor	Potential Environmental Effects	Quality	Significance	Duration
Groundwater New Ross Groundwater Body & Coolane Sand and Gravel Aquifer	Increased Run-off and Sediment Loading	**Negative**	**Moderate**	**Short-term**
	Accidental Spillages of Harmful Substances	**Negative**	**Moderate**	**Short-Term**
	Increased Groundwater Vulnerability	**Negative**	**Significant**	**Long-Term**
	Excavation of Bedrock Aquifer	**Negative**	**Significant**	**Long-Term**
	Excavation of Contaminated Soils	**Unlikely**	**Negligible**	**Unlikely**
Surface Water Ballynamony Stream and downstream receptor, River Greese	Increased Run-off and Sediment Loading	**Negative**	**Moderate**	**Temporary**
	Accidental Spillages of Harmful Substances	**Negative**	**Moderate to Significant**	**Temporary**
	Excavation of Contaminated Soils	**Unlikely**	**Negligible**	**Unlikely**
	Increase in Flood Risk to Receiving Catchment	**Negative**	**Moderate**	**Long-Term**

Increased Run-off and Sediment Loading

During the initial stages of the construction phase, enabling works will consist of stripping and removal of a layer of topsoil in some areas throughout the site. Earthworks will then follow to level the site and to facilitate the construction of foundations and the installation of services/drainage infrastructure which will also lead to the removal of some vegetation cover. The resulting stockpiles of the displaced soils and sediments, in the absence of suitable mitigation, will be susceptible to erosion during this period. This can create a potential pathway for silt and sediment to migrate off-site into surrounding water courses via wind-blown dust or run-off in times of heavy rain. The potential consequence for surface water receptors in this circumstance is elevated levels of silt, suspended solids, and nutrients, what can lead to water quality degradation, decline in fisheries resources and serious ecological degradation of aquatic biota.

Surface water at the site could be affected by increased sediment transport and runoff due to the presence of unstable, collapsible soils (TP-01, TP-06) and impermeable clays (TP-02, TP-03). Construction activities such as excavation and stockpiling may disturb these soils, potentially leading to erosion and increased sediment in drainage systems or nearby water bodies. Additionally, the presence of soils with different permeability could contribute to surface water pooling and slow water movement across the site. Depending on weather conditions and construction practices, these factors may influence runoff patterns and localised water flow.

Groundwater at the site is shallow in certain areas (TP-01 @ 1.5mbgl, TP-06 @ 1.1mbgl), indicating a potential for water ingress during excavation. The presence of groundwater-bearing layers, particularly in TP-06, suggests that construction activities could temporarily alter subsurface flow. Additionally, the high recharge potential means groundwater levels may fluctuate, which could affect excavation stability.

Given the documented strong interaction between groundwater and surface water in the region,

any deterioration in groundwater quality has the potential to affect nearby surface watercourses. This connectivity highlights the need for robust management measures to minimise potential impacts during both construction and operation.

Groundwater is anticipated to flow in a northeasterly direction, following the local topographic gradient. Several groundwater wells are recorded in this direction and could theoretically be impacted; however, none are identified as having sensitive or high-value uses. Moreover, the likely presence of localised flow paths within the groundwater body would act to constrain the spread of potential contaminants, thereby reducing the risk of widespread dispersion. As such, the likelihood of adverse impacts on Source Protection Areas or abstraction wells as a result of site-related groundwater influences is considered to be low.

Considering the natural topography of the proposed site and the surrounding areas along with the hydrological connection with the Ballynamony Stream***, in the absence of mitigation***, uncontrolled releases of sediment run-off would result in a ***negative, moderate, temporary effect*** on the water quality of the local hydrological system.

In the absence of mitigation, uncontrolled releases of sediment run-off would result in a ***negative, moderate, short-term effect*** on the water quality of the New Ross Groundwater Body & the Coolane Sand and Gravel Aquifer underlying the proposed site.

Accidental Spillages of Harmful Substances

During the construction phase, there is a possibility of a spillage of contaminants such as fuels, oils, chemicals and cement material, posing a potential risk to surface and groundwater quality. Fuels, oils and chemicals have a number of hazardous properties, and the constituents of concrete are alkaline and corrosive. Each one of these substances can have a significant deleterious effect on water quality and aquatic life should any become entrained in the receiving water environment.

The drainage characteristics of the site area outlined in **Section 8.4.5** concluded that the Qbar value for each of the sub catchments in the site are:

- Western service yard: 5.8 l/s.
- Office and eastern service yard: 3.1 l/s.
- Sump/Lower Level: 4.3 l/s.

In the event of any spillages, contamination would likely be carried by the site run-off and migrate into the adjacent drainage ditches, and subsequent downstream receptors.

The groundwater vulnerability assessment in **Section 8.4.8** classified the site as having ‘high’ vulnerability due to the presence of highly permeable subsoils. During the site investigation, groundwater was encountered in two trial pits, along with saturated soils and localised ponding along the northwestern boundary, likely influenced by preceding heavy rainfall. These conditions highlight the need for effective mitigation measures to protect groundwater quality.

Given the documented strong interaction between groundwater and surface water in the region, any deterioration in groundwater quality has the potential to affect nearby surface watercourses. This connectivity highlights the need for robust management measures to minimise potential impacts during both construction and operation.

Groundwater is anticipated to flow in a northeasterly direction, following the local topographic gradient. Several groundwater wells are recorded in this direction and could theoretically be impacted; however, none are identified as having sensitive or high-value uses. Moreover, the likely presence of localised flow paths within the groundwater body would act to constrain the spread of potential contaminants, thereby reducing the risk of widespread dispersion. As such, the likelihood of adverse impacts on Source Protection Areas or abstraction wells as a result of site-related groundwater influences is considered to be low.

In the absence of mitigation, uncontrolled releases of hydrocarbons, chemicals or cement would result in a ***negative, moderate to significant, temporary effect*** on the Ballynamony Stream. This would lead to impacts on the water quality of the River Greese and, although unlikely, the contamination could extend to downstream receptors, including the River Barrow and its respective SAC.

In the absence of mitigation, uncontrolled releases of hydrocarbons, chemicals or cement would result in a ***negative, moderate, short-term effect*** on the water quality of the New Ross Groundwater Body and the Coolane Aquifer underlying the proposed site.

Increased Groundwater Vulnerability

The removal and disturbance of a significant amount of soil required in order to level the site is anticipated during the construction phase which carries the potential to increase the vulnerability of a groundwater body to incidences of contamination at surface level.

The preliminary Cut and Fill analysis for the Proposed Development indicates that a total of 26,372.90 m^3 of subsoil will be excavated, of which 7,589.93 m^3 will be reused on-site as capping layers and fill. To minimise the volume of material removed from the site, the excavated soil will be used to construct a 1.2m-high berm with 1:4 graded sides and a 2m-wide flat top along the southern boundaries. This will provide both acoustic and visual screening for the site.

Additional reuse of excavated material may be possible for landscaping, as well as for backfilling existing drainage ditches and proposed drainage lines, provided it meets the necessary classification for backfill material. However, any surplus soil that cannot be reused will be transported to licensed disposal facilities. These volume estimates are subject to change pending further ground investigations before construction begins.

The deepest excavations on site will occur at the proposed bunded area, located in the cantral and southern portion of the site, and at the attenuation pond planned for the northeastern portion. Excavations up to 3.0 mbgl will be required to achieve the FFL at the bunded area, while depths of up to 1.9 mbgl will be necessary for the attenuation pond serving the Office and Eastern Service Yard sub-catchment.

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, which will extend to depths of approximately 4.0 mbgl into subsoils. Foundations of up to 0.5m below the FFL will be required along the structural outline of buildings.

GSI maps indicate the groundwater vulnerability throughout the site was classed as ‘high’. The groundwater protection response matrix (**Rg/M**) assigns the site a vulnerability rating of "**R1**," indicating that the development location is acceptable with respect to groundwater protection.

Desktop study suggests a subsoil depth of 5-10m throughout the area, considering the type of aquifers present in the area. Geotechnical investigations conducted on-site support this, as no bedrock was encountered during the excavation of trial pits. However, as water was observed at 0.9 and 1.5mbgl at TP-06 and TP-01, respectively, the possibility of encountering groundwater during the works exists. An excavation depth of 3.0m bgl could increase the vulnerability in these areas from 'high' to 'extreme'. Further trial pits pre-construction are recommended to determine soil depth, especially along the northwestern boundary and where the bunded area is to be located.

In the absence of mitigation, the removal of soil/subsoil cover during the construction phase would have a ***negative, significant, long-term effect*** on groundwater vulnerability at the Proposed Development site.

Excavation of Bedrock Aquifer

As depicted in **Table 8.11**, groundwater wells in the surrounding area typically encounter bedrock at depths ranging from 4.6 m to 10.4 mbgl. A desktop study indicates subsoil depths across the area to be approximately 5–10 meters, consistent with the site's high groundwater vulnerability and aquifer type. This assessment is supported by the site investigation carried out by ORS, which involved the excavation of six trial pits, ranging from 1.9m to 2.8mbgl, where none of which encountered bedrock. Since the maximum excavation depth required to level the site is expected to reach 3.0 mbgl, interaction with bedrock is unlikely to happen. Nevertheless, installation of impermeable liners under the attenuation tanks and the attenuation pond are recommended.

If excavation into bedrock is necessary and ***control and mitigation measures are not implemented***, predicted effects will have ***negative, significant and long-term effect*** on hydrogeology.

Excavation of Contaminated Soils

The excavation and construction activities will cause quantities of excavated materials to be reused on site or removed from site for disposal or recovery. The site is a greenfield site, and historical mapping does not suggest any incidences of land use which might result in the contamination of soils. Furthermore, a geotechnical site investigation conducted at the site in January 2025 did not detect any evidence of contaminated soils. It is not anticipated contaminated soils will be encountered during construction activities hence no adverse effects on the groundwater or surface water quality are expected as a result of contaminated soils.

The Outline Construction Environmental Management Plan (**Document Ref: 231239-ORS-XX-XX-RP-EN-13d-010**) will include a set of procedures to be implemented in the incidence of contaminated soils encountered nonetheless despite ***negligible impact or lack of significance*** to hydrogeology and hydrology.

Increase in Flood Risk to Receiving Catchment

The construction phase will involve the gradual conversion of the existing greenfield site to areas of hardstanding. Under this scenario, the risk of flooding within the receiving catchment will increase due to an increase in impervious land area and associated drainage systems, which leads to a large increase in volume and intensity of surface water run-off within a given catchment.

The increase in impervious area means that a greater proportion of the incident rainfall will appear in the drainage system as surface run-off. The provision of sealed pipes to convey run-off from the site to existing watercourse will result in larger (concentrated) volumes being discharged at point locations within a shorter duration, thereby increasing flood risks.

Additionally, due to the shallow groundwater levels observed on-site, dewatering may be required during excavation works. A detailed ground investigation will be carried out during the pre-construction phase to confirm the need for dewatering and, if necessary, to estimate the expected volumes and duration of abstraction, along with the associated discharge strategy. Should discharge to surface water be proposed, it is possible that this could increase the risk of flooding within the receiving catchment, and appropriate mitigation measures would need to be considered.

In the absence of mitigation, the predicted effects of the Proposed Development resulting in an increase of flood risk to the receiving catchment are ***negative, moderate and long-term.***

8.5.4 Sources - Operational Phase

A summary of the potential operational phase effects is provided in **Table 8.18**, with a detailed analysis below.

Table 8.18: Operation Phase Effects Summary (Unmitigated)

Receptor	Potential Environmental Effects	Quality	Significance	Duration
Groundwater New Ross Groundwater Body & Coolane Sand and Gravel Aquifer	Contaminated Run-off	**Negative**	**Moderate**	**Short-Term**
	Foul Water	**Negative**	**Moderate to Significant**	**Temporary**
	Increased Groundwater Vulnerability	**Negative**	**Significant**	**Temporary**
	Uncontrolled Releases & Spillage of Digestate and Feedstocks	**Negative**	**Slight to Moderate**	**Temporary**
	Fire and Resultant Firewater	**Negative**	**Moderate**	**Short-Term**
	Landspreading of Biobased Fertiliser	**Negative**	**Slight**	**Short-Term**
	Attenuation Tanks	**Negative**	**Moderate**	**Long-Term**
	Attenuation Pond	**Negative**	**Moderate,**	**Long-term**
Surface Water Ballynamony Stream and downstream receptor, River Greese	Contaminated Run-off	**Negative**	**Moderate to Significant**	**Temporary**
	Foul Water	**Negative**	**Moderate to Significant**	**Temporary**
	On-Site Flooding	**Negative**	**Slight**	**Temporary**
	Increase in Flood Risk to Receiving Catchment	**Negative**	**Moderate**	**Long-Term**
	Uncontrolled Releases & Spillage of Digestate and Feedstocks	**Negative**	**Slight to Moderate**	**Temporary**
	Fire and Resultant Firewater	**Negative**	**Slight to Moderate**	**Temporary**
	Landspreading of Biobased Fertiliser	**Negative**	**Slight**	**Temporary**
	Attenuation Tanks	**Neutral**	**Moderate**	**Long-Term**

Receptor	Potential Environmental Effects	Quality	Significance	Duration
	Attenuation Pond	**Negative**	**Moderate,**	**Long-term**

Contaminated Run-off

Run-off from impermeable areas within the Proposed Development site such as roads and car parking areas are likely to contain potentially polluting substances such as hydrocarbons, heavy metals and sodium chloride arising from de-icing of these surfaces during winter months.

The proposed rainwater harvesting system for the development comprises three facilities designed to collect runoff from building roofs, service yards, and impermeable surfaces. Overflow from the rainwater harvesting tanks located on the higher, western side of the site will be directed to an underground attenuation facility. At the lower level, measures will be implemented to isolate any potentially contaminated water in the event of a failure in the digestate tanks.

For the lower level there is a requirement to isolate any potential contaminated water should there be a failure in the digestate tanks. This limits the potential for SuDS based attenuation features and as such the full 1:100 year + 30% climate change volume will be contained below ground in the proposed pluvial cube system. An automated penstock will be provided within the final manhole prior to discharge from the sump level that will be activated in the unlikely event that there is a failure of the digester or digestate tanks

Following attenuation, surface water discharge from the Proposed Development will outfall to the drainage ditch situated along the north-western boundary of the site.

The risk of failure in the runoff collection and discharge system should be considered; however, it remains unlikely. In the event of a failure, there is a potential for contaminated runoff to reach the underlying aquifer system. ***In the absence of suitable design & mitigation measures***, there would be a ***negative, moderate, short-term effects*** on the water quality of the New Ross Groundwater Body and the Coolane Sand and Gravel Aquifer.

In the absence of suitable design & mitigation measures, there would be a ***negative, moderate to significant, temporary effects*** on the water quality of the Ballynamony Stream. The contamination could extend to downstream receptors, including River Greese & River Barrow.

Foul Water

A domestic scale wastewater treatment plan is proposed to cater for the foul water arising from staff facilities on-site only (Population Equivalent ‘PE’ of 6). The accompanying site suitability assessment has concluded that the site is suitable to provide treatment for domestic sewage via discharge to groundwater.

The inherent risk associated with wastewater treatment systems is leakage of untreated foul water. This situation can arise from poor construction methods, inadequate maintenance and failure to scale the system to an appropriate projected population equivalent.

During incidences of leakage foul water would likely follow preferential pathways created by permeated backfill and infiltrate into the site drainage system ultimately impacting both surface water and groundwater receptors. Adverse effects associated with foul water leakages consist of contamination relating to the of the following:

- Pathogens, (E. Coli etc.)
- Elevated levels of ammonia and nitrate
- Elevated levels of phosphorus

In the absence of suitable design and mitigation measures, such leakages could lead to eutrophication within the Ballynamony Stream and possibly the River Greese and to the New Ross Groundwater Body & Coolane Aquifer leading to degradation of water quality with negative consequences for aquatic life. Overall, the predicted effects of foul water leakage on hydrological and hydrogeological receptors are ***negative, moderate to significant and temporary.***

Given the documented strong interaction between groundwater and surface water in the region, any deterioration in groundwater quality has the potential to affect nearby surface watercourses. This connectivity highlights the need for robust management measures to minimise potential impacts during both construction and operation.

Groundwater is anticipated to flow in a northeasterly direction, following the local topographic gradient. Several groundwater wells are recorded in this direction and could theoretically be impacted; however, none are identified as having sensitive or high-value uses. Moreover, the likely presence of localised flow paths within the groundwater body would act to constrain the spread of potential contaminants, thereby reducing the risk of widespread dispersion. As such, the likelihood of adverse impacts on Source Protection Areas or abstraction wells as a result of site-related groundwater influences is considered to be low.

Increased Groundwater Vulnerability

The proposed FFL will be up to 1.85 metres below the existing site elevation, specifically in the south-western portion of the bunded area. TP-06, where groundwater was encountered at 1.1 mbgl, is located near the silage clamps, where excavations are expected to remain around 0.6 mbgl. Groundwater was also observed in TP-01 at 1.5 mbgl; this pit is situated within the office area, where infilling of terrain is planned. However, in close proximity to the north, excavations of up to 2.5 mbgl are anticipated, suggesting a risk of encountering groundwater during the works, particularly following rainfall events, when the water table may rise above previously recorded levels.

Excavations between 2.0 and 3.0 mbgl could increase the vulnerability of this area from ‘high’ to ‘extreme’.

In the absence of mitigation measures, the removal of soil/subsoil cover to reach the proposed FFLs would have a ***negative, significant, temporary effect*** on groundwater vulnerability at the Proposed Development site.

On-Site Flooding

A flood event occurring on the Proposed Development would cause the Sustainable Urban Drainage Infrastructure (SuDS) to become overwhelmed, creating additional pathways for

potential contaminants to migrate off-site into downstream receptors along with elevated flow rates.

The Proposed Development is not located in a Flood Zone, according to the OPW and the likelihood of fluvial flooding occurring on the site is unlikely. Please refer to Site Specific Flood Risk Assessment (Document Ref: **231239-ORS-XX-XX-RP-EN-13d-011**) which accompanies the application.

However, during the site investigation, areas of surface ponding were observed, indicating a potential risk of pluvial flooding. This ponding currently drains toward the ditch located along the northwestern boundary of the site.

Overall, ***in the absence of suitable design and mitigation measures*** the predicted effects of the occurrence a flood event on hydrological receptors is ***negative, slight,*** and ***temporary*** to hydrogeology and hydrology***.***

Increase in Flood Risk to Receiving Catchment

The operational phase will see a significant portion of the existing greenfield site converted to areas of hardstanding. Under this scenario, the risk of flooding within the receiving catchment will increase due to an increase in impervious land area and associated drainage systems, which leads to an increase in volume and intensity of surface water run-off within a given catchment.

The increase in impervious area means that a greater proportion of the incident rainfall will appear in the drainage system as surface run-off. The provision of sealed pipes to convey run-off from the Proposed Development to existing watercourse will result in larger (concentrated) volumes being discharged at point locations within a shorter duration, thereby increasing flood risks.

In the absence of mitigation, the predicted effects of the Proposed Development resulting in an increase of flood risk to the receiving catchment are ***negative, moderate, and long-term.***

Uncontrolled Releases and Spillages

During the operational phase, there is a possibility of leakage or spillage of biobased fertiliser or feedstocks via vehicle movements or from a failure of a tank or feed line. While such substances are significantly less hazardous than fuels, oils, chemicals, and cement material, the still pose a potential risk to surface and groundwater quality. Biobased fertiliser or animal slurries in high quantities can have a deleterious effect on water quality and aquatic life should any become entrained in the receiving water environment.

Uncontrolled releases of biobased fertiliser, feedstock, hydrocarbons, chemicals or cement, ***in the absence of mitigation measures***, would result in ***negative, slight to moderate, temporary effects*** on the water quality of the Ballynamony Stream. The contamination could extend to downstream receptors, including River Greese & River Barrow.

Fire and Resultant Firewater

Appropriate storage facilities will be provided for combustible and flammable materials (i.e. fuel) required for the operation of the Proposed Development. In the event of a fire, significant quantities of water resources will be utilised to quench the fire. Water used to quench a fire is

known as “firewater”. Firewater is known to contain the following harmful substances:

- Products of combustion
- Extinguishing foam / fluid
- Hazardous substances (fuels, oils & chemicals)

Due to the presence of these hazardous substances, firewater poses a significant risk to surface and groundwater quality.

Uncontrolled releases of firewater ***in the absence of mitigation measures***, would result in ***negative, slight to moderate, temporary effects*** on the water quality of the Ballynamony Stream. The contamination could extend to downstream receptors, including River Greese & River Barrow.

Uncontrolled releases of firewater, ***in the absence of mitigation measures***, would result in ***negative, Moderate, short-term effects*** on the water quality of the New Ross Groundwater Body & Coolane Aquifer underlying the proposed site.

Landspreading of Biobased Fertiliser

The biobased fertiliser produced will be a rich source of nutrients that will be used by customer farmers for the fertilisation of their land. In the worst-case scenario and in absence of mitigation, any inappropriate land-spreading of the biobased fertiliser could lead to impacts upon the receiving waters in local catchments and it can result in eutrophication, algal blooms, fish kills and loss of biodiversity. Designated habitats and species can be impacted upon. There is a greater risk when groundwater vulnerability at the lands for spreading is high, or when land-spreading is undertaken close to drains or streams. In these situations, the Pollution Impact Potential for both phosphates and / or nitrates is high.

The farms of the customer farmers have been identified; however, these will be subject to local change on an annual basis. All farmers will use the biobased fertiliser on lands that have an agronomic requirement for fertiliser. Spreading will be done in accordance with the specific Nutrient Management Plan for the farm and in accordance with S.I. 113 of 2022. Records for the movement of all biobased fertiliser will be kept.

Inappropriate land spreading ***in the absence of mitigation measures*** would result in ***negative, slight, temporary effects*** on the water quality of the Ballynamony Stream. The contamination could extend to downstream receptors, including River Greese & River Barrow.

The potential for contamination of the local groundwater body will depend on the specific characteristics of the land where the biobased fertiliser is applied. However, with proper management practices, contamination is unlikely to occur. If contamination is to reach the groundwater body, ***in the absence of mitigation measures***, the effects would be ***negative, slight, and short-term.***

The positive benefits of using the biobased fertiliser produced must also be considered, as this provides an alternative to the land-spreading of liquid slurry. Using biobased fertiliser presents several scientific advantages over the continued use of untreated manures, slurries, or chemical fertilisers, particularly concerning plant nutrient availability and the mitigation of nutrient leaching into watercourses. The benefits are outlined below.

- **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 biobased fertiliser supports comprehensive plant nutrition, contributing to improved crop yields and overall plant health (Möller and Müller, 2012)[15].

- **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 biobased fertiliser reduces the risk of nutrient loss and enhances nutrient uptake efficiency by plants (Yao et al., 2011)[16]. Analysis has shown that approximately 80% of the total nitrogen in biobased fertiliser is present as readily available nitrogen. Digestion of livestock slurry has also been shown to increase the plant availability of nitrogen in slurry by *ca.* 10%.

  Compared to untreated manures and slurries, biobased fertiliser poses a lower risk of nutrient leaching into watercourses. The balanced nutrient composition and slow-release nature of biobased fertiliser minimise the likelihood of excess nutrients washing away into streams or groundwater. This reduction in nutrient leaching coupled with land spreading best practice helps mitigate water pollution and eutrophication, safeguarding aquatic ecosystems and maintaining water quality (Möller and Müller, 2012).

- **Enhanced Soil Health: R**ich 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).[17]

- **Biobased Fertiliser Usage:** At full capacity the total tonnages for transportation off-site as biobased fertiliser to local agricultural operators are summarised below:

  - Digestate Fibre - 24,500 tonnes
  - Digestate Liquid - 53,500 tonnes

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 operator will apply for End of Waste status upon grant of permission.

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 on accordance with the specific Nutrient Management Plan for that farm.

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[15] Möller, K., & Müller, T. (2012). Effects of anaerobic digestion on biobased fertiliser nutrient availability and crop growth: a review. Engineering in Life Sciences, 12(3), 242-257.
[16] Yao, R., Li, G., Xie, H., Zhao, B., & Liu, H. (2011). *Release characteristics of nutrients from aerobic composted swine manure in soil. Journal of Soils and Sediments*, 11(1), 103-111.
[17] De Vries, J. W., Groenestein, C. M., & Kool, P. L. (2015). *Effects of anaerobic digestion and composting on reducing the environmental impact of pig manure*. Journal of Environmental Management, 162, 230-237.

Attenuation Tanks

The Proposed Development includes two no. attenuation tanks designed to manage surface water runoff from roads, yards, roofs, and the impermeable bunded area. Both tanks are located centrally within the site, within the bunded area and near the silage clamps. Site investigations, which involved the excavation of trial pits to a depth of 2.8 mbgl, identified no presence of bedrock in these areas. The proposed design indicates that excavation for the installation of the tanks will not exceed a depth of 2.0 mbgl.

If inappropriately constructed, the attenuation tanks may pose a risk to the underlying aquifer. As such, all underground structures will be fully impermeable in order to limit the risk of contaminants leaching into the underlying locally important gravel aquifer. There is also a potential risk of contaminants to reach surface water receptors via run-off.

Given the documented strong interaction between groundwater and surface water in the region, any deterioration in groundwater quality has the potential to affect nearby surface watercourses. This connectivity highlights the need for robust management measures to minimise potential impacts during both construction and operation.

Groundwater is anticipated to flow in a northeasterly direction, following the local topographic gradient. Several groundwater wells are recorded in this direction and could theoretically be impacted; however, none are identified as having sensitive or high-value uses. Moreover, the likely presence of localised flow paths within the groundwater body would act to constrain the spread of potential contaminants, thereby reducing the risk of widespread dispersion. As such, the likelihood of adverse impacts on Source Protection Areas or abstraction wells as a result of site-related groundwater influences is considered to be low.

The attenuation tanks, ***if not properly constructed and in the absence of mitigation measures*** is foreseen to have potentially ***negative, moderate, and long-term effects*** on surface water bodies and on the groundwater body.

Attenuation Pond

The Proposed Development includes the provision of one no. open attenuation pond designed to manage surface water runoff from the office and eastern service yard level. The attenuation pond is proposed to be located to the northeast of the site. The proposed design indicates that excavation for the installation of the attenuation pond will not exceed a depth of 1.9 mbgl.

If inappropriately constructed it may pose a risk to the underlying aquifer. As such, the attenuation ponds will be lined with an impermeable membrane to limit the risk of contaminants leaching into the underlying regionally important bedrock aquifer. There is also a potential risk of contaminants to reach surface water receptors via run-off.

Given the documented strong interaction between groundwater and surface water in the region, any deterioration in groundwater quality has the potential to affect nearby surface watercourses. This connectivity highlights the need for robust management measures to minimise potential impacts during both construction and operation.

The attenuation pond, ***if not properly constructed and in the absence of mitigation measures*** is foreseen to have potentially ***negative, moderate, and long-term effects*** on surface water bodies and on the groundwater body.

8.6 Mitigation Measures

Mitigation measures proposed in this section relate primarily to the preservation of the existing subterranean drainage regime, the protection of groundwater receptors and the protection of surface water receptors.

Mitigation Measures proposed in this section are in response to the risks identified in **Section 8.5.**

8.6.1 Construction Phase

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 effects on surface water and groundwater.

Increased Run-off and Sediment Loading

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. The below recommendations are advised with reference to the Eastern Regional Fisheries Board recommendations for protection of adjacent water courses during the construction phase:

- A temporary drainage system will be established complete with oil interceptors and settlement ponds to remove contaminants from run-off, prior to discharge off-site.
- Stockpile areas for sands and gravel should be kept to minimum size, well away from storm water drains, gullies leading off-site, and the drainage ditches.
- Installation of impermeable liner is recommended under the storage material areas.
- Covers are to be provided over soil debris stockpiles when high wind and inclement weather are encountered if required.
- Harmful materials and stockpiles should be stored well away from the adjacent drainage ditches on-site, as these provide a direct pathway to the Ballynamony Stream.
- Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and the aquifer.
- Landscaping should be carried out as soon as possible to minimise weathering.
- Silt fences will be erected where appropriate using a permeable filter fabric (Hy-Tex Terrastop Premium silt fence or similar).
- Excavation works will not be carried out during or following heavy rainfall (i.e., if there is a yellow weather warning in place or 5mm in 1-hour period). Excavations will be covered during rainfall to avoid creation of surface water with high concentrations of suspended solids that would require dewatering.
- A detailed hydrogeological investigation will be undertaken prior to the commencement of works to enhance understanding of the site's hydrogeological conditions and to determine whether dewatering of excavations will be required. If dewatering is deemed necessary, a comprehensive report will be prepared outlining the estimated dewatering volumes and duration, associated potential impacts, proposed mitigation measures, and a discharge strategy. This report will be submitted to the relevant local authority for review.
- Installation of temporary piezometers or standpipes is recommended in order to monitor groundwater levels during construction phase.

Accidental Spillages of Harmful Substances

The following measures will minimise the risk of a release of fuels, oils, chemicals or cement products at the site:

- Establishment of bunded oil and chemical storage areas.
- Refuelling of mobile plant in designated areas provided with spill protection.
- Fuel bowsers to be located in bunded areas which can cater for 110% of the primary vessel capacity or 25% of the total volume of the substance which could be stored withing the bunded area and to be located away from the adjacent drainage ditches.
- Only appropriately trained site operatives permitted to refuel plant and machinery on-site.
- Regular inspections carried out on plant and machinery for leaks and general condition.
- Emergency response plan.
- Spill kits readily available throughout the site.
- Use of ready-mixed supply of wet cement products.
- Scheduling cement pours for dry days.

Increased Groundwater Vulnerability / Excavation of Bedrock/Gravel Aquifer

A desk-based study has classified the site as having high groundwater vulnerability. This assessment was confirmed by on-site investigations, during which groundwater was encountered in two of the six trial pits excavated, indicating a relatively high water table. Excavations to depths of up to 3.0 metres below ground level (mbgl), particularly within the proposed bunded area, may locally increase the vulnerability rating from ‘high’ to ‘extreme’. Given these findings, it is likely that dewatering may be required during excavation works.

To better understand the hydrogeological conditions and inform construction planning, a detailed ground investigation should be undertaken prior to commencement of works. This should include:

- Drilling of cable percussion and/or rotary Bs with the installation of standpipes to obtain geological and hydrogeological data.
- Pumping tests to determine baseline groundwater levels and assess aquifer hydraulic properties.
- Assessment of hydraulic connectivity between the sand and gravel aquifer and nearby surface water features such as drainage ditches, ponded areas, and rivers.
- Evaluation of surface water infiltration pathways and the potential for groundwater ingress during excavation activities.
- Identification of any long-term risks to groundwater quality or quantity.

The results of this investigation will be compiled into a technical report and submitted to the relevant local authorities. These findings will be used to develop a hydrogeological conceptual model for the site to determine whether dewatering is necessary. If dewatering cannot be avoided, the following aspects will be assessed:

- Estimated volume and duration of dewatering required to facilitate the deepest excavations, always accounting for worst-case scenarios.
- Potential temporary impacts on local groundwater resources and groundwater-dependent receptors.

- Anticipated aquifer drawdown, including potential effects on existing wells and nearby surface water features.
- Evaluation of construction methods that may minimise dewatering requirements and reduce associated impacts.
- Discharge strategy based on predicted flow rates, identifying best discharge location (surface water or groundwater), and incorporating temporary settlement tanks or treatment units where necessary.
- Licensing requirements for discharge to surface water or groundwater, including the need to obtain a Discharge Licence from Kildare County Council.

Based on the outcomes of the assessment, relevant mitigation measures and any residual impacts will be identified. The potential impacts of discharging abstracted groundwater to surface water or groundwater will also be assessed, and mitigation measures developed accordingly.

During construction, the following measures will be implemented to protect groundwater and nearby surface water bodies:

- Excavations will be backfilled as soon as practicable to minimise the risk of contaminant infiltration into the subsurface and underlying aquifer.
- Landscaping works will be carried out promptly to reduce surface erosion and weathering.
- Baseline groundwater quality monitoring will be conducted prior to the commencement of works.
- Foundation and service designs will account for groundwater pressures and will include attenuation systems where appropriate, ensuring alignment with greenfield runoff rates (Qbar).
- Surface water will be managed using Sustainable Drainage Systems (SuDS) to reduce runoff and support on-site infiltration.
- Pollution prevention measures will be enforced throughout all construction phases to prevent untreated runoff, spills, or other pollutants from entering groundwater or surface waters.

Where dewatering systems are necessary, they will be designed in accordance with recognised best practice (i.e. CIRIA C750). Monitoring of groundwater levels and discharge quality will be undertaken in accordance with the requirements of the relevant local authorities. Dewatering plans will be subject to revision as site conditions evolve.

Following the completion of construction, any dewatering systems will be decommissioned gradually to allow for the natural recovery of groundwater levels. Post-construction monitoring will be carried out as required to verify restoration of pre-development conditions and to ensure there are no residual impacts on groundwater or associated receptors.

Excavation of Contaminated Soils

It is not anticipated contaminated soils will be encountered during construction activities hence no adverse effects on the groundwater or surface water quality are expected as a result of contaminated soils.

- All excavated materials will be visually assessed for contamination.

- Any contaminated material detected will be sent for analysis to a suitable environmental laboratory and subsequently quantified, segregated and transported for disposal by a licenced contractor.

Increase in Flood Risk to Receiving Catchment

The construction phase will involve the gradual conversion of the existing greenfield site to areas of hardstanding. The following measures will be implemented in the construction phase to minimise an increase of flood risk to the receiving catchment:

- A temporary drainage system will be implemented during the construction phase, incorporating oil interceptors and settlement ponds to treat surface water runoff and remove potential contaminants prior to controlled discharge off-site.
- Bunds and diversion channels will be installed to divert surface water away from sensitive areas, including open excavations and adjacent drainage ditches leading off-site.
- All temporary drainage features will be subject to regular inspection and maintenance to ensure effective operation and to prevent blockages or failures.
- The drainage strategy will be reviewed and adapted throughout the construction period to reflect evolving site conditions.
- A flood risk response plan will be developed to set out actions and procedures in the event of extreme weather during construction.
- If dewatering systems are required, they will be designed in accordance with recognised best practice guidance, such as CIRIA C750. A discharge strategy will be developed based on predicted flow rates, identifying the most suitable discharge location and incorporating temporary settlement tanks or treatment units where necessary. Discharge to surface water will be controlled to ensure it does not exceed greenfield runoff rates.
- Where discharge to surface water is proposed, the relevant licensing requirements will be addressed, and a Discharge Licence will be obtained from Kildare County Council, as required.

8.6.2 Operational Phase

General Mitigation Measures

An Environmental Management System (EMS) will be prepared and implemented by the operator 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 Development 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:

- Site specific trigger levels will be established and agreed with the EPA.
- 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

Contaminated Run-off

Compared to untreated manures and slurries, biobased fertiliser poses a lower risk of nutrient leaching into watercourses. The balanced nutrient composition and slow-release nature of biobased fertiliser minimise the likelihood of excess nutrients washing away into streams or groundwater. This reduction in nutrient leaching coupled with land spreading best practice helps mitigate water pollution and eutrophication, safeguarding aquatic ecosystems and maintaining water quality.

The $Qbar_{rural}$ calculations are outlined in the Civil Engineering report which accompanies this application.

The outflow from the sub catchments will be restricted to a maximum permissible discharge rate of 5.8 l/s (Western service yard) 3.1l/sec, (Office and eastern service yard) and 4.3l/sec (Sump/Lower Level). These rates were calculated in accordance with criteria defined in the IH 124 report Method (Institute of Hydrology) to ensure the proposed development will not affect the flow / flood regimes in the receiving environment.

The overflow from the rainwater harvesting tanks on the higher, western side of the site, will be collected in an attenuation facility below ground. This facility has been sized using Causeway Flow drainage software and considers that the rainwater harvesting tank may be full at the time of a 1:100year +30% climate change rainfall event.

For the lower level there is a requirement to isolate any potential contaminated water should there be a failure in the digestate tanks. This limits the potential for SuDS based attenuation features and as such the full 1:100 year + 30% climate change volume will be contained below ground in the proposed pluvial cube system. An automated penstock will be provided within the final manhole prior to discharge from the sump level that will be activated in the unlikely event that there is a failure of the digester or digestate tanks.

The office and eastern service yard catchment attenuation is provided by a proposed open surface pond. The banks of the pond allow for the attenuation volume required to be provided and can be planted with appropriate water-loving plants to improve biodiversity and amenity. The banks have been proposed at 1:4 to allow for maintenance requirements and grade back to proposed ground levels in the surroundings.

Post-attenuation, surface water runoff will be discharged at the greenfield runoff rate calculated for each catchment via means of a Hydrobrake or similar approved flow control device. This approach maintains the existing topographical discharge route from the site to the existing drainage ditch which traverses the northern boundary of the site. Attenuation and rainwater harvesting volumes have been sized based on a 95% runoff rate from all impermeable surfaces throughout the site. Given the variable water table and low permeability substrata observed in the trial pits, alongside the proposed depth of construction it was not considered feasible to mobilise discharge to ground for the development.

Design criteria adopted for the development include:

- Pipes are designed for small catchment areas as defined in GDSDS, based on the modified rational method and a rainfall intensity of 50mm/ hour onto impermeable surfaces.

- All surface water pipes have been designed to achieve a minimum self-cleansing velocity of 0.75m/s
- Surface water pipework will be laid to a gradient no flatter than 1:500
- Backdrop heights will be greater than 0.6m where practicable
- The GDSD requirements with respect to interception volume, long-term storage volume and treatment volume have been considered.
- Minimum surface water pipe size of 225mm
- Minimum depth of cover to pipework of 1.2m below trafficked area, or where this cannot be achieved, adequate protection will be provided.
- Maximum depth of pipework of 5m
- Roughness value for surface water pipework, k_s, 0.6mm

A flow control device will be fitted to the outlet manhole from the detention basin and attenuation facilities. This will be fitted to a suitably sized outlet pipe and will have a pull chord bypass. To allow for maintenance a penstock valve or similar approved will be installed on the inlet to the flow control manhole.

It is proposed that all surface water run-off from trafficked areas will outfall via a Class 1 Bypass Separator (Kingspan Klargester or similar approved) located upstream of the proposed attenuation pond and attenuation tanks. This device will remove hydrocarbons and fine sediment particles from the site runoff and lower the risk of downstream contamination following an oil spillage on site.

It is proposed to collect runoff generated from the washing out of internal buildings and wheel washes for reuse in the industrial process. The silage runoff will be collected via a network of linear drains within the buildings and at interior thresholds, it is not proposed to accept surface water into the silage reclaim network, excluding that which is used in the washdown process which has been collected from the rainwater harvesting facilities. The runoff generated will be directed to a piped network laid at a gradient of 1:60 to ensure blockage and siltation is minimised. A precast concrete sump chamber (Molloy P6 unit or similar approved) is proposed within the odour abatement building to allow for the collection of the silage runoff prior to being pumped to Prepit 01.

The proposed civil services layout, detailing the surface water drainage system is shown in **Technical Note Ref: 231239-ORS-XX-XX-RP-C-13a-001** and in **Drawing Ref: 231239-ORS-ZZ-00-DR-CE-400**.

Foul Water

A domestic scale wastewater treatment plant (TER 3 PACKAGED TERTIARY UNIT and a distribution attenuation layer of 60sqm) is proposed to cater for the foul water arising from staff facilities on-site only (Population Equivalent ‘PE’ of 6). A Site Suitability Assessment conducted by *Coyle Environmental* in line with the EPA Code of Practice for onsite domestic wastewater treatment systems (2022) has concluded that the soils at the Proposed Development have sufficient absorption capacity for the installation of a percolation area suited for this PE.

Based on the design population for the 10 relevant number of users, the population equivalent (PE) for the Proposed Development is calculated at PE6. The volume of foul water generated from the Proposed Development was calculated at 300 litres/day for hydraulic loading and 200 litres/day for organic loading. The proposed treatment system will produce an effluent with a standard compliant with SR66 the percolation area be designed on the hydraulic loading of 6

PE.

The wastewater treatment plant will comprise a tertiary treatment system (6PE EuroTank BAF2 Wastewater Treatment System), followed by a 6PE EuroTank TER3 Percolation Unit. The system is proposed with discharge to a Ter3 packaged tertiary unit with a minimum 60m^2 attenuation layer.

The treatment plant will be specified and installed by an appropriately qualified technician and will be subject to regular desludging and maintenance, subject to manufacturers recommendations.

Increased Groundwater Vulnerability

The proposed Finished Floor Levels (FFLs) will be up to 1.85 m below the existing elevation of the site in certain places, which may increase the vulnerability of the underlying locally important and poor aquifers from 'High' to 'Extreme'. Mitigation measures to ensure maximum protection of groundwater include:

Engineering and Structural Controls

- Site bunding will be designed in accordance with the EPA IPC Guidance Note on the Storage and Transfer of Materials for Scheduled Activities (EPA, 2004), ensuring high standards of containment and impermeability.
- The entire tank farm will be bunded to contain potential leaks. All bunds will be:
  - Impermeable, constructed of concrete or suitable material with chemical resistance.
  - Sized to hold a minimum of 110% of the volume of the largest single tank within the bunded area.
  - Fitted with sealed sumps to allow for safe inspection and removal of stormwater or spill residues.
- Dedicated hardstanding areas will be provided for vehicle off-loading and chemical handling, with appropriate drainage controls and a minimum setback distance from any nearby surface watercourses.
- Spill prevention and containment measures will include the use of:
  - Bunded pallets and secondary containment units for smaller storage vessels.
  - Mobile spill kits strategically located throughout the site.
  - Clearly marked and regularly inspected emergency shut-off systems.
- Runoff from substantial areas of impermeable surfaces, including roofs and service yards, will be directed to a rainwater harvesting system. These tanks will:
  - Store rainwater for reuse (e.g., for washdown or non-potable applications).
  - Include overflow mechanisms to regulate discharge during heavy rainfall and avoid overloading the system.
  - Connect to a properly designed outfall system incorporating flow control structures and filtration, where necessary.
- All proposed below-ground structures will be constructed to be fully impermeable. The rainwater harvesting tanks will comprise reinforced concrete construction. The smaller circular tanks are pre-cast concrete units supplied by Molloy Precast and are designed to be watertight. The larger rainwater harvesting tank will also be constructed from reinforced concrete, likely cast in-situ, and will achieve full impermeability. Both tank types are to be installed on a compacted bed of single-sized granular material, in accordance with standard detailing for below-ground concrete structures.
- Attenuation storage for the western portion of the site will be provided using proprietary

modular geocellular units (e.g. Pluvial Cube or similar) and an attenuation pond located to the northeast of the site. As these systems are not inherently impermeable, they will be encapsulated in a welded or taped impermeable geomembrane or geotextile liner to ensure full watertightness. The attenuation systems will also be laid on, and surrounded by, compacted single-sized granular fill to facilitate structural stability and membrane protection.

Operational Environmental Management

- A detailed Environmental Operating Plan will be developed and implemented, containing:
  - Site-specific standard operating procedures (SOPs) for material handling, storage, and waste management.
  - A documented emergency response plan for accidental spills, including notification protocols, isolation procedures, and clean-up instructions.
  - Staff training and awareness programmes to ensure proper implementation.

Groundwater Monitoring Programme

To ensure ongoing protection of the aquifer and to allow for early detection of any potential contamination, a long-term groundwater monitoring programme will be established. This will include:

- Installation of permanent monitoring Bs across the site, strategically positioned:
  - Upgradient and downgradient of key risk areas (e.g. bunded zones, chemical storage).
  - With consideration of local hydrogeological flow paths and proximity to surface water features.
- Baseline groundwater sampling will be undertaken prior to commissioning to establish reference conditions for key parameters.
- Ongoing monitoring will be carried out at a frequency set by the relevant authority (e.g., quarterly or biannually), and in accordance with EPA guidance.
- Threshold values for key water quality indicators will be developed in consultation with the authority. These will reflect:
  - Statutory limits (e.g. those in the Groundwater Regulations (S.I. No. 9 of 2010)),
  - Site-specific baseline conditions,
  - Best available knowledge of local groundwater-surface water interactions.
- Action response plans will be established. In the event that threshold levels are exceeded:
  - Immediate investigation of potential sources will be undertaken.
  - Corrective actions (e.g., isolation of suspect systems, bund repairs, containment upgrades) will be initiated.
  - Findings and remediation outcomes will be reported to the relevant regulatory body.

On-Site Flooding

The existing fluvial and coastal flood risk to the Proposed Development is negligible with the proposed site located in ‘Flood Zone C’. No specific mitigation measures to alleviate fluvial and coastal flood risk to the site are recommended.

During the site investigation, areas of surface ponding were observed, indicating a potential risk of pluvial flooding. This ponding currently drains toward the ditch located along the northwestern boundary of the site.

To manage rainfall volumes effectively, a combination of SuDS and an appropriate drainage network is proposed. The stormwater management system has been designed in accordance with industry best practices and aims to replicate the existing greenfield runoff rates determined for the site. Surface water will be discharged to the drainage ditch on the northwestern boundary.

It is recommended that a detailed assessment of the ditch's capacity be undertaken prior to the commencement of construction works to ensure its adequacy in receiving the proposed discharge.

Uncontrolled Releases and Spillage

An Environmental Management System (EMS) will be implemented and accredited to ISO: 14001:2015. The Proposed Development 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. Conditions of relevance to uncontrolled releases will include:

- 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 or 25% of the total volume of the substance which could be stored withing the bunded area (in compliance with Guidance to storage and Transfer of Materials for Scheduled Activities, EPA 2004)
- EMS to include site specific standard operating procedures pertaining to waste management and emergency response.
- All attenuation facilities that are tanked will avoid percolation of contents into the underlying locally important gravel aquifer.
- Impermeable membrane liner will be installed under the attenuation pond to limit percolation of contents into the underlying locally important gravel aquifer.
- The entire tank farm area of the Proposed Development will be bunded.
- The Reception Hall, Digestate Treatment building a will each be self-bunded.
- All bunds and underground pipelines (foul and process) will be subject to integrity assessments every 3 years by a suitably qualified engineer.
- Ongoing monitoring of stormwater discharge to the Ballynamony Stream.

Fire and Resultant Firewater

There is no watermain infrastructure within the site or within the vicinity of the site that would allow for fire-fighting capacity to be provided. The large rainwater harvesting tank detailed in the pertaining engineering report (**Ref: 231239-ORS-XX-XX-RP-C-13a-001**) will provide the source of water for use within the proposed firefighting ring main. A dual pump system will be installed within a manhole chamber connected to the rainwater harvesting tank to provide firefighting capacity to a number of hydrants located throughout the site. Hydrants have been located to ensure coverage of the site and accessibility by fire tenders

The Proposed Development 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.

The conclusions and recommendations of the Firewater Risk Assessment Report will ensure that fire response and firewater retention are adequately scaled for the size of the facility. The operator of the facility will be obliged to ensure:

- A Firewater Risk Assessment will be commissioned within the first six months of operation and will determine the volume of firewater retention storage require on site.
- Adequate firewater retention capacity is installed and maintained on-site in the event of a worst-case scenario fire event.
- Firewater retention will be the large rainwater harvesting tank.
- All retention infrastructure systems will be automatically activated in the event of a fire alarm being triggered.
- All retention tanks, etc., shall be maintained empty, or at least to a point where the required retention capacity is available.
- Bunds and tanks will be constructed to Eurocode standard (BS EN 1992-3:2006).
- All proposed below-ground structures will be constructed to be fully impermeable. The rainwater harvesting tanks will comprise reinforced concrete construction. The smaller circular tanks are pre-cast concrete units supplied by Molloy Precast and are designed to be watertight. The larger rainwater harvesting tank will also be constructed from reinforced concrete, likely cast in-situ, and will achieve full impermeability. Both tank types are to be installed on a compacted bed of single-sized granular material, in accordance with standard detailing for below-ground concrete structures.

Increase in Flood Risk to Receiving Catchment

The operation phase will involve the conversion of the existing greenfield site to areas of hardstanding. The following measures will be implemented to minimise an increase of flood risk to the receiving catchment during the operation phase:

- The outflow from the sub catchments will be restricted to a maximum permissible discharge rate of 5.8 l/s (Western service yard) 3.1l/sec, (Office and eastern service yard) and 4.3l/sec (Sump/Lower Level).These rates were calculated in accordance with criteria defined in the IH 124 report Method (Institute of Hydrology) to ensure the proposed development will not affect the flow / flood regimes in the receiving environment.
- The sump level was set at 81.50mAOD with a top of wall and ramp level of 83.00mAOD. To minimise excavation the upper-level service yard level was set to accommodate the existing largely level areas as noted in the topography section. The western side of the site will be constructed to accommodate FFLs of 82.50m AOD with the eastern side of the site sloping away to the northeast to accommodate the office and biogas ancillaries at FFLs of 81.60-81.65mAOD.
- The overflow from the rainwater harvesting tanks on the higher, western side of the site, will be collected in an attenuation facility below ground. This facility has been sized using Causeway Flow drainage software and considers that the rainwater harvesting tank may be full at the time of a 1:100year +30% climate change rainfall event.
- The office and eastern service yard catchment attenuation is provided by a proposed opensurface pond. The banks of the pond allow for the attenuation volume required to be provided and can be planted with appropriate water-loving plants to improve biodiversity and amenity.
- Post-attenuation, surface water runoff will be discharged at the greenfield runoff rate calculated for each catchment via means of a Hydrobrake or similar approved flow control

device. This approach maintains the existing topographical discharge route from the site to the existing drainage ditch which traverses the northern boundary of the site
- Attenuation and rainwater harvesting volumes have been sized based on a 95% runoff rate from all impermeable surfaces throughout the site.
- Pipes are designed for small catchment areas as defined in GDSDS, based on the modified rational method and a rainfall intensity of 50mm/ hour onto impermeable surfaces.
- All surface water pipes have been designed to achieve a minimum self-cleansing velocity of 0.75m/s.
- The GDSD requirements with respect to interception volume, long-term storage volume and treatment volume have been considered.
- Rainwater harvesting tanks will supply water for the office building's sanitary facilities and, after filtration, for potable use following treatment through UV disinfection and reverse osmosis systems installed at the point of use. Water quality will be verified through sampling before commissioning, and ongoing maintenance by a qualified contractor will be required to ensure safety. In periods of low rainfall, supplementary potable water (e.g., bottled water) may be needed due to the limited capacity of the proposed 7,000-litre tank, which will be fitted with a monitoring device to track water levels.

Land Spreading of biobased fertiliser

The operation phase will involve the production of a biobased fertiliser which will be used by customer farmers for the fertilisation of their land. Mitigation measures to ensure maximum protection of receiving environment include:

- 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.

Attenuation Tanks

The Proposed Development includes two no. attenuation tanks designed to manage surface water runoff from roads, yards, roofs, and the impermeable bunded area. The tanks are located centrally within the site, within the bunded area and near the silage clamps. The following mitigation measures are proposed in order to ensure maximum protection of the surface and groundwater systems:

- The attenuation tanks have been sized using Causeway Flow drainage software and considers that the rainwater harvesting tank may be full at the time of a 1:100year +30% climate change rainfall event.
- The lower-level sub catchment will discharge to an isolated drainage system in order to contain any potential contaminated water should there be a failure in the digestate tanks. This limits the potential for SuDS based attenuation features and as such the full 1:100 year + 30% climate change volume will be contained below ground in the proposed pluvial cube system. An automated penstock will be provided within the final manhole prior to discharge from the sump level that will be activated in the unlikely event that there is a failure of the digester or digestate tanks.

- Post-attenuation, surface water runoff will be discharged at the greenfield runoff rate calculated for each catchment via means of a Hydrobrake or similar approved flow control device.
- Attenuation and rainwater harvesting volumes have been sized based on a 95% runoff rate from all impermeable surfaces throughout the site.
- Attenuation storage will be provided using proprietary modular geocellular units (e.g. Pluvial Cube or similar). As these systems are not inherently impermeable, they will be encapsulated in a welded or taped impermeable geomembrane or geotextile liner to ensure full watertightness. The attenuation systems will also be laid on, and surrounded by, compacted single-sized granular fill to facilitate structural stability and membrane protection.

Attenuation Pond

The proposed attenuation feature for the office and eastern service yard level is an open attenuation pond with a permanent water level. Retention ponds can provide both stormwater attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline. The following mitigation measures are proposed in order to ensure maximum protection of the surface and groundwater systems:

- Runoff from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation and the opportunity for biological uptake mechanisms to reduce nutrient concentrations.
- Ponds can be designed to control flow rates by storing floodwater and releasing it slowly once the risk of flooding has passed (also known as a balancing pond). The stored water will change the water level, and ponds should be designed to function in both dry and wet weather. Quantity can also be influenced by the amount of water that can be allowed to infiltrate into the ground if there is no risk to groundwater quality.
- A flow control device will be fitted to the outlet manhole from the attenuation tanks and attenuation pond. This will control outflow from the features internally and offset discharge downstream within the network. The cumulative flow to discharge into the adjacent watercourse, will be discharged at greenfield runoff rates. All flow control manholes will be fitted with a pen stock on the inlet to the flow control manhole to facilitate any future maintenance work. All flow control chambers are also to have slit traps installed.

8.7 Cumulative Effects

8.7.1 Interactions

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

Hydrology and Hydrogeology is linked with Land, Soils and Geology as discussed in **Chapter 7** of this EIAR. In terms of hydrogeology specifically, the recharge capacity at the Proposed Development will be diminished as a function of surface sealing, which has the potential to adversely enhance flood events downstream of the Proposed Development. This is addressed in the above sections in regard to flood risk assessment and mitigation i.e.

attenuation and SUDs.

Hydrology is linked with Biodiversity as discussed in **Chapter 5**. With the successful implementation of adequate mitigation measures potential hazards will be managed and the likelihood of environmental incidents occurring is very low. Any potential impacts are therefore resolved or minimised.

Hydrology and Hydrogeology is linked with the Population and Human Health in **Chapter 6**. Specifically, in terms of hydrogeology, there is a minimal risk to human health from potential groundwater contamination. However, with the effective implementation of appropriate mitigation measures, any potential hazards will be managed, significantly reducing the likelihood of environmental incidents. As a result, any potential impacts are either resolved or minimised.

8.7.2 Potential Cumulative Impacts

Construction Phase

The phasing/commencement of any other future permitted developments in the locality could potentially result in the scenario where a number of other construction sites are in operation at the same time as the Proposed Development. Considering the mitigation measures outlined in this report and the expected residual effect pending successful implementation of those measures, the development is not considered to significantly contribute to cumulative adverse impacts to the associated hydrological network.

Operational Phase

In the absence of mitigation measures, surface sealing (paving, buildings on previously exposed ground), reduction in recharge to groundwater, and rapid transmission of runoff to surface water systems has the potential to significantly contribute to the cumulative / catchment hydrological response to rainfall.

Considering the mitigation measures outlined in this report and the expected residual effect pending successful implementation of those measures, the development is not considered to significantly contribute to cumulative adverse impacts to the associated hydrological network.

8.8 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 hydrological and hydrogeological features.

The purpose of this assessment is to specify mitigation measures where appropriate to minimise the ‘risk factor’ to all aspects of the water environment such as to minimise the potential for hydrocarbons to contaminate the streams or groundwater, reduce the risk of erosion and 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.

8.8.1 Construction Phase

A summary of the predicted effects associated with the construction phase in terms of quality, significance, and duration, along with the proposed mitigation measures and resulting residual effects are summarised in **Table 8.19**.

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

8.8.2 Operational Phase

A summary of the predicted effects associated with the operational phase in terms of quality, significance, and duration, along with the proposed mitigation measures and resulting residual effects are summarised in **Table 8.20.**

The overall impact anticipated during the operational phase of the project following the implementation of suitable mitigation measures is considered to be ***neutral***, ***slight***, and ***short-term*** to ***long-term***. There are no uncontrolled emissions anticipated as a result of the Proposed Development.

Table 8.19: Summary of predicted construction phase effects, mitigation measures and residual impact

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Increased Run-off and Sediment Loading	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	During the construction phase, groundworks, soil exposure, and erosion from stockpiles of exposed soils could result in the migration of silt, sediments, and organic matter into surface water receptors through dust dispersal and surface runoff.	***Negative***	***Moderate***	***Temporary***	• A temporary drainage system will be established complete with oil interceptors and settlement ponds to remove contaminants from run-off, prior to discharge off-site. • Stockpile areas for sands and gravel should be kept to minimum size, well away from storm water drains, gullies leading off-site, and the drainage ditches. • Installation of impermeable liner is recommended under the storage material areas. • Covers are to be provided over soil debris stockpiles when high wind and inclement weather are encountered if required. • Harmful materials and stockpiles should be stored well away from the adjacent drainage ditches on-site, as these provide a direct pathway to the Ballynamony Stream. • Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and the aquifer.	***Neutral, Slight, Temporary***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*	Loose sediments becoming entrained in open excavations.	***Negative***	***Moderate***	***Short-term***	• Landscaping should be carried out as soon as possible to minimise weathering. • Silt fences will be erected where appropriate using a permeable filter fabric (Hy-Tex Terrastop Premium silt fence or similar) and not a mesh. • Excavation works will not be carried out during or following heavy rainfall (i.e, if there is a yellow weather warning in place or 5mm in 1-hour period). Excavations will be covered during rainfall to avoid creation of surface water with high concentrations of suspended solids that would require dewatering. • A detailed hydrogeological investigation will be undertaken prior to the commencement of works to enhance understanding of the site's hydrogeological conditions and to determine whether dewatering of excavations will be required. If dewatering is deemed necessary, a comprehensive report will be prepared outlining the estimated dewatering volumes and duration, associated potential impacts, proposed mitigation measures, and a discharge strategy. This report will be submitted to the relevant local authority for review. • Installation of temporary piezometers or standpipes is recommended in order to monitor groundwater levels during construction phase.	***Neutral, Slight, Temporary***
Accidental Spillages of Harmful Substances	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	Spillage of contaminants such as fuels, oils, chemicals and cement material and subsequent migration into surface water receptors	**Negative**	**Moderate to Significant**	**Temporary**	• Establishment of bunded oil and chemical storage areas. • Refuelling of mobile plant in designated areas provided with spill protection. • Fuel bowsers to be located in bunded areas which can cater for 110% of the primary vessel capacity or 25% of the total volume of the substance which could be stored withing the bunded area and to be located away from the adjacent drainage ditches.	***Negative, Slight, Temporary***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*	Spillage of contaminants in soils and subsoils, particularly in open excavations, and subsequent migration to the underlying aquifer.	***Negative***	***Moderate***	***Short-term***	• Only appropriately trained site operatives permitted to refuel plant and machinery on-site. • Regular inspections carried out on plant and machinery for leaks and general condition. • Emergency response plan. • Spill kits readily available throughout the site. • Use of ready-mixed supply of wet cement products. • Scheduling cement pours for dry days.	***Neutral, Slight, Temporary***
Increased Groundwater Vulnerability	**Groundwater** *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*	Excavation depths of up to 3.0 mbgl could significantly increase groundwater vulnerability in certain areas from 'High' to 'Extreme'.	**Negative**	**Significant**	**Long-Term**	• Carry out a detailed ground investigation prior to works, including drilling cable percussion and/or rotary boreholes with standpipe installation. • Undertake pumping tests to establish baseline groundwater levels and assess aquifer characteristics. • Assess hydraulic connectivity between the aquifer and nearby surface water features. • Evaluate the potential for groundwater ingress during excavation activities. • Identify any long-term risks to groundwater quality or quantity. • Compile the investigation results into a technical report for submission to the relevant local authorities. • Develop a hydrogeological conceptual model to inform excavation and dewatering requirements. If deemed necessary.	***Negative, Slight, Temporary***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Excavation of Bedrock/Gravel Aquifer		Potential removal of bedrock in certain parts of the site to create a uniform base. Potential risk of excavations reaching the gravel aquifer.	**Negative**	**Significant**	**Long-Term**	• Estimate the volume and duration of any necessary dewatering, including worst-case scenarios. • Assess temporary impacts on local groundwater resources and groundwater-dependent receptors. • Evaluate aquifer drawdown and potential effects on existing wells and surface water features, if dewatering is deemed necessary. • Consider alternative construction methods that may minimise or eliminate the need for dewatering, as applicable. • Design a discharge strategy based on predicted flow rates, including identification of suitable discharge locations and incorporation of temporary settlement tanks or treatment units, if deemed necessary. • Determine licensing requirements for discharge to surface water or groundwater, including the need to obtain a Discharge Licence from Kildare County Council, if deemed necessary. • Implement dewatering systems in accordance with recognised best practice (e.g. CIRIA C750), if deemed necessary. • Monitor groundwater levels and discharge quality in accordance with the requirements of the relevant local authorities, as applicable. • Revise dewatering plans as site conditions evolve, as applicable. • Backfill excavations as soon as practicable to reduce the risk of contaminant infiltration. • Complete landscaping works promptly to minimise surface erosion and weathering. • Conduct baseline groundwater quality monitoring prior to the commencement of construction. • Design foundations and services to accommodate groundwater pressures, including attenuation systems where appropriate to align with greenfield runoff rates (Qbar). • Manage surface water using Sustainable Drainage Systems (SuDS) to encourage infiltration and reduce runoff.	***Negative, Slight, Long-term***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
						• Enforce pollution prevention measures throughout all construction phases to prevent spills, untreated runoff, or other pollutants entering water bodies. • Decommission any dewatering systems gradually following construction to allow natural recovery of groundwater levels, as applicable. • Undertake post-construction monitoring to confirm restoration of pre-development groundwater conditions and identify any residual impacts, as applicable	
Excavation of Contaminated Soils	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	There is no indication of any incidences of land use which might result in the contamination of soils; hence excavation of contaminated soils is unlikely.	***Unlikely***	***Negligible***	***Unlikely***	• All excavated materials will be visually assessed for contamination. • Any contaminated material detected will be sent for analysis to a suitable environmental laboratory and subsequently quantified, segregated and transported for disposal by a licenced contractor.	***Unlikely, Negligible, Unlikely***
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*		***Unlikely***	***Negligible***	***Unlikely***		***Unlikely, Negligible, Unlikely***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Increase in Flood Risk to Receiving Catchment	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	The gradual conversion of the site to hardstanding areas may increase the volume and intensity of surface water runoff within the receiving catchment, potentially elevating the risk of flooding both upstream and downstream of the proposed site.	***Negative***	***Moderate***	***Long-Term***	• A temporary drainage system will be implemented during the construction phase, incorporating oil interceptors and settlement ponds to treat surface water runoff and remove potential contaminants prior to controlled discharge off-site. • Bunds and diversion channels will be installed to divert surface water away from sensitive areas, including open excavations and adjacent drainage ditches leading off-site. • All temporary drainage features will be subject to regular inspection and maintenance to ensure effective operation and to prevent blockages or failures. • The drainage strategy will be reviewed and adapted throughout the construction period to reflect evolving site conditions. • A flood risk response plan will be developed to set out actions and procedures in the event of extreme weather during construction. • If dewatering systems are required, they will be designed in accordance with recognised best practice guidance, such as CIRIA C750. A discharge strategy will be developed based on predicted flow rates, identifying the most suitable discharge location and incorporating temporary settlement tanks or treatment units where necessary. Discharge to surface water will be controlled to ensure it does not exceed greenfield runoff rates. • Where discharge to surface water is proposed, the relevant licensing requirements will be addressed, and a Discharge Licence will be obtained from Kildare County Council, as required.	***Negative, Slight, Temporary***

Table 8.20: Summary of predicted operational phase effects, mitigation measures and residual impact

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Contaminated Run-off	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	Run-off from impermeable areas within the Proposed Development site discharging into surface water bodies	***Negative***	***Moderate to Significant***	***Temporary***	• Outflow from the sub catchments will be restricted to a maximum permissible discharge rate of 5.8 l/s (Western service yard) 3.1l/sec, (Office and eastern service yard) and 4.3l/sec (Sump/Lower Level). • Overflow from the rainwater harvesting tanks on the higher, western side of the site, will be collected in an attenuation facility below ground, considering the rainwater harvesting tank may be full at the time of a 1:100year +30% climate change rainfall event. • The office and eastern service yard catchment attenuation is provided by a proposed open surface pond. The banks of the pond allow for the attenuation volume required to be provided and can be planted with appropriate water-loving plants to improve biodiversity and amenity. The banks have been proposed at 1:4 to allow for maintenance requirements and grade back to proposed ground levels in the surroundings. • The bunded area drainage system (lower level) will be isolated from the other systems in order to guarantee no accidental discharge of contaminated runoff in case of failure of the digester or digestate tanks. • The full 1:100 year + 30% climate change volume will be contained below ground in the proposed pluvial cube system. • Surface water runoff will be discharged at the greenfield runoff rate calculated for each catchment via means of a Hydrobrake or similar approved flow control device. • Attenuation and rainwater harvesting volumes have been sized based on a 95% runoff rate from all impermeable surfaces throughout the site.	***Neutral, Slight, Temporary***
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*	Run-off from impermeable areas within the Proposed Development site infiltrating downwards through soils into aquifer	***Negative***	***Moderate***	***Short-term***		***Neutral, Imperceptible, Short-term***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
						• Pipes are designed for small catchment areas as defined in GDSDS, based on the modified rational method and a rainfall intensity of 50mm/ hour onto impermeable surfaces. • All surface water pipes have been designed to achieve a minimum self-cleansing velocity of 0.75m/s • Surface water pipework will be laid to a gradient no flatter than 1:500 • Backdrop heights will be greater than 0.6m where practicable • The GDSD requirements with respect to interception volume, long-term storage volume and treatment volume have been considered. • Minimum surface water pipe size of 225mm • Minimum depth of cover to pipework of 1.2m below trafficked area, or where this cannot be achieved, adequate protection will be provided. • Maximum depth of pipework of 5m • Roughness value for surface water pipework, ks, 0.6mm • A class 1 petrol interceptor (Kingspan Klargester or similar approved) will be installed prior to the main rainwater harvesting facility and the attenuation facility on the western service yard, the sump level and the office and eastern service yard. • Runoff from internal building washdowns and wheel washes will be collected for reuse in the industrial process. Silage runoff will be captured via linear drains within buildings and at thresholds, with surface water excluded except for rainwater used in washdowns. The runoff will flow through a piped network set at a 1:60 gradient to reduce blockages and silt build-up. A precast concrete sump chamber (e.g. Molloy P6 or equivalent) will be installed in the odour abatement building to collect silage runoff before it is pumped to Prepit 01.	

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Foul Water	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	Leakage of untreated foul water and infiltration via preferential pathways to site drainage system and subsequent discharge to surface water receptors	***Negative***	***Moderate to Significant***	***Temporary***	• A domestic scale wastewater treatment plant is proposed to cater for the foul water arising from staff facilities on-site only. • The wastewater treatment plant will comprise a tertiary treatment system, followed by a 6PE EuroTank TER3 Percolation Unit. • The system is proposed with discharge to a Ter3 packaged tertiary unit with a minimum 60m^2 attenuation layer. • The treatment plant will be specified and installed by an appropriately qualified technician and in accordance with EPA COP 2021. It also will be subject to regular desludging and maintenance, as per manufacturers recommendations. Pressure tests and CCTV surveys will be carried out prior to commissioning to ensure absence of defects. • Programme of inspection and maintenance to ensure any defects are repaired	***Negative, Slight, Temporary***
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*	Leakage of untreated foul water and infiltration downwards through sediments into aquifer	***Negative***	***Moderate to Significant***	***Temporary***		***Negative, Slight, Short-term***
Increased Groundwater Vulnerability	**Groundwater** *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*	The proposed Finished Floor Levels (FFL's) will be up to 1.85m below the existing elevation of the site in certain places, which may increase the vulnerability of the underlying locally important aquifer from 'High' to 'Extreme'.	***Negative***	***Significant***	***Temporary***	<u>*Engineering and Structural Controls*</u> • Site bunding will comply with EPA guidance (2004), ensuring full containment and impermeability. • The tank farm will be fully bunded using impermeable materials, with each bund sized to hold at least 110% of the largest tank's volume and equipped with sealed sumps. • Dedicated hardstanding areas for off-loading and chemical handling will include drainage controls and be set back from watercourses. • Spill prevention will include bunded pallets, secondary containment for smaller vessels, mobile spill kits, and emergency shut-off systems. • Runoff from roofs and service yards will be collected in rainwater harvesting tanks with overflow controls and discharge through filtered outfall systems. • All below-ground structures and ponds,	***Negative, Slight, Temporary***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
						including rainwater harvesting tanks and attenuation systems, will be fully impermeable. Precast and cast in-situ concrete tanks will be used, installed on granular fill. Geocellular attenuation systems (e.g. Pluvial Cube) will be wrapped in an impermeable geotextile membrane to ensure watertightness, with installation on compacted granular material for stability. *Operational Environmental Management* • An Environmental Operating Plan will outline site-specific procedures for material handling, waste management, and emergency spill response. • Staff training and regular updates will ensure effective implementation. *Groundwater Monitoring Programme* • A long-term monitoring programme will be established, including permanent Bs placed upgradient and downgradient of risk areas, based on site hydrogeology. • Baseline groundwater sampling will be completed before operations begin. • Ongoing sampling will follow EPA guidance, with frequency set by the relevant authority (e.g., quarterly or biannual). • Threshold values will be set in consultation with the authority, based on legislation, baseline data, and site-specific conditions. • If thresholds are exceeded, investigations will be launched, corrective measures taken, and findings reported to the regulator.	
On-Site Flooding	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	The site is located at an elevated point within its catchment and the likelihood of fluvial flooding occurring on the site are unlikely. However, there is a potential risk of pluvial	***Negative***	***Slight***	***Temporary***	• The proposed Finished Floor Levels are above the estimated 1 in 1000-year return period fluvial flood event placing the units within Flood Zone C • The proposed stormwater management system is designed in accordance with industry standards and is projected to emulate the	***Negligible, Imperceptible, Unlikely***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
		flooding.				current greenfield runoff rates calculated at the site. • Stormwater discharge is proposed to occur to the drainage ditch along the northwestern boundary of the site. It is recommended that a detailed assessment of the ditch's capacity be undertaken prior to the commencement of construction works to ensure its adequacy in receiving the proposed discharge.	
Uncontrolled Releases & Spillage of Digestate and Feedstocks	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	During the operational phase, there is a possibility of leakage or spillage of biobased fertiliser or feedstocks via vehicle movements or from a catastrophic failure of a tank or feed line. While such substances are significantly less hazardous than fuels, oils, chemicals and cement material, the still pose a potential risk to surface and groundwater quality.	***Negative***	***Slight to Moderate***	***Temporary***	• 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 or 25% of the total volume of the substance which could be stored withing the bunded area (in compliance with Guidance to storage and Transfer of Materials for Scheduled Activities, EPA 2004) • EMS to include site specific standard operating procedures pertaining to waste management and emergency response. • The entire tank farm area of the Proposed Development will be bunded. • The Reception Hall, Digestate Treatment building a will each be self-bunded. • All bunds and underground pipelines (foul and process) will be subject to integrity assessments every 3 years by a suitably qualified engineer. • Ongoing monitoring of stormwater discharge to the local hydrologic system.	***Neutral to Negative, Slight, Temporary***
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*		***Negative***	***Slight to Moderate***	***Temporary***		***Neutral to Negative, Slight, Temporary***
Fire and Resultant Firewater	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	Given the presence of flammable substances on the site, there is a risk of fire prevalent at the facility, during the operational phase. In the event of a fire, significant quantities of water resources will be utilised to quench the fire.	***Negative***	***Slight to Moderate***	***Temporary***	• A Firewater Risk Assessment will be commissioned within the first six months of operation and will determine the volume of firewater retention storage require on site. • Adequate firewater retention capacity is installed and maintained on-site in the event of a worst-case scenario fire event.	***Negative, Slight, Temporary***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*	Water used to quench a fire is known as “firewater”. Firewater is known to contain several harmful substances, as detailed in **Section 8.5.4.**	***Negative***	***Moderate***	***Short-Term***	• Firewater retention will be the large rainwater harvesting tank. • All retention infrastructure systems will be automatically activated in the event of a fire alarm being triggered. • All retention tanks, etc., shall be maintained empty, or at least to a point where the required retention capacity is available. • Bunds and tanks will be constructed to Eurocode standard (BS EN 1992-3:2006). • All proposed below-ground structures will be constructed to be fully impermeable. The rainwater harvesting tanks will comprise reinforced concrete construction. The smaller circular tanks are pre-cast concrete units supplied by Molloy Precast and are designed to be watertight. The larger rainwater harvesting tank will also be constructed from reinforced concrete, likely cast in-situ, and will achieve full impermeability. Both tank types are to be installed on a compacted bed of single-sized granular material, in accordance with standard detailing for below-ground concrete structures.	***Negative, Slight, Short-Term***
Increase in Flood Risk to Receiving Catchment	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	The conversion of a significant area of the site to hardstanding areas may increase the volume and intensity of surface water runoff within the receiving catchment, potentially elevating the risk of flooding both upstream and downstream of the proposed site.	***Negative***	***Moderate***	***Long-Term***	• Discharge from site sub-catchments will be restricted to greenfield runoff rates: 5.8 l/s (western yard), 3.1 l/s (office/eastern yard), and 4.3 l/s (sump/lower level), based on IH124 methodology to protect downstream flood regimes. • Finished floor levels (FFLs) are designed to minimise excavation: sump level at 81.50 mAOD, with surrounding wall and ramp at 83.00 mAOD. The western yard is set at 82.50 mAOD; the eastern yard and office/ancillaries at 81.60–81.65 mAOD. • Overflow from rainwater harvesting tanks (western side) will be captured in underground attenuation sized using Causeway Flow software for a 1-in-100-year storm event plus 30% climate change allowance.	***Neutral, Slight, Long-term***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
						• Surface water runoff will be controlled using Hydrobrake or similar devices to maintain natural drainage routes to the drainage ditch at the northern site boundary. • Attenuation and harvesting systems account for 95% runoff from impermeable areas. • Pipework is sized using GDSDS small catchment guidance and designed for a rainfall intensity of 50 mm/hr, ensuring a minimum self-cleansing velocity of 0.75 m/s. • GDSDS criteria for interception, long-term storage, and treatment volumes have been addressed. • Rainwater harvesting tanks will provide water for sanitary use and, post-filtration, potable supply via UV and reverse osmosis treatment. Quality will be verified pre-commissioning and maintained by qualified personnel. • A 7,000-litre tank with level monitoring is proposed; bottled water may supplement supply during dry periods.	
Land Spreading of biobased fertiliser	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	Application of processed biobased fertiliser to agricultural land. Reduction in chemical fertiliser use, pathogen and diseases which may be contained and spread in untreated manures Discharge of contaminated materials into the attenuation tanks/ pond may have the potential to percolate into the underlying aquifer and to reach surface water receptor via run-off.	***Negative***	***Slight***	***Temporary***	• 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***
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*		***Negative***	***Slight***	***Short-Term***		***Positive, Imperceptible, Short-term***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Attenuation Tanks	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	Discharge of contaminated materials into the attenuation tanks may have the potential to percolate into the underlying aquifer and to reach surface water receptor via run-off.	***Negative***	***Moderate***	***Long-Term***	• The attenuation tanks have been sized using Causeway Flow drainage software and considers that the rainwater harvesting tank may be full at the time of a 1:100year +30% climate change rainfall event. • The lower-level sub catchment will discharge to an isolated drainage system in order to contain any potential contaminated water should there be a failure in the digestate tanks. This limits the potential for SuDS based attenuation features and as such the full 1:100 year + 30% climate change volume will be contained below ground in the proposed pluvial cube system. An automated penstock will be provided within the final manhole prior to discharge from the sump level that will be activated in the unlikely event that there is a failure of the digester or digestate tanks. • Post-attenuation, surface water runoff will be discharged at the greenfield runoff rate calculated for each catchment via means of a Hydrobrake or similar approved flow control device. • Attenuation and rainwater harvesting volumes have been sized based on a 95% runoff rate from all impermeable surfaces throughout the site.	***Neutral, Slight, Long-term***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*					• Attenuation storage will be provided using proprietary modular geocellular units (e.g. Pluvial Cube or similar). As these systems are not inherently impermeable, they will be encapsulated in a welded or taped impermeable geomembrane or geotextile liner to ensure full watertightness. The attenuation systems will also be laid on, and surrounded by, compacted single-sized granular fill to facilitate structural stability and membrane protection.	
Attenuation Pond	**Surface Water** *Ballynamony Stream and downstream receptor, River Greese*	Discharge of contaminated materials into the attenuation pond may have the potential to percolate into the underlying aquifer and to reach surface water receptor via run-off.	***Negative***	***Moderate***	***Permanent***	• Runoff from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation and the opportunity for biological uptake mechanisms to reduce nutrient concentrations. • Ponds can be designed to control flow rates by storing floodwater and releasing it slowly once the risk of flooding has passed (also known as a balancing pond). The stored water will change the water level, and ponds should be designed to function in both dry and wet weather. Quantity can also be influenced by the amount of water that can be allowed to infiltrate into the ground if there is no risk to groundwater quality. • A flow control device will be fitted to the outlet manhole from the attenuation tanks and attenuation pond. This will control outflow from the features internally and offset discharge downstream within the network. The cumulative flow to discharge into the adjacent watercourse, will be discharged at greenfield runoff rates. All flow control manholes will be fitted with a pen stock on the inlet to the flow control manhole to facilitate any future	***Neutral, Moderate, Long-term***
	Groundwater *New Ross Groundwater Body & Coolane Sand and Gravel Aquifer*						

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
						maintenance work. All flow control chambers are also to have slit traps installed.	

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8.9 Monitoring

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

- Water Quality Monitoring of the surface water receptor – Ballynamony Stream U/S and D/S
- Daily inspections for housekeeping and site cleanliness
- 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 site inspections to ensure procedures outlined within the CEMP are adhered through throughout the Proposed Development.

The site will be subject to inspection by the Environmental Protection Agency (EPA) who will critically assess the site's compliance with Surface Water Regulations (S.I. No. 77/2019)

Monitoring for the Proposed Development will be conducted in line with BAT Waste treatment CID and conditions set out in the proposed EPA licence. Monitoring results will be reported to the EPA annually. The site will be subject to inspection by the Environmental Protection Agency who will critically assess the site's compliance with the conditions of the Industrial Emissions licence (IEL).

8.10 Summary of Significant Effects

The receptors for this assessment are considered to be local surface water receptors named the Ballynamony stream, the River Greese and River Barrow and the Locally Important Gravel Aquifer & the Poor Aquifer beneath the Proposed Development named the Coolane Sand and Gravel Aquifer and the New Ross Groundwater Body, respectively. Whilst the development proposals have the potential to cause detrimental effects to sensitive receptors identified, the recommended mitigation measures will ensure that the risk of potential effects are reduced to negligible.

8.11 Statement of Significance

The significance of impact upon local & regional hydrology and hydrogeology systems have been assessed for both during the construction and operational phases. The results of the assessment are presented on **Table 8.19** and **Table 8.20**.

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

The overall impact anticipated during the operational phase of the project following the implementation of suitable mitigation measures is considered to be ***neutral*** to ***negative***, ***slight***, and ***short-term*** to ***long-term***.