FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

Appendix 13

Surface Water and Hydrology

Appendix 13.1 - Site Specific Flood Risk Assessment (SSFRA)
Appendix 13.2 - Water Framework Directive Assessment (WFD)
Appendix 13.3 - Hydraulic Capacity Assessment

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

Appendix 13.1

Site Specific Flood Risk Assessment

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

EIAR FOR POWERSTOWN BIOENERGY

Site Specific Flood Risk Assessment

Prepared for:

Greengate Biogas 001 Ltd.

Greengate Biogas

Date: May 2026

Document No:

P24188-FT-EN-ZZ-RP-EN-0024

Unit 6, Bagenalstown Industrial Park, Royal Oak Road,
Muine Bheag, Co. Carlow, R21 XW81, Ireland

T: +353 59 972 3800 | E: info@ftco.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

Page

LIST OF TABLES

Page

1. INTRODUCTION

Greengate Biogas 001 Limited intends to apply for planning consent for a commercial anaerobic digestion (AD) facility at Powerstown, Milford, County Carlow (hereafter referred to as the proposed development). An overview of the proposed development is provided in Chapter 3 - Description of the Existing and Proposed development.

Fehily Timoney and Company (FT) have prepared this Flood Risk Assessment (FRA) in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities (DEHLG & OPW, 2009), together with Circular PL 2/2014 (hereafter collectively referred to as the Guidelines).

This Site-Specific Flood Risk Assessment (SSFRA) forms part of the Environmental Impact Assessment Report (EIAR) for the proposed development and assesses the potential flood risk associated with the development (hereafter referred to as the “Site”). It was prepared as an appendix to Chapter 13 Surface water and Hydrology.

The proposed gas pipeline route is 9.6 km from the anaerobic digestion plant biomethane network entry facility (BNEF) to an AGI at Clogrennan, Co. Carlow. As explained in Chapter 1, the environmental impact assessment of the pipeline route is included in the EIAR for Powerstown Bioenergy. Gas Networks Ireland GNI will be responsible for obtaining development consent for the pipeline as a Statutory Undertaker.

Figure 1-1: Site Location. Background Map

2. FLOOD RISK ASSESSMENT METHODOLOGY

2.1 General

The Guidelines (DEHLG & OPW, 2009), together with their Technical Appendices, outline the requirements for a SSFRA. They require that works:

- Avoid development in areas at risk of flooding.
- Substitute less vulnerable uses where avoidance is not possible.
- Mitigate and manage the risk where avoidance and substitution are not possible.

The key principles of these Guidelines apply the Sequential Approach to the planning process, as illustrated in **Error! Reference source not found.** of this report.

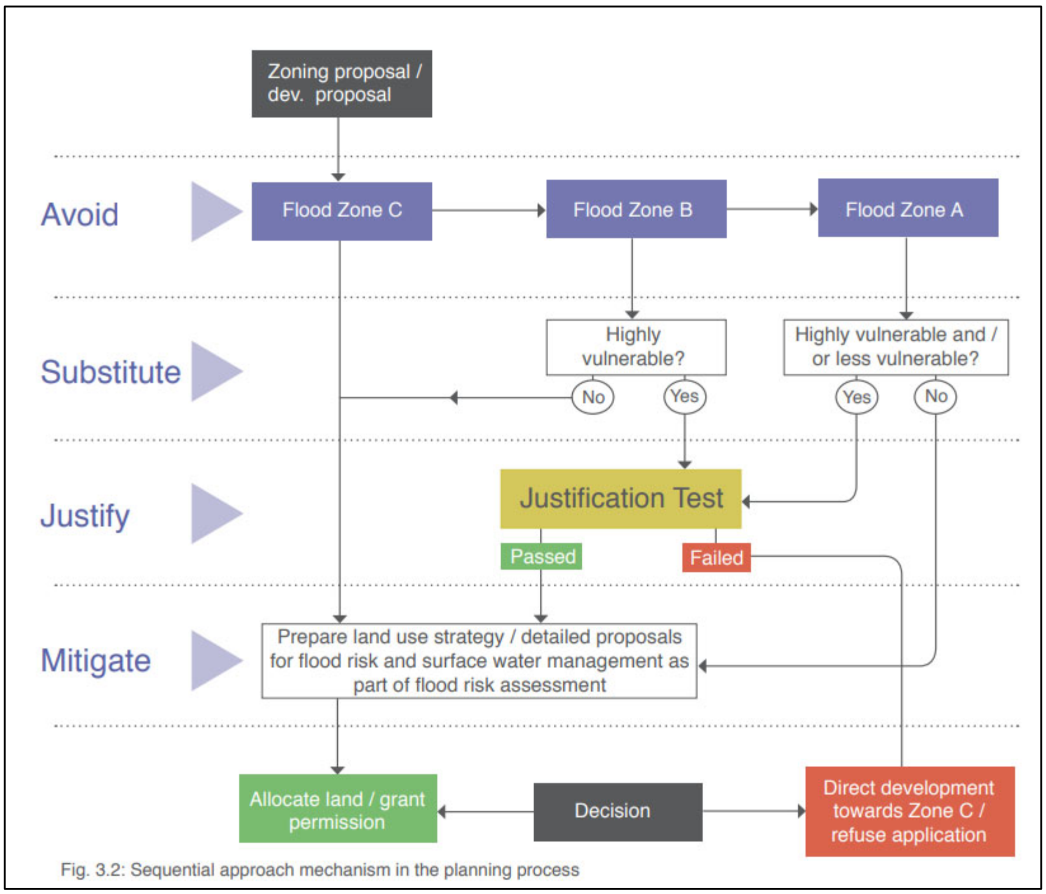


Figure 2-1: Sequential Approach Mechanism. (The Planning System and Flood Risk Management Guideline)

2.2 Source-Pathway-Receptor Model

The assessment of flood risk requires a thorough understanding of the following:

- The sources of flood water (e.g., high sea levels, intense or prolonged rainfall leading to runoff and increased flow in rivers and sewers)
- The pathways by which the flood water reaches those receptors (e.g., river channels, river and coastal floodplains, drains, sewers and overland flow).

The people and assets affected by flooding (known as the receptors).

The Source-Pathway-Receptor (S-P-R) Model illustrated in **Error! Reference source not found.** has become widely used to assess and inform the management of environmental risks.

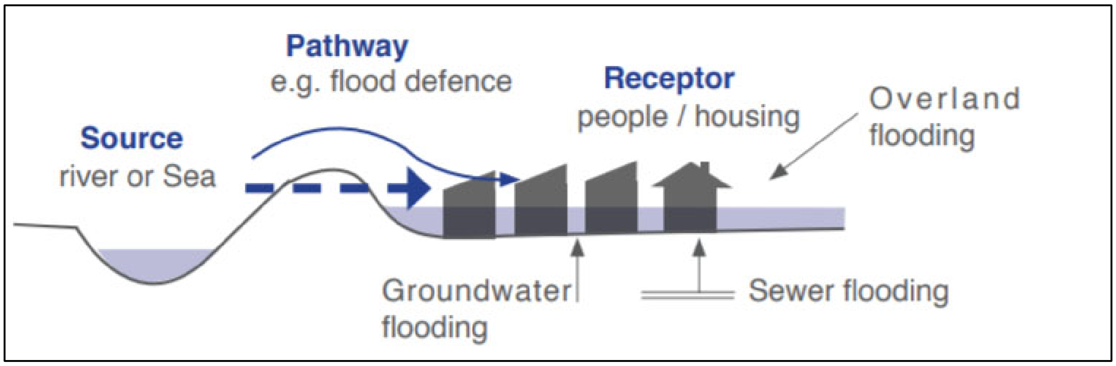


Figure 2-2: Source-Pathway- Receptor Model. (The Planning System and Flood Risk Management Guideline)

2.3 Likelihood of Flooding and Definition of Flood Zones

The Guidelines (DEHLG & OPW, 2009) define the likelihood of flooding as the percentage probability of a flood of a given magnitude occurring or being exceeded in any given year, for this specific site Flood risk assessment we are addressing 100yrs and 1000yrs. The likelihood of flooding is expressed as a return period or annual exceedance probability (AEP).

Flood Zones are graphical areas within which the likelihood of flooding is in a particular range. They are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning. The Guidelines split these flood zones into three categories:

- Flood Zone A – where the probability of flooding from rivers and the sea is high (greater than 1% AEP for river flooding or 0.5% AEP for coastal flooding).
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP and 1% AEP for river flooding and between 0.1% AEP and 0.5% AEP for coastal flooding).
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP for both river and coastal flooding).

2.4 Classification of the Proposed development and Justification Test

The Guidelines (DEHLG & OPW, 2009) categorises all types of development as either:

- Highly Vulnerable (garda, ambulances, schools, hospitals, dwelling houses, student halls).
- Less Vulnerable (buildings used for: retail leisure, warehousing, commercial, industrial, and non-residential institutions,).
- Water Compatible (flood control infrastructure, docks, marinas, amenity open spaces).

The Guidelines classify potential development in terms of its vulnerability to flooding. The types of development falling within each vulnerability class are described in Table 2.1 of the Guidelines, which is reproduced in Table 2-1.

Table 2-1: Vulnerability Class. Source: The Planning System and Flood Risk Management Guideline.

Highly vulnerable development (Including essential infrastructure)	• Garda, ambulance and fire stations and command centres required to be operational during flooding • Hospitals • Emergency access and egress points • Schools • Dwelling houses, student halls of residence and hostels • Residential institutions such as residential care homes, children's homes and social services homes • Caravans and mobile home parks • Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility • Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and • Sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding
Less vulnerable development	• Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions • Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans • Land and buildings used for agriculture and forestry • Waste treatment (except landfill and hazardous waste) • Mineral working and processing • Local transport infrastructure
Water-compatible development	• Flood control infrastructure • Docks, marinas and wharves • Navigation facilities • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location • Water-based recreation and tourism (excluding sleeping accommodation) • Lifeguard and coastguard stations • Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms • Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan)

Uses which are not listed in the table should be considered on their own merits.

The Sequential Approach restricts development types to occur within the flood zone appropriate to their respective vulnerability classes. Table 2-2 identifies the types of development appropriate for each flood zone and those that will require a Justification Test.

Table 2-2: Matrix of Vulnerability Versus Flood Zone.The Planning System and Flood Risk ManagementGuideline.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

The Justification Test has been designed to rigorously assess the appropriateness of developments that are being considered in areas of moderate or high flood risk. There are two types of the Justification Test:

- The first is the Plan-making Justification Test which is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test which is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

2.5 Flood Risk Assessment Stages

The Guidelines (DEHLG & OPW, 2009) outline that a staged approach should be adopted when carrying out a SSFRA. These stages, see also Figure 2-3.

- Stage 1 Flood Risk Identification.
- Stage 2 Initial Flood Risk Assessment.
- Stage 3 Detailed Flood Risk Assessment.

Shapes FRA

Influences FRA

	Flood risk identification	Initial flood risk assessment	Detailed flood risk assessment
Regional Flood Risk Appraisal	✓	U	U
Strategic Flood Risk assessment – County-wide	✓	P	U
Strategic Flood Risk Assessment – City or town within a county plan	✓	✓	P
Site-specific flood risk assessment	✓	✓	✓

P = Probably needed to meet the requirements of the Justification Test

U = Unlikely to be needed

✓ = Required to be undertaken

Figure 2-3: Flood risk assessment stages required per scale of study undertaken[1]

[1] The Planning System and Flood Risk Management: Guidelines for Planning Authorities.

Stage 1: Flood risk identification – to identify whether there may be any flooding or surface water management issues relating to the proposed development site that may warrant further investigations. The flood risk identification stage uses existing information to identify whether there may be any flooding or surface water management issues related to the site. Flood risks identified in this stage are then addressed in Stage 2.

Stage 2: Initial flood risk assessment – to confirm sources of flooding that may affect the development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. This stage involves the review of data addressed in Stage 1. Data where the flood risk at the site is recognised as being low is screened out and it is not further addressed in the report, data which recognised the flood risk on the site to be medium or high is further analysed in the report.

Stage 3: Detailed flood risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve the use of an existing or construction of a hydraulic model across a wide enough area to appreciate the catchment wide impacts and hydrological process involved.

3. EXISTING SITE

3.1 Site Description

The proposed development site, known as Mary Kelly's Pit, is located at Powerstown, Milford, County Carlow. The site covers an area of approximately 9 hectares and is situated approximately 2.5 kilometres north of Leighlinbridge, 2.5 kilometres northwest of Nurney village, and 8.6 kilometres south of Carlow town. A site location map is provided in **Error! Reference source not found.**.

The site is located within a mixed-use landscape comprising industrial, infrastructural, and agricultural activities. Powerstown Landfill, which is closed, capped, and restored in accordance with its EPA licence, is located directly to the north of the site. The Powerstown Recycling Centre, which remains operational and open to the public, is situated to the east. A railway line (Dublin–Waterford route) runs along the eastern boundary, while the R448 Regional Road is located immediately to the west. The River Barrow and intervening agricultural lands lie between the R448 and the M9 Dublin–Waterford motorway.

The wider surrounding area is characterised by extensive pastureland and non-irrigated arable fields in all directions. The site itself is depressed relative to the surrounding lands, reflecting its former quarry use. Steep slopes are present along the northern and eastern boundaries adjacent to the restored landfill. Internally, site topography is influenced by irregular stockpiles and areas of infilling within the eastern portion of the site, associated with the permitted soil recovery activity. The western portion of the site has been restored to grassland and slopes gently from west to east, with the lowest point located centrally along the northern boundary.

The Site location is defined by Irish Transverse Mercator (ITM) coordinates provided in Table 3-1, which are used to reference the proposed development in mapping and spatial analyses undertaken as part of the EIAR, including the Flood Risk Assessment.

Table 3-1: Location of the Site

Site	Easting Coordinates X (ITM)	Northing Coordinates Y (ITM)
Powerstown Bioenergy	670756.034	668647.229

3.2 Description of Catchments

This section describes the catchment characteristics of the watercourses in the vicinity of the proposed development. The proposed development site is characterised by a depressed quarry floor, steep internal slopes, and areas of partial restoration. The hydrological regime is strongly influenced by the quarry topography, which promotes internal ponding, limited overland flow, and localised infiltration. Surface water drainage is currently informal, with no engineered drainage network. There is no overland storm water or surface flow from the proposed development site. The local road L3045 and regional road R448 which bound the site to the south and the west are drained to the Powerstown Stream.

The nearest watercourse is Powerstown Stream, a tributary of the River Barrow (EPA waterbody ID: IE_SE_14B012700), located within the Barrow_SC_100 sub-catchment. Downstream, this tributary flows into the River Barrow.

The contributing catchment area of this stream is approximately 15.8 km² and is predominantly characterised by agricultural land use. Catchment and hydrological information have been derived from Discovery Series mapping and is illustrated in Figure 3-1.

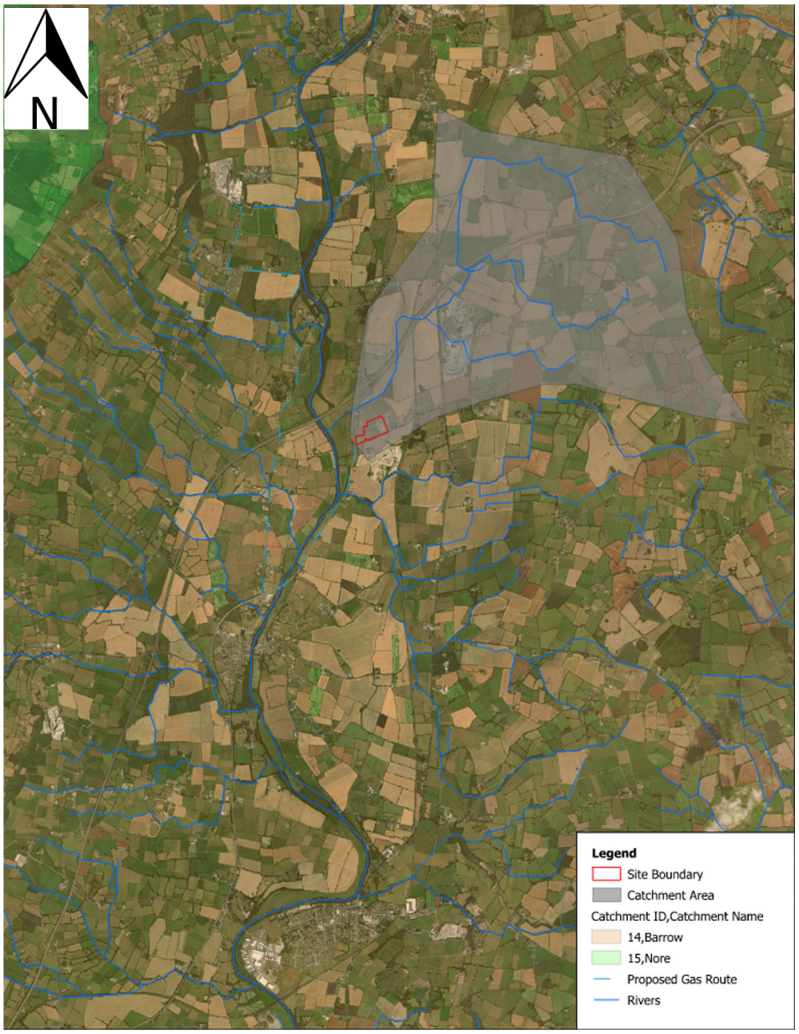


Figure 3-1:Catchment area of Powerstown Stream. Source Discovery map

The Standard Average Annual Rainfall (SAAR) for the site, according to the FSU node point ungauged (14_1391_5), is approximately 840.43 mm.

3.3 Subsoil and Hydrogeology

The Groundwater vulnerability has been mapped for the Site location and has been classified as High for the Site extent. In addition, The permeability at the proposed development was classified as High due to presence of Sand and Gravel deposits.

The groundwater vulnerability of the proposed development site is presented in Table 3-2. This table outlines the standard ratings of vulnerability used by the GSI, with the existing site conditions is highlighted in green based on the findings of the site investigation. For additional information refer to Chapter 12: Soils, Geology and Hydrogeology.

Table 3-2: Groundwater Vulnerability

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (sand/gravel)	Moderate Permeability (sandy soil)	Low Permeability (clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	> 3.0 m	3.0 -10.0 m	3.0 - 5.0 m
Moderate (M)	N/A	>10.0 m	5.0 - 10.0 m
Low (L)	N/A	N/A	>10 m

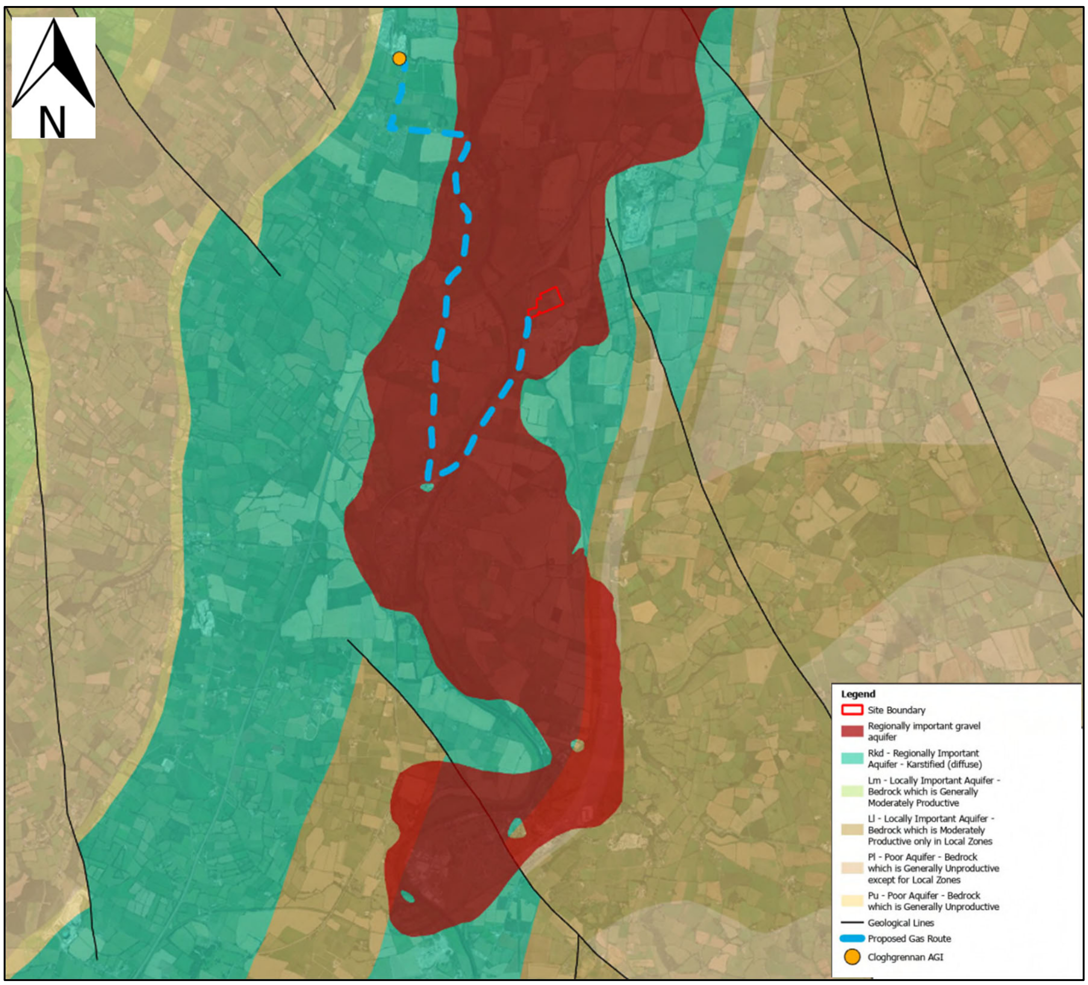


Figure 3-2:Groundwater Permeability. Source: GSI

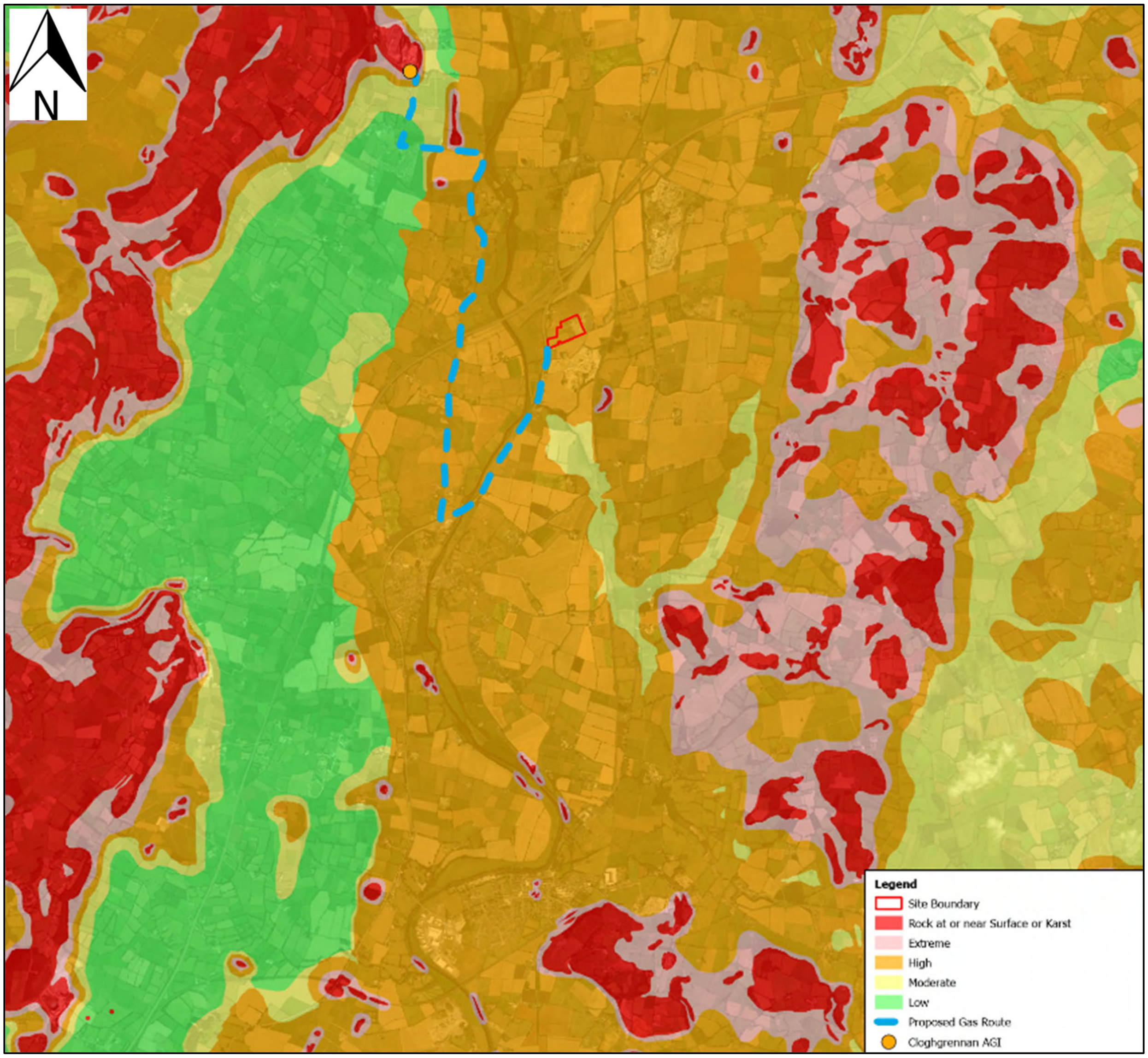


Figure 3-3: Groundwater Vulnerability. Source: GSI

4. STAGE 1 - FLOOD RISK IDENTIFICATION

4.1 Flood History

There are no recorded past flood events at the subject Site but there are other past flood events that have been recorded near the Site.

To identify any recorded flood history at or in the vicinity of the Site, information published by the Office of Public Works (OPW) was reviewed. The OPW maintains the National Flood Hazard Mapping website (www.floodmaps.ie), which compiles records of historical and observed flood events to identify areas at risk of flooding.

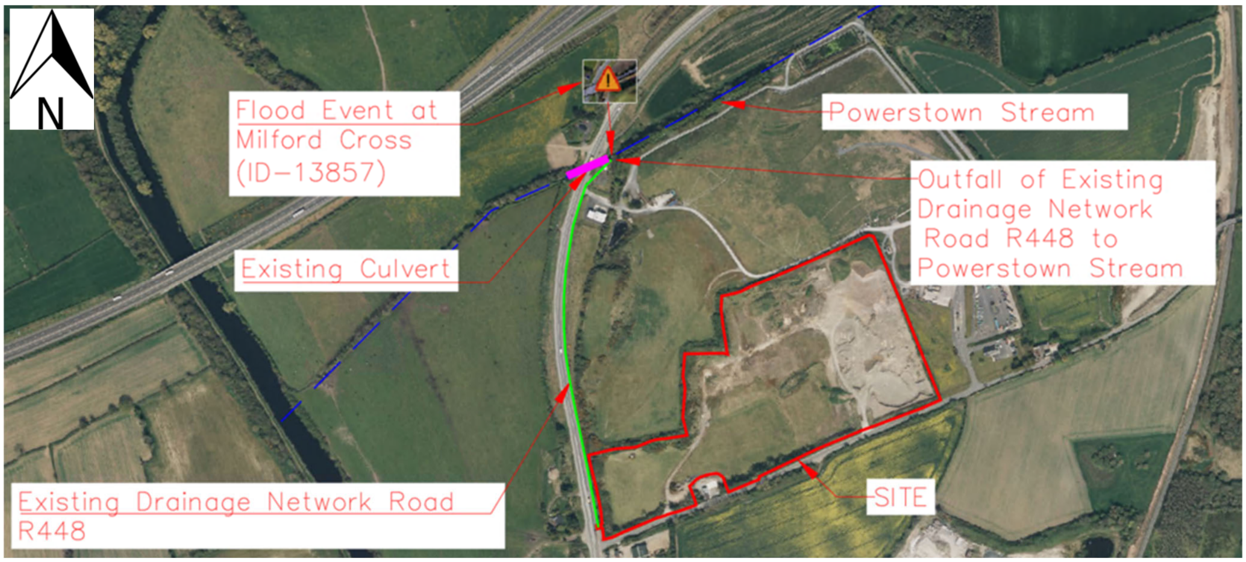


Figure 4-1: Past Flood Events: (Map from http://www.floodmaps.ie/)

4.2 Flood Sources

The first step in a flood risk assessment is to identify and examine the potential sources of flooding. This provides the basis for evaluating the level of flood risk associated with each source. The relevant flood sources are outlined below.

4.2.1 Fluvial Flooding

Fluvial flooding occurs when river levels rise and overflow onto land that is typically dry. Based on FloodMaps.ie mapping, there no fluvial flooding for the Site during or exceeding the following flood event probabilities:

- 1% Fluvial AEP or 1 in 100-year return period.
- 0.1% Fluvial AEP or 1 in 1000-year return period.

This is shown in Figure 4-2. The Site is therefore located within Flood Zone C, where the probability of flooding from rivers is low (less than 0.1% AEP). The proposed development comprises a biogas energy facility, which is considered an industrial building and may be classified as “Less Vulnerable Development”; however, as the facility also falls under the SEVESO Site, it may also be considered “Highly Vulnerable Development” in accordance with Table 2-1. Therefore, both classifications have been considered in the assessment.

The Barrow River is on the western side of the proposed development and is shown in the Flood Zones Map below.

Figure 4-2: Fluvial Flood Zones (Map from www.floodinfo.ie)

4.2.2 Coastal Flooding

Coastal flooding occurs when tide levels rise and overflow onto normally dry land. As shown in Figure 4-3, the mapping provided by Floodmaps.ie indicates no coastal flood vulnerability for the Site during or exceeding the following flood event probabilities:

- 0.5% Tidal AEP or 1 in 200-year return period.
- 0.1% Tidal AEP or 1 in 1000-year return period.

The Site is in Flood Zone C, where the probability of flooding from the sea is low (less than 0.1% AEP).

Figure 4-3: Coastal Flood Extents (Map from www.floodinfo.ie)

4.2.3 Pluvial Flooding

The occurrence of pluvial or surface water flooding is typically caused by high-intensity rainfall, generating flows before runoff enters a watercourse or sewer. As illustrated in Figure 4-4, the mapping provided by FloodMaps.ie indicates no pluvial flood vulnerability for the site during or exceeding the following flood event probabilities (low, medium or high rainfall probabilities).

Figure 4-4: Rainfall Flood Extents (Map from www.floodinfo.ie)

Pluvial flooding also encompasses exceedance from artificial drainage systems. The Site will be re-graded and developed, with new buildings and infrastructure incorporating a dedicated storm water drainage network.

The proposed drainage system will collect stormwater runoff generated within the development footprint. Collected flows will discharge to a proposed storm water lagoon, which is an attenuation pond with a total depth of 3.6 m, including 0.3 m freeboard.

The attenuation pond has been sized to accommodate the 1-in-30-year design storm event, with an additional 20% allowance for projected increases in rainfall intensity due to climate change. Stored water will be pumped for reuse within the development. Suction pipework will extract water once the pond reaches its freeboard level, with any remaining surplus discharged via the existing drainage network to the Powerstown Stream, a tributary of the River Barrow.

The discharge will be managed to ensure that runoff entering the existing drainage network does not increase flood risk or cause flooding downstream.

The system has been designed to discharge exceedance flows from storm events equal to or greater than the 1-in-30-year event, and only in scenarios where the lagoon is at capacity. In such cases, outflows will be restricted to the greenfield runoff rate for the combined tributary catchments and controlled so that the total exceedance volume is released gradually over a minimum period of 24 hours, in accordance with TII specifications or best practice, thereby preventing sudden downstream flooding, replicating greenfield runoff.

OPW flood mapping indicates historical flood events at the proposed discharge point, as outlined in the Flood History section. Although detailed records are limited, the Site is not considered to be at risk of pluvial flooding. In addition, the proposed development is not expected to increase flood risk relative to existing conditions, either within the Site or at the downstream discharge location.

4.2.4 Groundwater Flooding

Groundwater flooding occurs when sub-surface water levels are elevated, resulting in the saturation of upper layers of soil and previously dry areas. As illustrated in Figure 4-5 , the mapping provided by Floodmaps.ie indicates no groundwater flood vulnerability for the Site during or exceeding the following flood event probabilities (low, medium or high).

- 10% Groundwater AEP (Annual Exceedance Probabilities) or 1 in 10-year return period.
- 1% Groundwater AEP or 1 in 100-year return period.
- 0.1% Groundwater AEP or 1 in 1000-year return period.

Figure 4-5: Groundwater Flood Extents (Map from www.floodinfo.ie)

No groundwater flood susceptibility is indicated on the mapping presented above. The proposed development does not incorporate any infiltration-based drainage features, and the proposed surface water management strategy relies on an attenuation pond to regulate runoff from the development during storm events. Water stored within the stormwater lagoon will be reused within the anaerobic digestion process at the plant. This arrangement does not interact with, or impose loading on, the underlying groundwater regime.

Accordingly, the proposed development is not considered to be at risk of groundwater flooding.

5. STAGE 2 - INITIAL FLOOD RISK ASSESSMENT

The primary objective of the Stage 2 Initial Flood Risk Assessment is to examine any potential flood-related constraints identified during the Stage 1 Flood Risk Identification. Stage 1 findings confirm that the Site is not located within a mapped fluvial or coastal flood zone. However, a review of available flood mapping indicates historical flooding in the wider area, particularly in proximity to the proposed discharge location. On this basis, a Stage 2 assessment was undertaken to evaluate any potential implications for the proposed development.

National Flood Information Mapping (NFIM) identifies the Site as being located within Flood Zone C. The proposed anaerobic digestion (AD) facility is considered an industrial development and may be classified as "Less Vulnerable Development" in accordance with Table 2-1. However, as the facility also falls under the SEVESO site, it may additionally be considered "Highly Vulnerable Development". Therefore, both classifications have been considered as part of this assessment.

As summarised in Table 5-1, both high and Less Vulnerable Development is considered Appropriate within Flood Zone C. The proposed development is therefore acceptable from a flood risk perspective, and a Stage 3 Detailed Flood Risk Assessment is not required.

Table 5-1:Matrix of Vulnerability Versus Flood Zone - Case of Study

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable Development	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water-Compatible Development	Appropriate	Appropriate	Appropriate

6. CONCLUSION

The Site-Specific Flood Risk Assessment (SSFRA) has been undertaken for the proposed anaerobic digestion (AD) facility at Powerstown, in accordance with the core principles of the guidelines (DEHLG & OPW, 2009). A Stage 1 and Stage 2 Flood Risk Identification was completed to determine whether any flooding or surface water management issues may arise in relation to the proposed development. This assessment confirmed that the Site is not at risk of flooding from fluvial, coastal, pluvial, or groundwater sources.

The proposed development layout incorporates drainage infrastructure to collect and manage storm water generated on site, as outlined in the Pluvial Flooding section, which also considers exceedance from artificial drainage systems. The proposed attenuation pond has been designed to accommodate the 1-in-30-year storm event, with an additional 20% allowance for projected increases in rainfall intensity due to climate change. Stored water will be pumped for reuse within the anaerobic digestion process, while suction pipework will facilitate the controlled discharge of excess water once the stored volume reaches the freeboard level of the stormwater lagoon.

Surplus flows from the attenuation pond will discharge to the existing drainage network located parallel to the eastern side of the Road R448, which flows northwards and ultimately discharges to the existing Powerstown Stream, a tributary of the River Barrow. The discharge will be managed to ensure that runoff entering the existing drainage network does not increase flood risk or cause flooding downstream.

Discharge rates will be restricted to the greenfield runoff rate, and exceedance flows will be managed such that the total exceedance volume is released gradually over a minimum 24-hour period, in line with best practice. This approach ensures the prevention of sudden downstream flooding, supports replication of greenfield runoff.

OPW flood mapping indicates that historical flood events have occurred at the proposed discharge point, as discussed in the Flood History section. However, in the absence of detailed flood records, and considering the proposed drainage and attenuation measures, the Site is not considered to be at risk of pluvial flooding. On this basis, the proposed development is not expected to increase flood risk relative to existing conditions, either within the Site or at the downstream discharge location. Accordingly, the Stage 1 and Stage 2 assessments are deemed sufficient, and progression to a Stage 3 Detailed Flood Risk Assessment is not required.

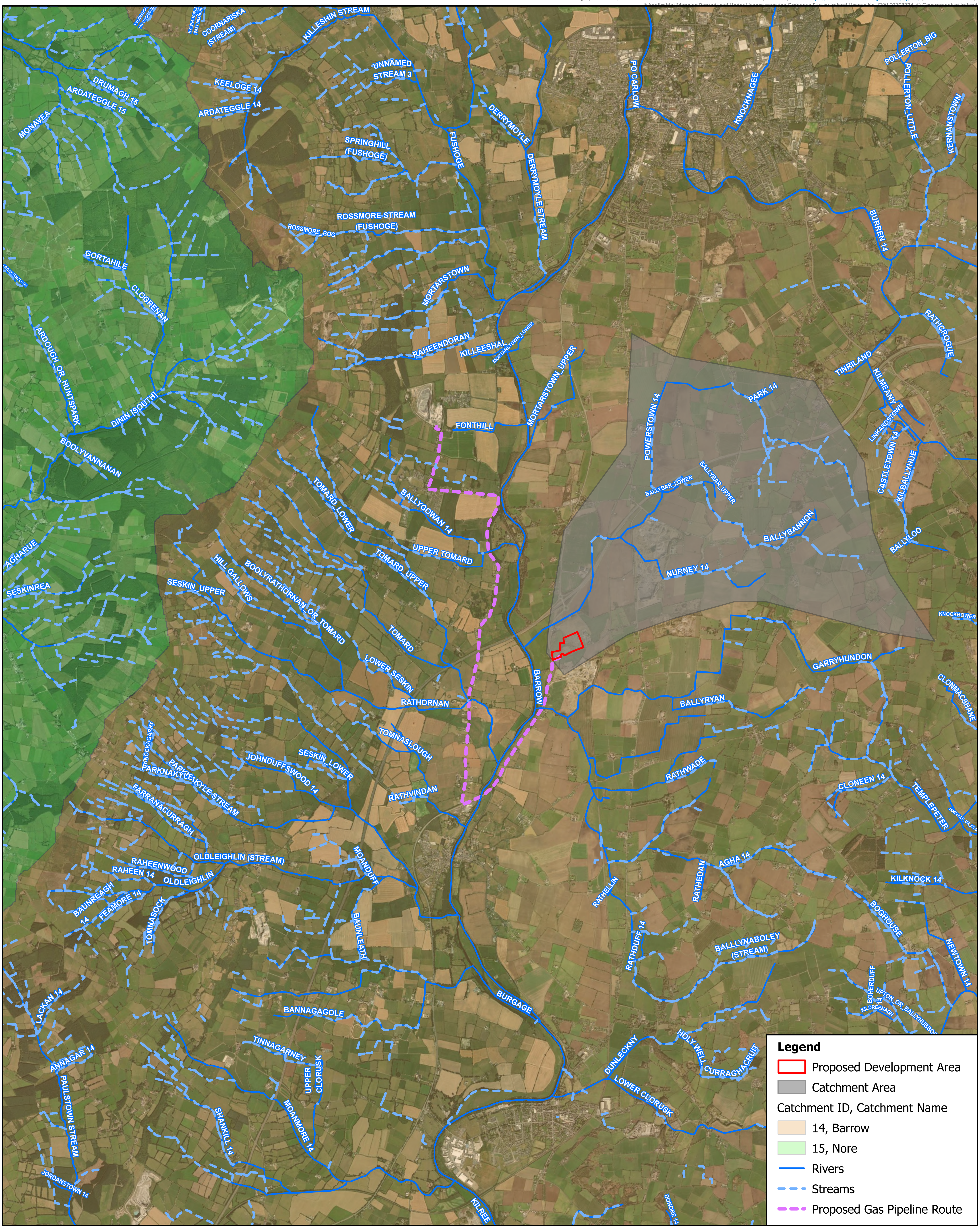
DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

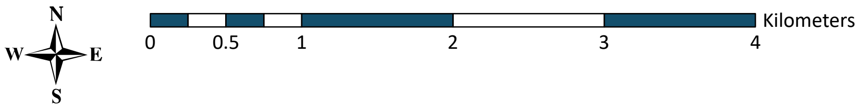
APPENDIX 1

Site Location Map

Path: R:\Map Production\2024\P24-188\Workspaces\P24_188_Chapter_13_Figures\P24_188_Chapter_13_Figures.aprx

Streams: © Tailte Éireann .
Rivers: Environmental Protection Agency
Proposed Development Area:
IE_GSI_EPA_WFD_Catchments_50K_IE26_ITM: Environmental Protection Agency
World Imagery: Microsoft, VantorCreative and Commons Attribution 4.0 International (CC BY 4.0) licence https://creativecommons.org/licenses/by/4.0/ [INPUT SOURCE HERE];
If Applicable: Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. CYAL50368274 © Government of Ireland





TITLE:	WFD Catchments and Watercourses - Proposed Development and Proposed Gas Pipeline Route	FIGURE NO:	13.1		
		CLIENT:	Greengate Biogas		
PROJECT:	Powerstown Bioenergy	SCALE:	1:50,000	REVISION:	0
		DATE:	01/07/2026	PAGE SIZE:	A3

FEHILY TIMONEY

Cork | Dublin | Carlow

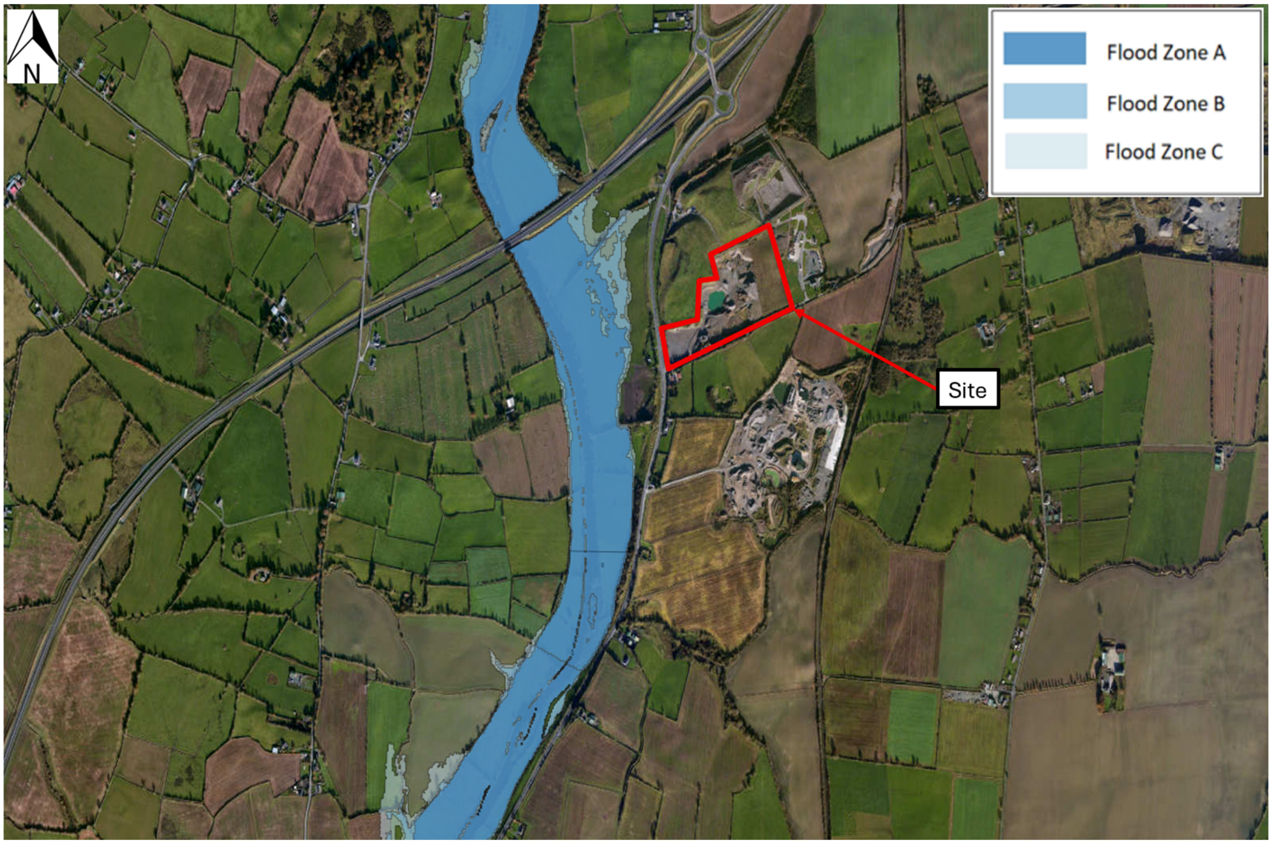
www.fehilytimoney.ie

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 2

Flood Maps



Flood Map- Fluvial Flood Zones 10%, 1% & 0.1% Annual Exceedance Probability (AEP)

Flood Map- Coastal Flood Zones- 10%, 0.5% & 0.1% Annual Exceedance Probability (AEP)

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 3

Site Photos

View from southwest (restored area in fore and mid ground)

View from southeast (active quarrying in foreground)

View from south shows ongoing restoration of former quarry

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

www.fehilytimoney.ie

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

Appendix 13.2

Water Framework
Directive Assessment

FEHILY TIMONEY

DESIGNING AND DELIVERING A SUSTAINABLE FUTURE

EIAR FOR POWERSTOWN BIOENERGY

Water Framework Directive Assessment

Prepared for:

Greengate Biogas 001 Ltd.

Greengate Biogas

Date: June 2026

Document No:

P24188-FT-EN-ZZ-RP-EN-0029

Unit 6, Bagenalstown Industrial Park, Royal Oak Road,
Muine Bheag, Co. Carlow, R21 XW81, Ireland

T: +353 59 972 3800 | E: info@ftco.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

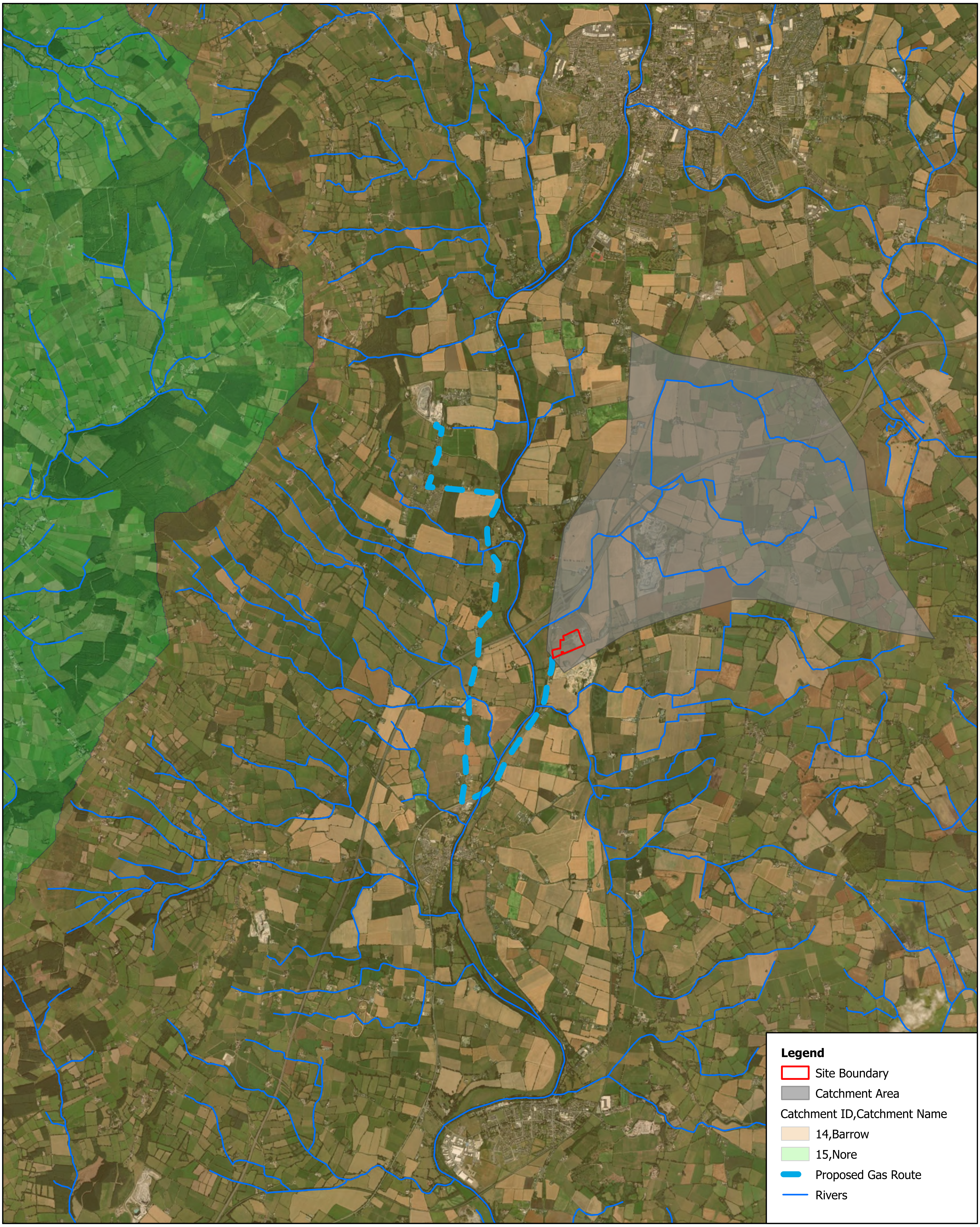
1. INTRODUCTION

1.1 Scope and Purpose of this Water Framework Directive Assessment

The purpose of this document is to present a Water Framework Directive Assessment (WFDA) for the proposed development using a combination of professional judgement, legislation, policy and guidance. The WFDA focuses on the potential water quality effects of the proposed development and assesses the potential risk of deterioration on the water quality and ecological waterbody status for waterbodies (rivers, lakes, estuaries, and coastal waters) within and downstream of the proposed development.

1.2 Description of the Proposed Development

Refer to Chapter 3 of Volume 2 of the EIAR.



TITLE: WFD Catchments and Watercourses - Proposed Development and Proposed Gas Pipeline Route

FIGURE NO: 13.1

CLIENT: Greengate Biogas

PROJECT: Powerstown Biogas

SCALE: 1:50,000 **REVISION:** 0

DATE: 22/01/2026 **PAGE SIZE:** A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

1.3 Statement of Authority

This document was completed by Fehily Timoney and Company where it was prepared by Eibhlín Vaughan and reviewed by Pablo Delgado.

Eibhlín is a Project Environmental Scientist in the Circular Economy and Environment Department at Fehily Timoney and Company. She holds a First Class Honours Bachelor's Degree in Environmental Science from Trinity College Dublin and a Master of Engineering Science Degree from University College Dublin. She has experience supporting with Environmental Impact Assessment Reports (EIARs) for infrastructure projects and completing Water Framework Directive Compliance Reports. Eibhlín provides technical support to the EIAR teams for a variety of projects.

Pablo is a Principal Engineer and Drainage Lead at Fehily Timoney and a Chartered Member of Engineers Ireland. He is the Lead Engineer for Drainage and Flooding for the proposed development. He has extensive experience in planning, design, and construction of hydraulic engineering projects, collaborating effectively with clients and contractors. Specialising in hydraulic infrastructure, he works closely with all stakeholders to deliver practical and efficient designs while addressing issues throughout project delivery.

He has strong expertise in hydraulic design, including developing best-practice guidelines, drainage design, standards, and specialist software tools. Pablo has delivered drainage designs in Design & Build and Public-Private Partnership environments, with experience across the UK, Ireland, and Spain. He holds a Bachelor's degree in Civil Engineering, a Master’s degree, and Postgraduate Diplomas in Civil and Environmental Engineering from the University of Zaragoza and the Polytechnic University of Valencia, Spain, focusing on hydraulic design of civil and environmental infrastructure.

Throughout his career, Pablo has provided technical design and advisory services across all project stages in both urban and rural settings. His major projects include Dunkettle Interchange, N4 Collooney to Castlebaldwin, N22 Baile Bhuirne to Macroom, HS2, A737 Dalry Bypass, and Leanamore Wind Farm. He has also served as a Third-Party Checker on projects such as Adare Bypass and the N5 Ballaghaderreen to Scramoge. Additionally, he has delivered preliminary and detailed designs for renewable energy developments, including flood risk assessments, modelling, hydrological and hydraulic analyses, and environmental impact assessment chapters. CVs are in Appendix 1.1 of Volume 3 of this EIAR.

1.4 Legislative Requirements

The European Union (EU) Water Framework Directive (2000/60/EC) (the Water Framework Directive or WFD) (European Union , 2000) came into force on 22 December 2000 and established a framework for community action in the field of water policy. The WFD requires EU member states to aim to reach good chemical and ecological status in inland and coastal waters. The WFD is designed to enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands, to promote sustainable water use, to reduce pollution of water and to ensure progressive reduction of surface water pollution. The WFD established a strategic framework for managing the water environment and requires a River Basin Management Plan (RBMP) to be developed every six years. In cases where good status/potential could not be achieved by 2015, a provision was given under Article 4.4 of the WFD extending the deadline to 2021 or 2027. The date has been extended to 2027 in respect of a large number of waterbodies.

The WFD has been implemented by dividing the island of Ireland into eight river basin districts. These districts are natural geographical areas that occur in the landscape. River Basin Management Plan 2022-2027 (Department of Housing, Local Government and Heritage, 2024) has been prepared by Department of Housing, Planning and Local Government, presenting a RBMP for catchments throughout Ireland. This RBMP sets out the actions that Ireland will take to improve water quality and achieve 'good' ecological status in waterbodies (rivers, lakes, estuaries and coastal waters) by 2027.

The WFD has been transposed into Irish law following:

- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003) (as amended S.I. No. 52 of 2025) (Department of Environment, Heritage and Local Government, 2003);
- European Union (Water Policy) Regulations 2014 (S.I. No. 350 of 2014) (as amended S.I. No. 52 of 2025) (Department of Environment, Community and Local Government, 2014);
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009) (as amended 2015 and 2025 updates) (Department of Environment, Heritage and Local Government, 2009);
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2022 (S.I. No. 113 of 2022) (as amended S.I. No. 42 of 2025) (Department of Environment, Heritage and Local Government, 2010);
- European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011) (Government of Ireland, 2011).

Water Framework Directive Waterbody Status

The European Communities Environmental Objectives (Surface Water) Regulations 2009 (S.I. No. 272 of 2009) (as amended) (the Surface Water Regulations), implement the criteria and standards used for classifying surface waters in accordance with the WFD. There are five categories of surface water status: 'High', 'Good', 'Moderate', 'Poor' and 'Bad'.

A surface waterbody must achieve both good ecological status and good chemical status before it can be considered good status. The chemical status of a waterbody is assessed based on certain chemical pollutants. The ecological status is assessed based on Biotic Indices or Quality (Q) Values in the form of Environmental Protection Agency's (EPA) Biological Quality Rating System for Rivers (Q Rating System).

In accordance with the Surface Water Regulations, water classified as having 'High' or 'Good' status must not be allowed to deteriorate. Water classified as less than good must be restored. The Surface Water Regulations also state that, for the purpose of classification, a status of less than Good is assigned in the case of a waterbody where the environmental objectives are not met, and in accordance with these Regulations shall be restored to at least good status or good ecological potential.

The role of a WFD Assessment is to evaluate the potential for deterioration in the overall status of a waterbody from a proposed development, based on the latest River Basin Management Plan (RBMP). The role of a WFD Assessment is also to determine whether the proposed development may hinder any existing Programmes of Measures (known as Areas for Action in Irelands RBMP) in returning a failing waterbody to 'Good' status.

1.5 Structure of this WFD Assessment Report

Section 2 presents the details of the proposed development and baseline description of the proposed development site and proposed gas pipeline route in terms of its hydrology, land-use, topography and WFD water quality.

Section 3 presents the baseline condition of the River Basin Management Plan 2022-2027 for each of the relevant waterbodies, as defined by the latest available WFD 'Cycle 3' and presents the Programme of Measures (Areas for Action) for each waterbody.

Section 4 presents the consultation outcomes undertaken for the Proposed Development and proposed Gas Pipeline route which relate to the WFD Assessment.

Section 5 discusses the mitigation for the proposed development and proposed gas pipeline route for the construction, operational and decommissioning phases.

Section 6 presents the Water Framework Directive Assessment for all phases of the Proposed Development and proposed Gas Pipeline route. Key points from the WFDA are summarised in the concluding Section 7 and references are available in Section 8.

2. BASELINE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 Existing Area Drainage

There is existing formal drainage in the road network (L3045 and R448) adjacent to the proposed development red line boundary, identified during the phased hydrological walkover survey undertaken within and adjacent to the proposed development. There is no formal drainage in the existing site of the proposed development, storm water infiltrates to ground.

2.2 Watercourse Crossings

Six watercourse crossings have been identified outside of the redline boundary which are relevant to the proposed Gas Pipeline route. Four watercourse crossings are on WFD Waterbodies, and two are drains. The existing watercourse crossings along the proposed Gas Pipeline route are listed in Table 13-1 of Chapter 13, Surface Water and Hydrology, in Volume 2 of this EIAR. The crossing methodology is described in Chapter 3 in Volume 2 of this EIAR.

2.3 Study Area

The Study Area for the hydrological assessment and water quality is comprised of catchments, sub-catchments, sub-basins and associated hydrological features hydrologically connected to the propose development site and the proposed gas pipeline infrastructure. The delineation of the waterbodies encompassing the drainage networks is defined by the latest available Water Framework Directive (WFD) ‘Cycle 3’.

2.4 Hydrological Setting

As outlined in Table 2-1, the proposed development site is located within one catchment of the Irish River Network System - the Barrow Catchment (ID 14). The proposed development is situated within the sub-catchment delineated under the WFD as Barrow_SC_100 (Sub-catchment ID 14_4). The proposed development is situated within one sub-basin, known as Barrow_180. The WFD Waterbody Barrow_180 (IE_SE_14B012700) is contained in this sub-basin. The proposed development is situated on the WFD Groundwater Body (GWB) Athy-Bagenalstown Gravels (European Code: IE_SE_G_160).

The proposed gas pipeline is located within one catchment of the Irish River Network System - the Barrow Catchment (ID 14). The proposed development is situated within two sub-catchments delineated under the WFD as Barrow_SC_100 (Sub-catchment ID 14_4) and Barrow_SC_110 (Sub-catchment ID 14_5). The proposed development is situated within four sub-basins, known as Rathornan_010, Barrow _170, Ballynaboley Stream_010, and Barrow _180. The WFD Waterbodies Rathornan_010 (European Code IE_SE_14R430830), Barrow _170 (European Code IE_SE_14B012600), Ballynaboley Stream_010 (European Code IE_SE_14B080700), and Barrow_180 (European Code : IE_SE_14B012700), are contained in these sub-basins. GWBs of relevance to the proposed gas pipeline are Athy-Bagnalstown Gravels (European Code: IE_SE_G_160) and Bagenalstown Lower (European Code: IE_SE_G_157).

The proposed development is located approximately 300 m east of the River Barrow (EPA code 14B01), WFD Waterbody Barrow _180 (European Code: IE_SE_14B012700). However, as the proposed development site lies lower than the surrounding lands, the depressed topography creates a naturally enclosed basin, reducing the immediate risk of uncontrolled surface water contamination from the site entering external watercourses during rainfall events.

Table 2-1: WFD catchment divisions and surface waterbodies

Catchment	Sub-Catchment	Sub-Basin/Waterbodies	Component of the proposed development within Sub-Basin	Is the Site Boundary Located Within the Sub-Basin
Barrow Catchment (Catchment ID 14)	Barrow_SC_100 (Sub-catchment ID 14_4)	Barrow _180 (European Code: IE_SE_14B012700)	The proposed development and the proposed gas pipeline	Yes
		Ballynaboley Stream_010 (European Code: IE_SE_14B080700)	The proposed development and the proposed gas pipeline	No
		Athy-Bagenalstown Gravels (European Code: IE_SE_G_160).	The proposed development and the proposed gas pipeline	No
	Barrow_SC_110 (Sub-catchment ID 14_5)	Barrow _170 (European Code: IE_SE_14B012600)	Proposed gas pipeline	No
		Rathornan_010 (European Code: IE_SE_14R430830)	Proposed gas pipeline	No
		Bagenalstwon Lower (European Code: IE_SE_G_157)	Proposed gas pipeline	No

WFD river waterbodies in Ireland are often formed by grouping smaller waterbodies or segments, acting as the primary management and reporting units. Large rivers may be broken into smaller waterbodies based on characteristics such as flow, tributaries, and monitoring data, allowing for precise reporting on water quality. Table 2-2 identifies the component waterbodies included within each of the WFD river waterbodies relevant to the proposed scheme.

Table 2-2: Component waterbodies included within the WFD river waterbodies/sub basins

WFD River Waterbody	Contributing Waterbodies (EPA Name)
Barrow _180 (IE_SE_14B012700)	• Barrow • Powerstown 14 • Nurney 14 • Ballybannon • Park 14
Ballynaboley Stream_010 (IE_SE_14B080700)	• Balllynaboley (Stream) • Garryhundon • Ballyryan • Agha 14 • Rathedan • Rathduff 14
Barrow _170 (IE_SE_14B012600)	• Fushoge • Rossmore stream (Fushoge) • Mortarstown • Raheendoran • Derrymoyle stream • KILLEESHAL • Mortarstown Lower • Fonthill • Mortarstown Upper • Ballygowan 14 • Upper Tomard
Rathornan_010 (IE_SE_14R430830)	• Tomard Lower • Tomard Upper • Tomard • Rathornan • Boolyrathornan • Hill Gallows

2.5 Existing Land Use and Site Context

The proposed development site, a partially restored quarry, is operated as a sand and gravel quarry and takes in soil and stone material to backfill the spent areas of the quarry in accordance with its planning permission.

Further details on the existing development are available in Chapter 3, Details of the Proposed Development, in Volume 2 of this EIAR.

2.6 Surface Water Quality

The EPA scheme of Biotic Indices or Quality (Q) Values was developed to determine the status of organic pollution in Irish rivers by assessing the occurrence of macro-invertebrate taxa with varying sensitivity to pollution. This process often involves the use of water chemistry parameters for determination of the WFD status of each waterbody. Baseline chemical water quality sub-elements of these waterbodies are available online from Catchments.ie (Environmental Protection Agency, 2026).

The closest EPA Q Value Monitoring Locations to the proposed Site on the River Barrow are Milford Bridge (station code: RS14B012600) upstream, and Cardinal Moran Bridge (station code: RS14B012680) downstream. The Milford Bridge monitoring station is at the demarcation point between the Barrow_180 and the Barrow_170 WFD Waterbodies, at (52.780635, -6.963590). The latest reported Q Value both upstream and downstream of the proposed development is 3-4, indicating a 'Moderate' WFD Status and 'Slightly Polluted' Pollution Status for the River Barrow.

The latest chemical surface water sampling undertaken at the upstream station (RS14B012600) was in October 2025 (Environmental Protection Agency, 2026). The results indicate that there were elevated phosphorus levels in the stream, with 0.043 mg/l orthophosphate (as P) reported for this monitoring round. No chemical surface water results are available for the Cardinal Moran Bridge monitoring location (RS14B012680) downstream of the proposed development. Monitoring is ongoing for these Q Value Monitoring Stations.

There is one Q-Value Monitoring Station on the Rathornan_010 WFD Waterbody (station code: RS14R430830). However, this waterbody is not on a published monitoring programme. Therefore, there are no Q Value or chemistry data available from this monitoring location.

There is one Q-Value Monitoring Station on the Ballynaboley Stream (station code: RS14B080700). The latest reported Q Value at this monitoring station is Q3-4, indicating a 'Moderate' WFD Status. There are no chemical data available for this stream. The stream is considered to have moderate potential for fish and suitability for juvenile lamprey given the presence of suitable soft, fine sediments. Habitat is suitable for white-clawed crayfish as evidenced by historical records. It is noted that upstream, the stream has barriers to fish passage at the two crossing points on the L3046 as identified in the IFI National Barrier Programme.

Refer to Chapter 11, Biodiversity, for baseline descriptions of the aquatic environment at stream crossings for the proposed gas pipeline route.

2.6.1 Powerstown Stream

Surface water monitoring data are also available for the Powerstown Stream, a tributary of the River Barrow which runs in a south westerly direction along the northern border of licensed closed landfill that is directly north of the proposed development. The Powerstown Stream is considered part of the Barrow_180 WFD Waterbody (European Code: IE_SE_14B012700). The EPA maps website shows the stream as 'At risk' of achieving good status. However, due to the proximity of this stream to the proposed development and the proposed discharge of stormwater runoff to this stream during 1 in 30-year storm events (see Section 6 of this report), an assessment of its baseline quality and status is included in this WFD Assessment. Surface water monitoring assessment reports for the Industrial Emissions Licence (Licence Number: W0025) for the existing Civic Amenity and Landfill, are available on the EPA Leap website (Environmental Protection Agency, 2026) and were reviewed for this assessment. The landfill is closed and fully capped and is in the aftercare stage. There is an operational civic amenity facility on Site. The facility is operated and maintained by Carlow County Council. There is an attenuation pond on the north eastern side of the landfill which collects storm water from Site, attenuates and discharges it to the Powerstown Stream. Monitoring of the stream is carried out up and downstream of the discharge point and biological status monitoring is conducted annually.

The 2024 Surface Water Monitoring Report for the Powerstown Stream (Carlow County Council, 2024) undertook physiochemical and chemical analysis of stream water to assess quality and status in line with the EPA licence. The results indicate similar chemical conditions upstream and downstream of the existing discharge. Chloride and ammonia were detected upstream and downstream, with Chloride exceeding the trigger level value of 50 mg/l, with a value of 53.3 mg/l at the downstream monitoring point during Q4 2024. The parameters analysed as part of the annual monitoring event include metals, sulphate, alkalinity, orthophosphate, and total oxidised nitrogen. The concentrations detected for these parameters were below their corresponding parametric limit values.

The most recent available biological assessment of surface water quality in the Powerstown Stream is from January 2025 (Limnos Consultancy on behalf of Carlow County Council, 2025). This report utilised the EPA's Quality Rating System (Q-Value) and macroinvertebrate data to assess the stream condition. The results indicate that the stream has a Q-Value of 3 (Poor WFD Status) both upstream and downstream of the existing discharge. This aligns with previous Q Value ratings assigned to this stream during previous monitoring rounds, with results between 2001 and 2013 fluctuating between Q3 (Poor WFD Status) and Q3-4 (Moderate WFD Status). The Powerstown Stream has been reported as having a value of Q3 (Poor WFD Status) between 2014 and 2022 (Conservation Services on behalf of Carlow County Council, 2022).

The Q Value results reported in 2025 indicate that the Powerstown Stream was in slightly poorer condition in 2024 than the Barrow_180 to which it drains. The report (Limnos Consultancy on behalf of Carlow County Council, 2025) notes that the upstream Site may be impacted by a quarry 1 km upstream of the proposed development, and agricultural sources, with extensive tillage in the vicinity of the monitoring location. Small streams risk score (SSRS) and small streams characterisation score (SSCS) assessments were also undertaken. The results indicate a decline in quality of the Powerstown Stream from upstream to downstream, indicating an additional pressure on the lower Site.

Refer to Chapter 11, Biodiversity, in Volume 2 of this EIAR for further details on the aquatic ecology of the Powerstown Stream.

2.7 Protected Ecological Environment

The proposed development is not within a designated protected ecological environment. However, the proposed gas pipeline will be partly located within the River Barrow and River Nore Special Area of Conservation (SAC) (Site code 002162).

The SAC is selected for its high number of protected and priority habitats and species listed on Annex I/II of the EU Habitats Directive (European Union, 1992), including (Department of Housing, Local Government and Heritage, 2024):

- Floating River Vegetation
- Hydrophilous Tall Herb Communities
- Desmoulin's Whorl Snail (Vertigo moulinsiana)
- Freshwater Pearl Mussel (Margaritifera margaritifera)
- White-clawed Crayfish (Austropotamobius pallipes)
- Sea Lamprey (Petromyzon marinus)
- Brook Lamprey (Lampetra planeri)
- River Lamprey (Lampetra fluviatilis)
- Atlantic Salmon (Salmo salar)
- Otter (Lutra lutra)

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. Site-specific conservation objectives aim to define favourable conservation conditions for a particular habitat or species at that Site.

Conservation objects for the River Barrow and River Nore SAC include (National Parks and Wildlife Service, 2025):

- To maintain the favourable conservation condition of Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels in the River Barrow and River Nore SAC,
- To maintain the Favourable conservation condition of Desmoulin's whorl snail in the River Barrow and River Nore SAC
- To restore the Favourable conservation condition of the Freshwater pearl mussel (Margaritifera margaritifera) in River Barrow and River Nore SAC
- To maintain the Favourable conservation condition of White-clawed crayfish in the River Barrow and River Nore SAC
- To restore the Favourable conservation condition of Sea lamprey in the River Barrow and River Nore SAC
- To restore the favourable conservation condition of Brook lamprey in the River Barrow and River Nore SAC
- To restore the Favourable conservation condition of River lamprey in the River Barrow and River Nore SAC
- To restore the favourable conservation condition of Twaite shad in the River Barrow and River Nore SAC
- To restore the favourable conservation condition of Salmon in the River Barrow and River Nore SAC
- To restore the favourable conservation condition of Otter in the River Barrow and River Nore SAC
- To maintain the Favourable conservation condition of Killarney Fern in the River Barrow and River Nore SAC

Refer to Chapter 11 in Volume 2 of this EIAR for a description of the biodiversity baseline of the environment. The Freshwater Pearl Mussel is extinct from the main Barrow channel and populations are confined to the Mountain and Ballymurphy rivers which are c 20 km downstream of the proposed development but within the same catchment.

3. REVIEW OF THE RIVER BASIN MANAGEMENT PLAN

The proposed development is located in the Barrow WFD Catchment and in the sub-basin known as Barrow_180. The River Barrow is the principal drainage channel of the area into which the surrounding streams discharge. The River Barrow (WFD Waterbody code Barrow_180) is located approximately 300 m to the west of the proposed development. There is no direct discharge from the existing quarry, as all rainwater falling on Site and overland flows discharge to ground.

The WFD River Waterbody Status for the River Barrow (WFD Waterbody code Barrow_180) within Barrow_180 sub-basin for the monitoring period 2019-2024 is 'Moderate'.

The proposed gas pipeline route is also in the proximity of the Ballynaboley Stream (WFD Waterbody code Ballynaboley Stream_010), River Barrow (WFD Waterbody code Barrow_170) within Barrow_180 sub-basin and the Rathornan River (WFD Waterbody Code Rathornan_010). The WFD River Waterbody Status for Ballynaboley Stream_010 for the monitoring period 2019-2024 is 'Poor'. The WFD River Waterbody Status for Barrow_170 for the monitoring period 2019-2024 is 'Moderate'. The WFD River Waterbody Status for Rathornan_010 for the monitoring period 2019-2024 is 'Good'.

Both the Barrow_170 and Barrow_180 have Moderate Ecological Status or Potential. For the monitoring period 2019-2024, Nitrogen Conditions and Nitrate were 'Moderate' for both waterbodies. Rathornan_010 did not undergo monitoring assessment in 2019-2024 period and was instead modelled. For this reason, there are no data available on Ecological Status or Potential and chemistry.

Significant issues identified for the Barrow_170 and Barrow_180 during the 2nd Cycle monitoring for the waterbodies are diffuse agriculture, urban diffuse, and habitat degradation. Significant pressure are urban run-off and agriculture (Environmental Protection Agency, 2019). One significant issue is noted for the Ballynaboley Stream_010, nutrients. Agriculture is a significant pressure on this WFD Waterbody.

A summary of the WFD Status of Ballynaboley Stream_010, Rathornan_010, Barrow_170, and Barrow_180 is available in Table 3-1. A summary of the WFD Status of relevant GWBs is presented in Table 3-2.

Table 3-1: WFD status for WFD Surface Waterbodies for monitoring period 2019-2024

Element	Barrow_180	Barrow_170	Rathornan_010	Ballynaboley Stream_010
Assessment Technique	Monitoring	Monitoring	Modelling	Monitoring
Status Confidence	Medium	Unknown	Low Confidence	Medium
Ecological Status or Potential	Moderate	Moderate	Good	Poor
Biological Status or Potential	Moderate	Moderate	N/A	Poor
Invertebrate Status or Potential	Moderate	Moderate	N/A	Poor
Supporting Chemistry Conditions	Pass	Pass	N/A	N/A
General Conditions	Pass	Pass	N/A	N/A
Oxygenation Conditions	Pass	Pass	N/A	N/A
Dissolved Oxygen (% Sat)	Pass	Pass	N/A	N/A
Other determinants for oxygenation conditions	High	High	N/A	N/A
Acidification Conditions	Pass	Pass	N/A	N/A
pH	Pass	Pass	N/A	N/A
Nutrient Conditions	Pass	Pass	N/A	N/A
Nitrogen Conditions	Moderate	Moderate	N/A	N/A
Nitrate	Moderate	Moderate	N/A	N/A
Ammonium	High	High	N/A	N/A
Phosphorous Conditions	High	High	N/A	N/A
Orthophosphate	High	High	N/A	N/A
Specific Pollutant Conditions	N/A	Pass	N/A	N/A
Risk of Deterioration, Objectives, Pressures, Issues (Environmental Protection Agency, 2019) (Environmental Protection Agency, 2024)				
WFD Risk 2019-2021	At risk	At risk	At risk	At risk
Objectives	Good chemical and ecological status by 2027	Good chemical and ecological status by 2027	Good chemical and ecological status by 2027	Good chemical and ecological status by 2027

Element	Barrow_180	Barrow_170	Rathornan_010	Ballynaboley Stream_010
Significant Issue(s)	Diffuse agriculture, urban diffuse, habitat degradation	Diffuse agriculture, urban diffuse, habitat degradation	Under review due to unassigned status	Nutrients
Significant Pressures	Urban Run-off, Agriculture	Agriculture, Hydromorphology	Pasture	Agriculture

Table 3-2 WFD status for WFD Groundwater Bodies for monitoring period 2019-2024

Element	Athy-Bagnelstown Gravels	Bagenalstown Lower
Overall Groundwater Status	Good	Good
Quantitative Groundwater Status	Good	Good
Saline (or Other) Intrusions Test	Good	Good
Impact of Groundwater on Surface Water Ecological/Quantitative Status Test	Good	Good
Groundwater Dependent Ecosystems (GWDTE) - Quantitative Assessment Test	Good	Good
Water Balance Test	Good	Good
Chemical Groundwater Status	Good	Good
Saline (or Other) Intrusions Test	Good	Good
Impact of Groundwater on Surface Water Ecological/Chemical Status Test	Good	Good
Groundwater Dependent Ecosystems (GWDTE) - Chemical Assessment Test	Good	Good
Drinking Water Protected Area Test	Good	Good
General Chemical Assessment Test	Good	Good
WFD Risk	At Risk	Not at Risk
Objectives	Good status by 2027	Good status by 2027
Significant Issue(s)	Nutrients	N/A
Significant Pressures	Agriculture	N/A

3.1 Programme of Measures

The Department of Housing, Local Government, and Heritage produced a River Basin Management Plan (RBMP) for Ireland for 2022-2027 (Department of Housing, Local Government and Heritage, 2024). The RBMPs describe Programme of Measures which will be implemented to deliver water quality improvements for all catchments in Ireland to deliver the objectives of the WFD. These Programme of Measures are referred to as Areas for Action (AFA) in Ireland. In total, 517 areas have been selected for focused attention in the third cycle. The Barrow_170, Barrow_180, and Rathornan_010 are not considered Priority Areas for Action (Department of Housing, Local Government and Heritage, 2024). The Ballynaboley Stream_010 is listed as an Area for Action, specifically an area for restoration.

As part of the WFD Compliance Assessment, any potential for hindrance of AFA improvement measures would normally be assessed. However, due to having no 'Measures' currently stated for improvement, the Hindrance of Measures assessment will not be undertaken as there are no 'measures for improvement' to compare to for the identified waterbodies.

4. CONSULTATION

Refer to Chapter 5 of this EIAR for consultation carried out.

The WFD Assessment will take account of potential hydrological impacts on downstream WFD Water Bodies, wetland habitats, National Heritage Areas (NHA) and Priority NHA, as it is implicit in the assessment of potential deterioration of WFD waterbodies within/near the proposed development and on downstream WFD transitional waterbodies.

5. MITIGATION MEASURES

5.1 Mitigation by Avoidance and Design

Mitigation by avoidance and design forms the primary control on potential impacts to surface water hydrology and surface water quality. The drainage strategy for the proposed development has been designed to physically interrupt pollution pathways, control runoff rates, and provide multiple, redundant stages of treatment, containment, and isolation prior to any discharge.

The key design measures include:

- Development of the proposed development within a former quarry, thereby avoiding impacts on natural floodplains and minimising interference with existing surface water flow paths.
- Adoption of a fully separated drainage strategy, comprising three distinct hydraulic networks designed according to runoff quality and risk:
- A drainage network serving plant carriageways and bunded tank areas;
- A roof water drainage network collecting uncontaminated runoff from building roofs; and
- An interceptor drainage network collecting clean overland flows from surrounding lands and quarry cut areas.

For design details, please refer to Chapter 3, Description of the Proposed Development, in Volume 2 of this EIAR. They are summarised for ease of reference but Chapter 3 is the source reference.

5.1.1 Storm Water Management During Construction Phase

The stormwater lagoon will be the first piece of infrastructure constructed on site. It is described in the following section.

5.1.1.1 Stormwater Lagoon

- During operation, all three hydraulic networks will discharge to a sealed lagoon, preventing infiltration to groundwater. During construction, all stormwater generated on site will discharge to the sealed lagoon.
- A forebay will be provided at the lagoon inlet to manage first-flush runoff and capture residual sediment.
- The lagoon will include a settling zone, sufficient storage volume, and a minimum freeboard of 300 mm.
- It will be designed for the 1-in-30-year storm event plus a 20% climate change allowance.
- Due to the quarry setting, the lagoon will operate as a drainless system, with exceedance flows managed by pumping during the operational phase. During construction, the lagoon will be emptied by tanker as required, ensuring that no stormwater is discharged from the site.
- A temporary version of the operational phase pump station associated with the lagoon will be equipped with water-quality sensors designed to continuously monitor lagoon water prior to reuse of stormwater as a construction water source. Reuse of stormwater will only occur where monitoring confirms acceptable water quality. Where monitored parameters indicate contamination or abnormal conditions, water will be tankered off site for further treatment and management at an authorised facility.

  - During construction, mitigation will focus on controlling sediment mobilisation, managing temporary drainage arrangements, and preventing accidental pollution. The construction of the proposed development includes the construction of the drainage system. There will be no discharge of stormwater from the site during the construction phase. All stormwater generated on site will be directed to and contained within the lined stormwater lagoon for containment, settlement, reuse where appropriate, and tankering off site where required. Monitoring of stormwater within the lagoon will be undertaken to determine its suitability for reuse as a construction water supply.
  - A temporary drainage treatment train will be implemented throughout the construction phase. Surface runoff generated within disturbed areas of the site will be collected and conveyed through a sequence of treatment measures comprising temporary interceptor drains, check dams, sediment traps, the stormwater lagoon forebay and the stormwater lagoon settlement zone prior to storage within the lagoon. The treatment train can be summarised as follows:
  - Runoff → Temporary Interceptor Drains → Check Dams → Sediment Traps → Lagoon Forebay → Lagoon Settlement Zone
  - This treatment sequence will progressively reduce flow velocities, promote sediment settlement, capture suspended solids at multiple stages and minimise the risk of polluted runoff entering the stormwater lagoon. The lagoon will provide the final stage of sediment settlement and water quality management prior to reuse on site or removal by tanker where required.
  - The following measures will be implemented during construction:
  - Phased construction of drainage infrastructure to ensure that permanent drainage and treatment features are operational at the earliest practicable stage. The stormwater lagoon will be constructed in advance of earthworks.
  - Installation of temporary sediment control measures, including silt fences, sediment traps, settlement areas, and temporary interceptor drains with check dams.
  - Protection of the stormwater lagoon from uncontrolled inflows and excessive sediment loading during early construction phases through the use of temporary diversion ditches, check dams and sediment-control measures.
  - Discharge from the stormwater lagoon to sealed tankers for off-site treatment and disposal where water quality monitoring identifies contamination or where excess volumes require removal.
- Water will be treated through a sequence of drainage elements, including the temporary and permanent sediment-control measures described above. The lagoon will provide additional treatment through settlement within the forebay and settlement zone.
- All temporary drainage measures, including interceptor drains, check dams, sediment traps, settlement areas and the stormwater lagoon, will be inspected regularly and following significant rainfall events. Accumulated sediment will be removed as required to maintain the effectiveness of the drainage system and preserve available storage capacity.
- Construction activities will be planned with consideration of forecast weather conditions. Activities with an increased risk of sediment mobilisation may be modified, suspended or rescheduled during periods of prolonged or intense rainfall where necessary to minimise pollution risk.
- Management of excavations and exposed soils to minimise erosion, including temporary stabilisation where required.
- Temporary stockpiles of soil and excavated material will be located away from drainage features where practicable and managed to minimise erosion and sediment runoff. Additional protection measures will be implemented where required during periods of prolonged or intense rainfall.
- Storage of fuels, oils and chemicals in bunded, sealed and designated areas, with refuelling restricted to controlled locations.

- Provision of spill kits and training of construction personnel in spill response procedures.
- An emergency pollution response procedure will be implemented on site. In the event of a spill, leak or other pollution incident, the source will be isolated immediately, contaminated material will be contained and recovered, and any contaminated water will be removed from site by an authorised contractor for treatment and disposal at an appropriately authorised facility.
- Strict control of concrete works to prevent alkaline runoff. All concrete wash out water will be collected in a dedicated tank and transported off Site by a permitted contractor to an authorised private WWTP.
- No direct discharge of stormwater to groundwater, surface water bodies or off-site drainage systems will occur during the construction phase.
- Protection of watercourse crossings along the gas pipeline route, with works undertaken at existing culverts or bridges in accordance with Inland Fisheries Ireland (IFI) guidance and OPW.

Section 12.7.1 and 12.7.2 of Chapter 12 Soils, Geology And Hydrogeology of Volume 2 of this EIAR lists the avoidance measures in the design. The measures as outlined ensure that there will be no significant effect on the receiving land, soil, geology and hydrogeology.

5.1.2 Storm Water Management During Operational Phase

The design and operation of the operational storm water management system is described in Chapter 3 of Volume 2 of this EIAR and in the drainage drawings in Volume 4 of this EIAR. The design of each of the elements is described below.

5.1.2.1 Plant Drainage and Bunded Area Drainage Network

- Runoff from plant carriageways and circulation areas will be collected via gullies, eco-drains and drainage kerbs incorporating sumps, providing primary sediment control at source.
- Flows will discharge into TII-specified catchpits with a minimum sump depth of 300 mm, providing secondary sediment settlement.
- A petrol/oil interceptor, designed in accordance with TII specifications, will be installed to remove hydrocarbons from runoff generated in trafficked and operational areas.
- The plant drainage network will be equipped with water-quality sensors designed to continuously monitor the characteristics of water collected within the system.
- Penstocks will be installed downstream of the interceptor and upstream of the lagoon.
- Under normal operating conditions, uncontaminated runoff will be permitted to pass through the drainage network.
- In the event that water-quality parameters indicate the presence of contamination or a spillage, the penstocks will automatically close to prevent discharge to the lagoon.
- Contaminated runoff will instead be automatically diverted to the dedicated spillage containment system, thereby ensuring full isolation of polluted flows from the wider drainage system.
- A dedicated spillage containment system with a minimum capacity of 25 m^3 will be provided to retain large spillages. This system will be located at a lower level than the drainage network to prevent reverse flows and to facilitate safe recovery and removal of contaminated material.
- Bunded areas associated with the tank farm and process infrastructure will be drained via a dedicated pumped system into the Plan Drainage System:

- The pumped system will also be fitted with water-quality sensors to continuously monitor runoff collected within bunded areas.
- Where contamination is detected, the pump will automatically prevent discharge to the plant drainage network, ensuring isolation of potentially contaminated water within the bund.
- Only water confirmed to be uncontaminated will be permitted to discharge under controlled conditions.

This combination of continuous monitoring, automatic isolation, and controlled diversion provides an active and fail-safe layer of protection against accidental pollution.

5.1.2.2 Roof Water Drainage Network

- Clean roof water from industrial buildings will be collected via a dedicated roof water drainage network, fully separated from potentially contaminated runoff.
- Roof runoff will be conveyed through catchpits with sumps, allowing settlement of debris and fine particulates and providing access for inspection and maintenance.
- As roof water is uncontaminated, no hydrocarbon interception is required; however, the inclusion of catchpits provides additional resilience and operational control.
- Roof water will discharge to the lagoon, contributing to overall flow balancing and attenuation.

5.1.2.3 Interceptor Drainage Network

- Overland flows from surrounding lands and the existing quarry cut will be intercepted downslope of operational areas via a dedicated interceptor drainage system.
- The interceptor network will primarily comprise of vegetated swales, designed to reduce flow velocities and promote sediment settlement.
- Check dams will be installed at regular intervals along the swales to:
  - reduce runoff velocities
  - increase hydraulic residence time
  - promote settlement of suspended solids
  - improve water quality prior to discharge
- Where space constraints prevent the use of swales, filter drains will be provided as an alternative interceptor element.
- Interceptor drainage flows will discharge to the lagoon.

5.1.2.4 Stormwater Lagoon

- All three hydraulic networks will discharge to a sealed lagoon, preventing infiltration to groundwater.
- A forebay will be provided at the lagoon inlet to manage first-flush runoff and capture residual sediment.

- The lagoon will include a settling zone, sufficient storage volume, and a minimum freeboard of 300 mm.
- It will be designed for the 1-in-30-year storm event plus 20 % climate change allowance.
- Due to the quarry setting, the lagoon will operate as a drainless system, with exceedance flows managed by pumping.
- Pumping of exceedance flows will be restricted to the greenfield runoff rate for the combined tributary catchments and will be controlled such that the total exceedance volume is discharged gradually over a minimum period of 24 hours (minimum retention time) recommended to the TII specifications or best practice, ensuring:
  - prevention of sudden downstream flooding;
  - replication of greenfield runoff behaviour; and
  - enhanced sedimentation and water-quality improvement prior to discharge.
- The pump station associated with the lagoon will be equipped with water-quality sensors designed to continuously monitor lagoon water quality prior to pumping exceedance flows.
- Pumping of exceedance flows will only occur where monitoring confirms water quality is compliant with the conditions of the IE licence issued by the EPA .
- Where monitored parameters indicate contamination or abnormal conditions, the pump system will automatically inhibit discharge, ensuring retention of potentially contaminated water within the lagoon for further treatment and management at an authorised facility.
- Pumping of water will commence 125 minutes following the start of the rainfall event as per Appendix 12.3 Hydraulic Capacity assessment.

These integrated, multi-stage and actively controlled design measures provide a robust, fail-safe approach to surface water management and significantly reduce the likelihood of adverse impacts on surface water quality, hydrological regimes, and downstream receptors.

5.1.3 Groundwater Mitigation

Mitigation by avoidance and design forms the primary control on potential impacts to land, soils, geology and hydrogeology receptors. As part of the design, the following was carried out:

- Excavation of trial pits and advancement of boreholes to establish overburden and bedrock characteristics: Trial pits and boreholes were carried out across the site. Trial pits were undertaken to identify the materials present on the site and to recover samples for laboratory testing. Boreholes were installed to establish depth to bedrock and bedrock properties, and to confirm the overburden materials present below the base of the trial pits. Standpipes were installed in the borehole to allow for the recording of groundwater levels within the site. A pump test was also undertaken in a specifically drilled well to confirm that a significant proportion of the process water could be supplied from the groundwater at the site.
- Storm Water Management: A storm water management system has been designed for the proposed development as described in Chapter 3 and Chapter 13 of this EIAR. It will be subject to EPA approval prior to construction and subject to IE licence for operation. There will be no discharge of stormwater from the proposed development during the construction phase. Any excess water will be tankered off site for reuse or treatment if required. There is no process water generated at the proposed development. All sanitary foul water will be tankered off site for treatment at a private wastewater treatment plant.

- Horizontal Directional Drilling: As per Section 3.6 of Chapter 3, the construction method for HDD has in built environmental controls the following of which are relevant to protection of soils, geology and hydrogeology:
    - use of a fully degradable drilling fluid
    - appropriate storage of drilling fluid
    - collection of excess drilling fluid for appropriate treatment as a waste material
    - launch and reception pits to be located outside of motorway reservation, which includes the drainage system
    - launch and reception pits to be located >10 m from stream bank at crossing point ID3
    - minimum environmental protection measures as per Section 3.6.1 of Chapter 3 of this EIAR
- Concrete: Concrete batching will not take place at the proposed development or along the proposed pipeline route. The import by concrete wagon has been assessed in Chapter 6 Traffic and Transportation.

5.2 Construction Phase

The Construction Environmental Management Plant (CEMP) (Appendix 3.1 in Volume 3 of this EIAR) will be adhered to in terms of managing construction vehicles, machinery, equipment and staff on site. An Ecological Clerk of Works (ECoW) will be employed for the duration of the construction phase and will be awarded a level of authority and to allowed cessation of construction activity if there is potential for significant environmental effects other than those predicted and mitigated in the EIAR. The ECoW will ensure:

- All biodiversity-relevant mitigation measures set out in the EIAR, NIS and any conditions of consent are implemented.
- Timely advise on environmental effects and communication with the Project owner and contractor to ensure the required actions to implement the mitigation prescribed in this EIAR are carried out in a timely manner.

Construction best practice guidelines will be adhered to (refer to Chapter 11, Biodiversity, in Volume 2 of this EIAR).

5.2.1 River Water

5.2.1.1 Protection of Aquatic Ecosystems

The main potential for significant effects during the construction phase on the aquatic environment is via water pollution. Construction phase mitigation for water quality will follow that outlined in Chapter 13 Surface Water and Hydrology in Volume 2 of this EIAR, and the mitigation measures outlined will be adhered to in conjunction with those outlined in this chapter, relating to the protection of specific aquatic species, noting that all measures for the protection of water quality, as detailed in Chapter 13, will also protect the aquatic ecology and fisheries value of downstream watercourses, particularly the habitats supporting sensitive aquatic species and with connectivity to the River Barrow and River Nore SAC.

Works adjacent to drains and watercourses including as part of HDD crossings will adhere best practice guidelines for the control of water pollution as listed in Chapter 11, Biodiversity, in Volume 2 of this EIAR. The following are additional mitigation measures to protect aquatic ecology:

1. Timing of the Works:

Works within 60m of the drain and watercourse crossings will be carried out outside of the salmonid and lamprey spawning seasons (i.e. works will be confined to between 1st July to 30th September to avoid Atlantic salmon and lamprey species spawning seasons).

2. Measures to prevent Surface water runoff from works areas at/near watercourse crossings:

A double row of silt fences will be established along the perimeter of source areas of contaminated runoff at the following works locations:

- Surrounding the works area at the HDD launch and exit pits for all the drain /waterbody crossings
- For all in-road open cut crossings of drains and watercourses

Silt fencing will be installed by the construction contractor in advance of the works. Silt fencing will consist of a UV-stabilized geotextile membrane (e.g., Hy-Tex Terrastop Premium or similar) attached to wooden posts. The fabric will be buried at least 100-250mm below ground level and anchored, with clean drainage stone, to prevent undercutting.

The silt fencing will be left in place until the works are completed (which includes removal of any temporary ground treatment). Silt fences will not be removed during heavy rainfall.

The integrity of the silt fencing will be checked daily and after poor weather conditions (rain or wind) and any failures rectified immediately. Any build-up of sediment along the fence will be removed in accordance with manufacturers requirements.

A record of when it was installed, inspected and removed will be maintained.

5.2.1.2 Horizontal Directional Drilling (HDD)

The HDD crossings have been selected as mitigation-by-design measures to avoid direct in-stream works and minimise disturbance to sensitive hydrological and ecological receptors.

Specialist drilling contractors will be employed with experience in working in gravel aquifers for all HDD works.

The Contractor will report daily to the Developer's Engineer and the Engineer will also be present on site to supervise all HDD works.

The HDD works will be informed by detailed geotechnical investigations prior to drilling. Drilling tools and mud programme will be selected to match soil/rock conditions.

The approach to HDD will focus on the three pillars of environmental protection: mechanical stabilisation of borehole integrity, fluid non-toxicity, and physical containment:

- Mechanical Stabilisation - Mechanical Stabilisation in the gravelly, non-cohesive aquifer, will be managed by installing steel conductor casing through the shallow gravels to bypass the cover zone (i.e. the material above the bore depth) where fluid would be most likely to breach the surface. This casing acts as a physical barrier, protecting the riverbed from pressure spikes and ensuring returns are directed back to the entry pit rather than into the sensitive substrate.

- Fluid non-toxicity - The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used). Biocompatible Drilling Fluids (European Standards) utilize NSF/ANSI Standard 60 or CE-marked additives which are high-performance, biodegradable viscosifiers and will be used to provide the necessary "gel strength" to suspend heavy gravel cuttings. Fluid loss will be controlled using biodegradable sealants, which create a thin, flexible filter cake on the borehole wall to prevent fluid migration into the aquifer. These products break down naturally, ensuring no permanent alteration to the hydraulic conductivity of the aquifer. These products break down naturally, ensuring no permanent alteration to the hydraulic conductivity of the aquifer or the delicate micro-habitats of QIs.
- Physical containment - Real-time annular pressure monitoring will be mandatory. By keeping pressures below the Delft Equation limits, operators can detect lost circulation before it becomes a surface fracture blow-out (frac-out release of drilling fluid through cracks/fissures/weaknesses in the substrate).

The following mitigation measures will also be implemented during HDD works:

- All HDD Work Areas associated with the River Barrow crossing will remain outside the River Barrow and River Nore SAC boundary, mapped flood extents and the river corridor itself.
- A minimum stand-off distance of 10 m will be maintained between HDD Work Areas and the SAC boundary and Flood Zone B/extreme flood extents.
- No direct in-stream works will be undertaken within the River Barrow, the other streams or associated drainage channels.
- HDD Work Areas will incorporate bunded storage and containment measures to prevent accidental discharge of contaminants to surrounding lands, drains or watercourses.
- Refuelling activities associated with HDD works will only occur in designated areas with appropriate spill containment measures.
- Spill kits and emergency response equipment will be available at all HDD Work Areas throughout the construction phase.
- Bentonite-based drilling fluids will be managed within a closed-loop containment system to prevent uncontrolled discharge to the environment.
- HDD drilling fluid storage tanks and associated infrastructure will be located within contained areas with secondary containment measures.
- Daily inspections of HDD Work Areas, drilling fluid systems and containment infrastructure will be undertaken during active drilling operations.
- Measures will be implemented to monitor and manage the risk of inadvertent drilling fluid return (“frac-out”).
- In the event of an accidental drilling fluid release, works will cease immediately and emergency containment and clean-up procedures will be implemented in accordance with the CEMP.
- Surface water runoff generated within HDD Work Areas will be managed through temporary drainage controls and sediment management measures.
- Excavated materials generated during HDD activities will be stored away from watercourses and protected from rainfall runoff generation.
- Reinstatement works will be undertaken following completion of HDD activities to restore disturbed areas.
- HDD works beneath waterbodies will be undertaken in accordance with relevant Inland Fisheries Ireland guidance documents and best practice measures for works adjacent to watercourses.

5.2.2 Groundwater

The design measures and construction phase methodology have been developed to avoid any potential for significant effects on land, soils and hydrogeology during the construction phase. Therefore, no mitigation measures are required.

5.3 Operational Phase

5.3.1 River Water

Routine inspection and maintenance of the stormwater lagoon will be undertaken throughout the operational life of the development. Sediment accumulated within the forebay and settlement zone will be removed periodically as required to maintain the design storage volume and treatment performance of the lagoon.

5.3.2 Groundwater

During the operational phase of the proposed development there is limited to no potential for any effect on the receiving hydrogeological environment due to avoidance by design and therefore there is no mitigation required in regard to the proposed development.

The procedures set out in the EMS under a condition of the IE licence will be strictly adhered to for the duration of the operational phase of the proposed development. The EMS will be a condition of the IE licence to operate.

Accident prevention and emergency response procedures developed in accordance with the conditions of the EMS, will be strictly implemented during the operational phase of the proposed development and spillage kits will be available on-site including in vehicles operating on-site. All staff will be familiar with emergency procedures for in the event of accidental fuel spillages.

During the operational phase there will be no discharges to groundwater at the proposed development. Stormwater runoff from the proposed development will be stored within the settlement lagoon and reused as process water. During a storm event, the water level the pond will be controlled by discharging to a permanent drainage connection into the Powerstown Stream to the north of the site in accordance with the IE licence. Therefore, potential effects to the hydrological flow regime will likely be ‘neutral’, ‘imperceptible’ and ‘permanent’. There will be no discharges of process water to ground or surface water.

5.4 Decommissioning Phase

5.4.1 River Water

In the event of decommissioning, mitigation measures will include:

- Preparation of a Decommissioning Environmental Management Plan, proportionate to the scale and nature of the works.
- Removal of fuels, chemicals, and wastes from the site prior to dismantling activities.
- Continued use of the drainage, lagoon, and treatment systems to manage runoff during decommissioning works.
- Controlled removal of structures to minimise soil disturbance and sediment mobilisation.
- Restoration of site surfaces to prevent long-term erosion or uncontrolled runoff.

5.4.2 Groundwater Mitigation

It is considered that the potential decommissioning impacts will be similar to those identified in the construction phase.

Any remaining risks during decommissioning relate primarily to:

- Localised disturbance of ground surfaces during removal of infrastructure.
- Potential mobilisation of residual contaminants from tanks, bunds, or drainage systems.
- Accidental spills during dismantling or cleaning of equipment.

These risks are short-term and can be effectively managed through standard decommissioning controls.

The decommissioning (if required) of the gas pipeline will be under the control of GNI.

6. WATER FRAMEWORK DIRECTIVE ASSESSMENT

6.1 Guidance used in this WFD Assessment

WFD Assessment guidance is not available for the Republic of Ireland, so this assessment has been based on the Environment Agency guidance for WFD Risk Assessments for England (Environment Agency, 2016), which provides guidance on the development of a WFD Assessment. The guidance identifies four stages:

3. Ensure that the existing risk assessment covers the receptors that are protected by WFD. These are set out in the section on environmental standards below.
4. Demonstrate that the proposed activity supports the objectives of the local River Basin Management Plan (RBMP). The wider environmental objectives of the RBMPs that are relevant to physical works are:
    - To prevent deterioration of the status or potential of surface waters and groundwater; and
    - To aim to achieve good status for all water bodies (or for heavily modified water bodies and artificial water bodies, good ecological potential) and good surface water chemical status.
5. Reach a high level of confidence that the proposed activity supports the objectives of the RBMP, if not, carry out more investigation into the risks on WFD receptors and possible ways of managing those risks.
6. If the conclusion is that the proposed activity does not support RBMP objectives, then demonstrate that it meets the sustainability criteria set out in Article 4(7) of the WFD.

6.2 Stage 1: Waterbodies for Assessment

This assessment includes four WFD waterbody, the River Barrow Barrow_180, Barrow_170, Rathornan_010, and Ballynaboley Stream_010, Athy-Bagenalstown Gravels (European Code: IE_SE_G_160) and Bagenalstown Lower (European Code: IE_SE_G_157) as the potential WFD waterbody receptors from the proposed development.

6.3 Stage 2(i): Assessment of Deterioration

The approach of this section is to assess potential impacts to identified water environment receptors through the WFD screening assessment, whether that be for aquatic ecology, water quality or hydromorphology.

As previously mentioned, the proposed development site lies lower than the surrounding lands. This depressed topography creates a naturally enclosed basin, providing natural mitigation against surface storm water runoff generated during excavation and earthworks by ensuring it will remain contained within the Site rather than flowing directly off Site directly into watercourses. Water has to be pumped up out of the proposed development site during the operational stage under specific circumstances as described in Section 5.1.2. As a result, the risk of uncontrolled surface water contamination entering external watercourses within the redline boundary of the Site is unlikely.

In relation to the potential for deterioration in WFD status, the following section scopes the construction, operational, and decommissioning phases of the proposed development.

Table 6-1: Scoping of Activities and Potential Risks of Deterioration of the WFD Classification Elements of Receiving Waterbodies

Activity/Source of Impact	WFD Classification Element									Is the activity within/close to the WFD Waterbody						
	Ecological				Chemical			Groundwater Status		WFD Waterbody						Comments
	Ecological Status / Potential	Physiochemical Quality Elements	Nutrients: Phosphorus/ Nitrogen	Hydro-morphological Supporting Elements	Specific Pollutants	Priority Substances	Other Pollutants/ Priority Substances	Quantitative	Chemical	Barrow_180	Barrow_170	Rathornan_010	Ballynaboley Stream_010	Athy-Bagnelstown Gravels	Bagenalstown Lower	
Construction Phase																
HDD crossing beneath the River Barrow (Crossing ID B2)	✓	✓	×	✓	✓	✓	×	×	×	Yes	No	No	No	No	No	Potential impacts include accidental drilling fluid release (“frac-out”), sediment runoff, hydrocarbon spillages and temporary localised disturbance
Construction of Structures	×	×	×	×	×	×	×	✓	×	No	No	No	No	Yes	No	Potential impacts include reduction in infiltration / groundwater recharge
Operational Phase																
N/A	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	N/A
Decommissioning Phase																
N/A	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	N/A

6.3.1 Construction Phase

The construction methodology is outlined in Section 3.5 of Chapter 3, Description of the Proposed Development, in Volume 2 of this EIAR.

The following potential construction phase activities have been scoped into the assessment:

- HDD crossing beneath the River Barrow (Crossing ID B2)
- Construction of Structures

The following sections describe the elements of the design that address any risk of deterioration from the above activities in terms of the WFD status classification elements for the operational phase of the affected waterbodies for each activity.

6.3.1.1 Ecological Status

For most receiving waterbodies, 'ecological status or potential' element is the only published classification element under the WFD as it is the core assessment required by the Water Framework Directive, and it is the element for which monitoring data are most consistently available across waterbodies. The construction phase activities listed in Section 6.3.1 have been scoped in for consideration in the assessment for their possible effects on Ecological Status or Potential of WFD Waterbodies Barrow_180, Barrow_170, Ballynaboley Stream_010, and Rathornan_010.

The proposed gas pipeline installation and development consent is the responsibility of Gas Networks Ireland (GNI), and the precise methodology will be confirmed by GNI. However, it is anticipated that this process will include trench excavation, pipe installation, pipe coverage, and reinstation of the surface finish. At location ID B2, ID B3, ID B4 and ID B7 (refer to Chapter 13, Surface Water and Hydrology in Volume 2 of this EIAR), Horizontal Directional Drilling (HDD) is the preferred gas pipeline installation method to avoid ecological impacts. It is likely that the construction of the gas pipeline across culverts and bridges increases the risk of negative ecological effects on the river Barrow. Similarly, any pumping and controlled discharge of stormwater has the potential to introduce sediment, nutrients, and chemical pollutants to the receiving waterbody. HDD may be used by GNI which has a lower impact potential. Details on the construction methodologies for each crossing are available in Chapter 13, Surface Water and Hydrology, in Volume 2 of this EIAR.

Where HDD is required for the crossings above, there is potential for impacts in the absence of mitigation during the construction phase:

- accidental release of bentonite-based drilling fluid (“frac-out”)
- hydrocarbon spillages
- sediment-laden runoff generation
- temporary localised soil disturbance
- accidental contamination of surface water receptors and aquifers

The most sensitive receptor associated with the proposed HDD crossings is the River Barrow and River Nore SAC due to the ecological sensitivity and hydrological connectivity of the receiving environment.

Without mitigation, accidental drilling fluid release or contamination events could result in temporary localised impacts on water quality and aquatic ecological receptors. However, the HDD methodology substantially reduces potential impacts compared to conventional open-cut crossing methods through:

- avoidance of direct in-stream works
- avoidance of channel excavation
- avoidance of riverbank disturbance
- minimisation of floodplain interaction

In the absence of mitigation, the earthworks involved in these processes have the potential to cause sediment impacts, hydromorphological impacts, reductions in dissolved oxygen, increase in nutrients, and impacts on aquatic ecology, decreasing overall ecological status or potential of the waterbody.

The potential spillage of oils and fuels from motorised vehicles used throughout the construction process increases the risk of introduction of priority substances such as anthracene, benzene, and naphthalene on-site, and the de-icing of roads may increase concentrations of salt (chloride). This would also negatively affect the ecological health of the receiving waterbody.

Hydrocarbons can reduce dissolved oxygen in watercourses, as micro-organisms break them down and consume oxygen in the process. This rapid depletion of dissolved oxygen can be toxic to aquatic organisms and affect mammals and birds that rely on the waterbody for drinking or feeding.

Mitigation

Refer to Section 5.2.1.

Conclusion

Taking these measures into account, the risk of status deterioration for the ecological status sub-element will be **low** for all construction phase activities occurring within the vicinity of each waterbody

6.3.1.2 Physio-chemical Quality Elements

In terms of the Physio-chemical quality elements, the following presents a summary of the relevant sub-elements, with a description of the activities that could cause deterioration and an assessment of the risk of deterioration.

6.3.1.2.1 Dissolved Oxygen, Turbidity, and Nutrients

Earthworks, soil movement and ground disturbance from vehicle movement, Gas Pipeline cover and resurfacing, and the loss of hydrocarbons from motorised vehicles, plant machinery and fuel storage/refuelling facilities all have the potential to result in the release of sediment from unmitigated runoff and the increase in nutrients (ammoniacal nitrogen and phosphate). This can reduce photosynthesis in aquatic plants and reduce dissolved oxygen concentrations. Contamination from vehicular leaks and spills can increase hydrocarbons concentrations, resulting in increased Biochemical Oxygen Demand (BOD) and reduced dissolved oxygen concentrations in receiving waters.

6.3.1.2.2 pH

pH of receiving waterbodies is considered unlikely to be affected by construction phase activities.

Conclusion

The potential for physio-chemical deterioration for WFD river waterbodies is considered unlikely.

6.3.1.3 Nutrients Phosphorus and Nitrogen

No construction phase activities are anticipated to likely affect nutrients phosphorus and nitrogen.

6.3.1.4 Hydromorphology

The hydromorphology element is scoped into the WFD Assessment.

If unmitigated, the potential for sediment loading to the WFD waterbodies is increased by HDD construction activities. Accidental release of bentonite-based drilling fluid typically causes temporary increases in suspended solids and turbidity. Earthworks involved in HDD drilling can also lead to increased sediment-laden runoff, if unmitigated.

Excess sediment may result in hydromorphological changes to waterbodies through its impacts on channel form, bed structure, and flow patterns. As a result, aquatic and riparian habitats may be degraded or lost, biodiversity can decline, and ecological processes such as fish spawning may be impaired, leading to a reduced ecological status or potential of the waterbody.

Mitigation

Refer to Section 5.2.1.

Conclusion

The risk of status deterioration for the Hydromorphology sub-element will be not significant for all construction phase activities occurring within the vicinity of WFD waterbodies.

6.3.1.5 Chemical Elements

The Chemical effects relevant to the proposed development are the potential loss of hydrocarbons.

Without mitigation, accidental drilling fluid release or contamination events could result in temporary localised impacts on WFD waterbodies. There is also a possibility for hydrocarbons transmission (including Polycyclic Aromatic Hydrocarbons (PAHs)) to surface water, if unmitigated. Leaks or spillages from vehicles can result in impacts related to Specific Pollutants and Priority Substances e.g. BTEX compounds as well as aliphatic hydrocarbons. Petroleum hydrocarbons would impede essential biological processes and impact aquatic ecology if unmitigated. Cementitious materials could physically damage fish.

Mitigation

Refer to Section 5.2.1.

Conclusion

Taking the measures into account, the risk of chemical deterioration of any WFD Waterbody will be **low** for all construction phase activities occurring within the vicinity of each waterbody.

6.3.1.6 Groundwater Status

Construction phase works associated with the increase in structures at the proposed development site have the potential to affect groundwater status of the Athy-Bagnelstown Gravels WFD groundwater body. The construction of the proposed development will result in the conversion of permeable surfaces to hardstanding surfaces at the site. This sealing of land has a long-term impact on the underlying soil, reducing the water infiltration. If infiltration decreases, groundwater levels may decline, flow regimes may be altered, and storage may be reduced. A decrease in groundwater recharge can lead to WFD non-compliance if it causes significant water level decline or damages dependent ecosystems. However, as outlined in Chapter 12, Soils, Geology, and Hydrogeology, in Volume 2 of this EIAR, the total area draining into the underlying groundwater body is considered very large. The size of the proposed development site is very small, relative to this groundwater body, and the site represents only a tiny proportion of the contributing area. As such, any changes to groundwater levels or discharge are expected to be negligible and unlikely to result in significant impacts on WFD status.

Mitigation

No mitigation is required as this is considered not significant.

Conclusion

Although groundwater discharge has the potential to affect WFD compliance, the scale of the proposed development relative to the large underlying groundwater body means any impacts are expected to be negligible. Therefore, significant effects on groundwater levels, dependent ecosystems, or overall WFD ecological status are not anticipated.

6.3.1.7 Construction Phase Summary

Construction works related to the HDD crossing of the River Barrow_180 have the potential to impact WFD Watercourses through the introduction of sediment, nutrients, and hydrocarbons to the receiving waterbodies.

Taking into account the mitigation measures proposed, the potential impacts from construction activities that could impact water quality and WFD status of the relevant waterbodies identified in Table 6-1 are considered temporary, localised, and not significant and will not result in WFD status deterioration in any waterbody within or near to the Site boundary or its associated activities.

6.3.2 Operational Phase

The operational Site drainage strategy is designed to segregate water streams based on their origin and potential contamination risk, ensuring that all water is either recovered for reuse within the process or segregated for appropriate treatment off Site. The proposed development manages five primary water types:

- storm water
- rainwater
- wash water
- foul water
- process water

As stated in Chapter 3, Description of the Proposed Development, in Volume 2 of this EIAR, the water consumption of the proposed development significantly exceeds the projected total volume of storm water and rainwater collected on-site. Therefore, there is no requirement to discharge water off-Site under normal operational conditions. However, during instances where there is an exceedance in the volume of rainfall of the designed return period (30 years), the additional water collected on-site will be pumped at greenfield rates out of the proposed development to an existing drainage system in the R448 which connects to the Powerstown Stream, which forms part of the WFD Waterbody Barrow_180.

In the unlikely event of contamination within the storm water lagoon, the contents will be contained, removed via tanker, and transported to an authorised wastewater treatment facility.

The proposed gas pipeline is expected not to have any potential effects on the WFD Waterbodies. Any potential effects would be exceptional rather than routine, such as from maintenance works, or bank erosion at crossings, and will be managed through monitoring and standard industry controls. Therefore, the proposed gas pipeline would not generate meaningful hydrological impacts during operation, as it is a sealed, static underground asset with no emissions, discharges or operational water requirements.

No operational phase activities have been scoped into the assessment.

6.3.3 Decommissioning Phase

The expected lifetime of the proposed development is 30 years. Upon cessation of anaerobic digestion activities at the proposed development, it will be decommissioned in accordance with a Closure Plan for the facility, which will be prepared as a condition of the IE licence for the proposed development.

Plant, equipment and tanks will be safely decontaminated/cleaned using standard procedures and competent contractors/staff e.g. desulphurisation plant, CO2 liquefaction plant, gas upgrade plant, flares, BNEF.

The proposed gas pipeline, buildings, concrete hardstanding, weighbridge, drainage systems, boundary treatment or landscaping and fencing may be left in-situ if value for sale or dismantled for recovery, recycling and reuse as appropriate.

In the event of decommissioning, the drainage system will be left in situ to manage stormwater during the decommissioning phase.

No decommissioning phase activities have been scoped into this assessment.

6.4 Stage 2(ii) Assessment of Hindrance Measures

As the second wider objective is to “aim to achieve good status for all water bodies” it is important that the proposed development actively supports this objective on a wider level by helping farms better manage nutrient load at source. It also does not hinder any existing Programmes of Measures, known as Areas for Action (AFA) in the RBMP for Ireland for 2022-2027 (Department of Housing, Local Government and Heritage, 2024). The Cycle 3 RBMP identified 507 Priority AFAs for 2022-2027.

One WFD Waterbody contained in this report has been assigned an AFA, the Ballynaboley Stream_010. This Waterbody has been assigned an Area for Restoration. Areas for Restoration are places where the focus for the current RBMP is on actions to restore water quality. Significant pressures and issues recognised for this stream are nutrients, agriculture, and 'unknown' pressures/issues. 'Unknown' pressures have been assigned to waterbodies requiring further monitoring, investigation and characterisation as the causes of impacts are still uncertain. The known significant pressure for this waterbody is agriculture. The known significant issue with this waterbody is nutrients. The potential for hindrance of the proposed development on existing Programmes of Measure for the Ballynaboley Streamm_010 are discussed in Sections 6.4.1.

6.4.1 Significant Pressures and Issues

The River Basin Management Plan 2022-2027 lists general actions to address significant pressures/issues for WFD waterbodies. Those main actions relating to agriculture and nutrients as a significant pressure and issue are:

- Implementation of the stronger and more targeted Nitrates Action Programme.
- To strengthen the inspection and enforcement relating to agricultural diffuse pollution.
- Implementation of Ireland's Common Agricultural Policy Strategic Plan with emphasis on achievement of a higher level of environmental ambition
- Eco-scheme measures will contribute to the protection of water quality. The Department of Agriculture Food and the Marine (DAFM) will promote and target the uptake of these measures in locations at farm level where they will maximise water protection.
- The Water European Innovation Partnership will focus on reducing losses of phosphorus, nitrogen, sediment and, pesticides to water from agricultural lands.

Additional measures to support the actions listed above include the provision of independent assessment and reviews of the Nitrates Action Programme, publication of an Agricultural Sectoral Action Work Plan, provision of advice to farmers and upskilling of farmers and advisors.

6.4.2 Construction Phase Assessment

The proposed Gas Pipeline will cross this WFD Watercourse (Ballynaboley Stream_010) at one location (Crossing ID B1).It was determined that the gas pipe can be routed across the existing culvert as there is sufficient head room above the existing culvert under the R448, meaning that instream works are not required. As the pipeline will be installed in the road, grass verge or surfaced road verge, is not anticipated that there is potential for significant nutrient loading to the stream as nutrients are largely agricultural in origin and not associated with the proposed works. The construction phase mitigation measures outlined in Section 5.1 will further minimise potential for sediment loading to the Ballynaboley Stream_010. During Gas Pipeline installation, all waterbodies will be protected. Sediment control measures, including silt fences, settlement areas, and temporary interceptor drains will be implemented to prevent loading of sediment and any potential nutrients to the stream.

Potential for hinderance to the programme of measures for the Ballynaboley Stream_010 AFA are considered unlikely.

6.4.3 Operational Phase Assessment

There is no potential for hinderance of measures for the restoration and protection of the Ballynaboley Stream_010 during the operation of the proposed development. As the proposed gas pipeline is a closed system, there is no pathway for the release of nutrients to the surrounding environment. Therefore, there is no mechanism by which the pipeline could interfere with the implementation or effectiveness of any Water Framework Directive restoration or protection measures for this waterbody.

6.4.4 Decommissioning Phase Assessment

No works carried out during the decommissioning phase are anticipated to have any interaction with the Ballynaboley Stream_010. As the proposed gas pipeline will remain in-situ, the potential for hindrance of the measures and objectives of this AFA are considered unlikely.

6.4.5 Summary Assessment of Hindrance Measures

Taking into account the mitigation measures outlined in Section 5, as well as the minimal interaction between the proposed development Gas Pipeline and the watercourse, it is anticipated that the construction, operation, and decommissioning phases of the proposed development will not hinder the Ballynaboley Stream_010 AFA. Watercourse crossings along the proposed gas pipeline route will be protected. Works undertaken at this existing crossing will be carried out in accordance with Inland Fisheries Ireland guidance.

The remaining WFD Waterbodies, the Barrow_180, Barrow_170, Rathornan_010, have not been assigned an AFA. As part of the WFD Compliance Assessment, any potential for hindrance of AFA improvement measures would be assessed. However, due to the River Barrow (Barrow_180 and Barrow_170) having no measures currently stated for improvement, the Hindrance of Measures assessment will not be undertaken as there are no measures for comparison.

6.5 Assessment Summary

This WFD Assessment consists of an assessment of deterioration and an assessment of hindrance measures for all WFD waterbodies relevant to the proposed scheme.

The current status of these watercourses ranges from Poor (Ballynaboley Stream_010) to good (Rathornan_010). The WFD River Waterbody Status for Ballynaboley Stream_010 for the monitoring period 2019-2024 is 'Poor'. The WFD River Waterbody Status for Barrow_170 for the monitoring period 2019-2024 is 'Moderate'. The WFD River Waterbody Status for Rathornan_010 for the monitoring period 2019-2024 is 'Good'. Considering the mitigation measures outlined for the proposed scheme's construction, operation, and decommissioning phases, it is not anticipated that the proposed scheme will have deleterious effects on the quality of the watercourses or provide a hinderance in their goals of achieving 'Good' status by 2027.

There is a low risk of deterioration of the WFD Watercourses during the construction, operation or decommissioning of the proposed development. A low risk of deterioration is stated as there would be sufficient mitigation measures in place to address all potential impacts from the construction, operational, and decommissioning phases of the proposed development, which principally relate to management, the proposed drainage system, SWMP, CEMP, adherence to best practice and established guidance on the use, storage and control of hazardous materials in the event of accidental releases.

7. CONCLUSION

The proposed development has been assessed in terms of the risk of WFD status deterioration of four waterbodies within the vicinity of the proposed development and proposed gas pipeline and any potential hindrance of the planning improvements in the Programme of Measures, known as Areas for Action, in the Ireland River Basin Management Plan 2022- 2027. The WFD Compliance Assessment indicates that the proposed development is unlikely to include any activities that are likely to cause deterioration in WFD status for the waterbodies within the proposed development site boundary or prevent the waterbodies from achieving their WFD objectives, provided that best practice and established guidance are adhered to. The assessment considered both the local scale in the vicinity of the proposed development and at the water body scale. At either scale, no effect has been identified that risks deterioration in WFD status.

8. REFERENCES

Carlow County Council. 2024. *Powerstown Landfill Industrial Emissions Licence W0025-04 Surface Water Monitoring Report 2024.* 2024.

Conservation Services on behalf of Carlow County Council. 2022. Powerstown Landfill, County Carlow, Biological Assessment of Surface Water Quality . [Online] 2022. https://leap.epa.ie/docs/adb3e629-f93b-4f64-9615-68b78de84494.pdf.

Department of Environment, Community and Local Government. 2014. European Union (Water Policy) Regulations 2014 (S.I. No. 350 of 2014). 2014.

Department of Environment, Heritage and Local Government. 2010. European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2010 (S.I. No. 610 of 2010). Amended in 2014 (S.I. 31/2014), 2017 (.S.I. No. 605/2017), 2020 (S.I. No. 40/2020), 2022 (S.I. No. 113 of 2022) . 2010.

—. 2009. European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009) Amended in 2012 (S.I. No. 327/2012) and 2015 (S.I. No. 386/2015), 2019 (S.I. No. 77/20). 2009.

—. 2003. S.I. No. 722/2003 - European Communities (Water Policy) Regulations 2003 and amended in 2005 (S.I. No 413/2005), 2008 (S.I. No. 219/2008) and 2010 (S.I. No. 93/2010). 2003.

Department of Housing, Local Government and Heritage. 2024. River Basin Management Plan 2022 – 2027. 2024.

—. 2024. River Basin Management Plan 2022-2027, Appendix 04 2024 03 11 National AFA with Catchment Projects identified. 2024.

—. 2024. Site Synopsis Site Name: River Barrow and River Nore SAC Site Code: 002162. 2024.

Environment Agency. 2016. *Water Framework Directive Risk Assessments: How to Assess the Risk of your Activity.* 2016.

Environmental Protection Agency. 2026. Catchments Data Waterbody: BARROW_170. [Online] 2026. https://www.catchments.ie/data/#/waterbody/IE_SE_14B012600?_k=tuvgat.

—. 2024. Cycle 3 HA 14 Barrow Catchment Report, May 2024. [Online] 2024. https://catchments.ie/wp-content/files/catchmentassessments/14%20Barrow%20Catchment%20Summary%20WFD%20Cycle%203.pdf.

—. 2026. EPA Catchments. [Online] 2026. https://www.catchments.ie/data/#/?_k=req2gv.

—. 2026. Leap Online. [Online] 2026. https://leap.epa.ie/confirm?returnUrl=https%3A%2F%2Fleap.epa.ie%2F.

—. 2019. WFD Cycle 2 Catchment Barrow Subcatchment Barrow_SC_100 Code 14_4. [Online] 2019. https://catchments.ie/wp-content/files/subcatchmentassessments/14_4%20Barrow_SC_100%20Subcatchment%20Assessment%20WFD%20Cycle%202.pdf.

European Union . 2000. Directive 2000/60/EC Of The European Parliament And Of The Council 23 October 2000 establishing a framework for Community action in the field of water policy. 2000.

European Union. 1992. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. 1992.

Government of Ireland. 2011. European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489/2011) . 2011.

—. 1959. Fisheries (Consolidation) Act 1959 (Act No. 14 of 1959). 1959.

—. 1997. Local Government (Water Pollution) Act 1977 (S.I. No. 1 of 1997) Revised Updated 2024. 1997.

Inland Fisheries Ireland. 2010. *Biosecurity Protocol for Field Survey Work.* 2010.

Limnos Consultancy on behalf of Carlow County Council. 2025. *POWERSTOWN LANDFILL, COUNTY CARLOW, BIOLOGICAL ASSESSMENT OF SURFACE WATER QUALITY.* 2025.

National Parks and Wildlife Service. 2025. Conservation Objective Series: River Barrow and River Nore SAC 002162. 2025.

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

www.fehilytimoney.ie

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

Appendix 13.3

Hydraulic Capacity Assessment

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

EIAR FOR POWERSTOWN BIOENERGY

Hydraulic Capacity Assessment of the Existing Drainage Network (R448)

Prepared for:

Greengate Biogas 001 Ltd.

Greengate Biogas

Date: June 2026

Document No:

P24188-FT-EN-ZZ-RP-EN-0036

Unit 6, Bagenalstown Industrial Park, Royal Oak Road,
Muine Bheag, Co. Carlow, R21 XW81, Ireland

T: +353 59 972 3800 | E: info@ftco.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Purpose of the Report

Greengate Biogas 001 Ltd. intends to apply for planning consent for a commercial anaerobic digestion (AD) facility at Powerstown, Milford, County Carlow (hereafter referred to as the "Proposed Development").

Fehily Timoney and Company (FT) has prepared this Hydraulic Capacity Assessment as part of the Environmental Impact Assessment Report (EIAR) for the Proposed Development. The purpose of this assessment is to determine whether the existing drainage network located adjacent to the R448 has sufficient hydraulic capacity to accommodate the proposed controlled discharge from the proposed storm water lagoon.

1.2 Description of the Project

A detailed description of the Proposed Development is provided in Chapter 3 of the EIAR. This appendix focuses on the proposed surface water drainage strategy and the interaction between the proposed stormwater lagoon surplus discharge and the existing drainage network of the road R448.

1.3 Scope of the Assessment

The assessment includes a review of the existing drainage network, available survey information, hydrological calculations and hydraulic assessment of the network to determine its capacity to accommodate the proposed discharge from the stormwater lagoon.

1.4 Limitations of the Study

The assessment has been undertaken using the information available at the time of preparation. Where data gaps existed, conservative engineering assumptions have been adopted to facilitate the hydraulic assessment. These assumptions are described in Section 3.4.

2. PROPOSED DEVELOPMENT

2.1 Description of the Proposed Development

Storm water runoff generated within the Proposed Development will be collected and directed to a proposed stormwater lagoon. The lagoon has been designed to provide attenuation storage for storm events up to 1-in-30-year rainfall event, including a 20% allowance for climate change and 300 mm of freeboard. Under normal conditions, all storm water generated at the proposed development will be used in the process. Only when all fire and process tanks are full, the lagoon is full coinciding with a 1 in 30 year storm event, and when water is clean will the system allow pumping to the discharge.

A controlled discharge is proposed from the lagoon to the existing drainage network adjacent to the R448 via an upstream manhole connection. In exceedance conditions, when water levels rise above the lagoon freeboard level, surplus water will be pumped to the same upstream manhole of the existing stormwater drainage network. The network ultimately discharges to the Powerstown Stream via an existing headwall.

2.2 Location

The Proposed Development is located at Powerstown, Milford, County Carlow. The existing drainage network assessed in this report is located northeast of the road R448 and discharges northwards to the Powerstown Stream. The site location and the existing stormwater drainage network are shown on Figure 2-1 where the light blue indicates the stream and dark blue indicates the drainage network in the R448. The proposed development boundary is shown in red. The Powerstown Stream flows into the River Barrow as shown.

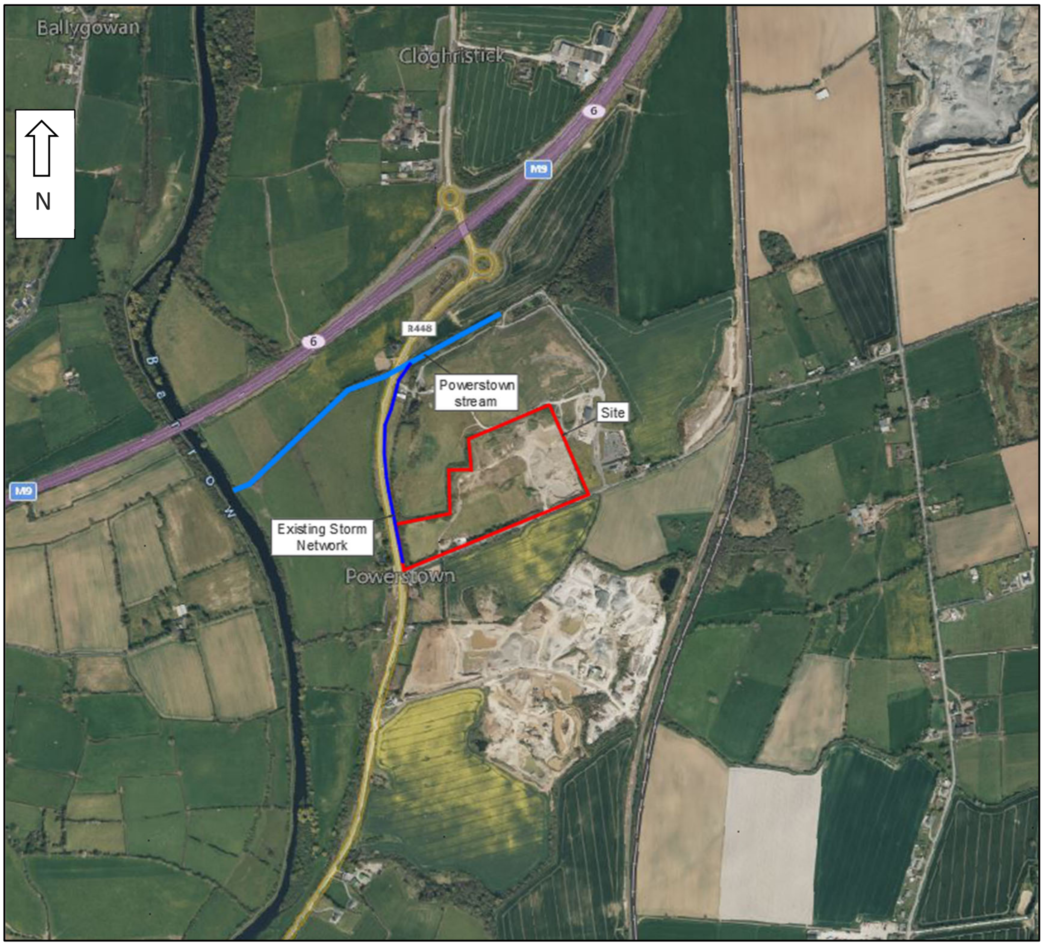


Figure 2-1: Site Location

3. BACKGROUND INFORMATION

3.1 Existing Drainage Network

An existing drainage network is located along the eastern boundary of the R448 and conveys surface water runoff northwards before discharging to the Powerstown Stream. The network starts at approximately Coordinate X: 670480.467, Y: 668443.288 and continues northwards to its outfall. The proposed discharge from the stormwater lagoon is proposed to connect to the upstream section of this network. The existing drainage network ultimately discharges to the Powerstown Stream, which forms the receiving watercourse for the proposed controlled discharge.

3.2 Available Data

The hydraulic assessment was based on available topographical survey information, including pipe diameters, pipe invert levels, manhole cover levels and manhole invert levels. The Survey was provided by Control Surveys Company. No CCTV survey information was available for the drainage network.

3.3 Site Characteristics

The Proposed Development is located at Powerstown, Milford, County Carlow and occupies approximately 9 ha. The site comprises a partially restored quarry and is lower than the surrounding lands. There is no existing storm water discharge from the site. Rain falling on site discharge to ground.

Existing surface water drainage from the R448 road network is conveyed via the existing drainage network adjacent to the R448.

3.4 Catchment Description

The site is located within the Powerstown Stream catchment. The existing drainage network assessed in this report discharges to the Powerstown Stream, which forms part of the wider River Barrow catchment. The contributing catchment area of the Powerstown Stream is approximately 15.8 km^2 and is predominantly agricultural in nature. The Standard Average Annual Rainfall (SAAR) for the catchment is approximately 840 mm.

3.5 Data Gaps and Assumptions

The manhole on the existing drainage network to which it is proposed to discharge, was not confirmed during the site survey due to overgrown vegetation. However, the closest manhole shows a pipe connection towards it. In addition, water level information for the Powerstown Stream was unavailable.

To facilitate the hydraulic assessment, the following assumptions were adopted:

1. An upstream manhole is located at the position indicated on Drawing No. P24188-FT-XX-XX-DR-CE-0500 (labelled on drawing as 5-MH-1-002) in Volume 4 of this EIAR.
2. A 225 mm and 300 mm diameter pipe are assumed to connect the surveyed manholes, based on the lowest recorded pipe connections within the manholes. Pipe invert levels correspond to the lowest surveyed pipe connections within adjoining manholes.

3. The downstream outfall to the Powerstown Stream is assumed to operate under free discharge conditions, based on the surveyed pipe invert level (41.49 m), which is lower than the receiving stream invert level (40.81 m), providing a positive level difference and indicating no restriction to discharge under normal flow conditions. The river water levels for different return periods are not available; however, there remains a potential for surcharge conditions under elevated fluvial levels. However, the pipe network has been assessed on the basis of free discharge conditions at the outfall for the purposes of this hydraulic analysis.
4. Where conflicting pipe diameter information was recorded, the larger diameter was adopted for the assessment.

These assumptions are considered conservative and provide a robust basis for assessing the hydraulic capacity of the existing stormwater drainage network.

4. HYDROLOGICAL ANALYSIS

4.1 Methodology

The hydrological assessment has been undertaken using a Greenfield and Brownfield runoff calculation based on the IH124 (HA 106) methodology. The Modified Rational Method was applied to estimate peak runoff rates for the contributing catchment draining to the existing drainage network.

The proposed development is predominantly permeable with no significant impermeable areas contributing to runoff. Hydrological inputs were derived from available site and drainage information.

Table 4-1: Hydrological Parameters for the Powerstown Development Catchment

Parameter	Value	Units
Catchment Area	0.055	km²
Impermeable Area	0.000	km²
Permeable Area	0.055	km²
SAAR	997	mm
Soil Index	0.100	-
Max Catchment Width	315	m
Average Height of Divide	9.25	m
Runoff Coefficient (Cv)	0.84	-
Climate Change Allowance	20	%

Table 4-2: Greenfield Runoff Rates for the Proposed Development Catchment

Return Period	Peak Flow	Units
1 in 30 year	9.22	l/s
1 in 50 year	9.95	l/s
1 in 75 year	10.57	l/s
1 in 100 year	11.02	l/s

The greenfield runoff rates presented in Table 4-2 has been adopted as the allowable discharge rate from the Proposed Development. This value is used in the hydraulic assessment of the existing drainage network.

5. HYDRAULIC ANALYSIS

5.1 Hydraulic Model Development

The hydraulic assessment was carried out using the available topographical survey information and the assumptions outlined in Section 3.5. A hydraulic model of the existing drainage network was developed using InfoDrainage to represent existing conditions.

The model was used to test how the drainage network performs under a range of storm events, including the 1-in-30-year, 1-in-50-year, 1-in-75-year and 1-in-100-year return periods.

Different storm durations were applied (15, 30, 60, 120, 180, 240 minutes and greater) in order to identify the critical storm duration and assess peak network response. The assessment also considered the drainage system recovery time, defined as the period required for flows to reduce and pipe water levels to drop below 20% of pipe capacity. This was also used to identify suitable conditions for introducing the proposed lagoon discharge into the network.

The performance of the network was assessed for surcharge and flooding under each scenario. It was found that for the majority of longer duration storms (generally greater than 360 minutes), no surcharge or flooding occurred within the network.

5.2 Existing scenario

The assessment found that the network generally recovers from peak flow conditions within 125 to 185 minutes, depending on the return period. At these recovery times, pipe water levels had reduced to below 20% of pipe capacity and more than 80% capacity was available within the network.

Some localised flooding and temporary surcharging were observed during shorter-duration storm events. However, these conditions were short-lived and reduced as flows passed through the Network. No flooding or Surcharge was observed at the recovery times presented in Table 5-1.

For clarity, Table 5-1 presents the storm duration associated with the longest network recovery time for each return period.

Table 5-1: Existing Stormwater Road Network Performance

Return Period	Storm Duration (min)	Hydraulic Simulation Duration (min)	Pipe Recovery Time to <20% Capacity (min)	Pipe Water Depth (m)	Flow in Pipe (l/s)	Available Pipe Capacity
1 in 30 year	120	240	125	0.043	4.2	81%
1 in 50 year	120	240	130	0.021	1.0	85%
1 in 75 year	180	360	185	0.041	3.8	82%
1 in 100 year	180	360	185	0.042	4.0	81%

Based on the assessment, a discharge time of 125 minutes following the rainfall event has been selected for the proposed scenario assessment and is applied across all return periods. This is discussed further in Section 5.3.

5.3 Proposed scenario

The assessment was undertaken using the same storm events and durations as the existing scenario analysis. For each return period, the proposed discharge was introduced into the model as a constant flow rate derived from the greenfield runoff analysis.

In the model, the proposed discharge was introduced 125 minutes after the start of the rainfall event, based on the recovery characteristics of the existing drainage network identified in the previous assessment.

The performance of the network was assessed under combined rainfall runoff and proposed discharge conditions, with consideration given to pipe water levels, flow conditions, surcharging and flooding.

The results indicate that the existing drainage network is capable of accommodating the additional inflow without surcharge or flooding under the assessed return periods when the discharge is introduced at 125 minutes after the start of rainfall. The results are summarised in Table 5-2.

Table 5-2: Proposed Stormwater Road Network Performance

Return Period	Duration (min)	Hydraulic Simulation Duration (min)	Pipe Recovery Time to <20% Capacity (min)	Pipe Water Depth (m)	Flow in Pipe (l/s)	Available Pipe Capacity
1 in 30 year	120	240	125	0.062	4.2	72%
1 in 50 year	120	240	130	0.064	0.064	72%
1 in 75 year	180	360	185	0.103	23.1	54%
1 in 100 year	180	360	185	0.107	24.3	52%

6. COMPARISON

A comparison of the existing and proposed scenarios was undertaken for the critical 225 mm diameter pipe, which was identified as the first pipe within the network to exhibit surcharge during the hydraulic assessment. The comparison was carried out to assess the impact of the proposed stormwater lagoon discharge on the performance of the existing stormwater drainage network.

The comparison considered changes in pipe water depth and available pipe capacity following the introduction of the proposed discharge 125 minutes after the start of the rainfall event. The results of the comparison are presented in Table 6-1 and Table 6-2.

Table 6-1: Comparison of pipe water depth - Existing Scenario VS Proposed Scenario

Return Period	Duration (min)	Hydraulic Simulation Duration (min)	Existing Scenario Pipe Water Depth (EPWD) (m)	Proposed Scenario Pipe Water Depth (PPWD) (m)	Difference (PPWD)-(EPWD)
1 in 30 year	120	240	0.043	0.062	+ 0.019
1 in 50 year	120	240	0.021	0.064	+ 0.043
1 in 75 year	180	360	0.041	0.103	+ 0.062
1 in 100 year	180	360	0.042	0.107	+ 0.065

Table 6-2: Comparison of Available pipe Capacity - Existing Scenario VS Proposed Scenario

Return Period	Duration (min)	Hydraulic Simulation Duration (min)	Existing Scenario Available Pipe Capacity (EAPC)	Proposed Scenario Available Pipe Capacity (PAPC)	Difference (PAPC)-(EAPC)
1 in 30 year	120	240	81%	72%	- 9%
1 in 50 year	120	240	85%	72%	- 13%
1 in 75 year	180	360	82%	54%	- 28%
1 in 100 year	180	360	81%	52%	- 29%

The results show that the proposed discharge increases pipe water depth and reduces the available pipe capacity across all assessed return periods. The greatest change occurs during the 1-in-100-year event, where the pipe water depth increases by 0.065 m and the available capacity reduces by 29%.

Despite these increases in pipe utilisation, the hydraulic modelling indicates that the network continues to operate without surcharge or flooding under the assessed conditions and retains sufficient hydraulic capacity.

Table 6-3: Network Outfall Velocity Comparison - Existing Scenario VS Proposed Scenario

Return Period	Duration (min)	Hydraulic Simulation Duration (min)	Existing Scenario Outfall Velocity (ESOV) (m/s)	Proposed Scenario Outfall Velocity (PSOV) (m/s)	Difference (PSOV)-(ESOV)
1 in 30 year	120	240	2.1	2.1	0
1 in 50 year	120	240	2.1	2.1	0
1 in 75 year	180	360	2.1	2.1	0
1 in 100 year	180	360	2.1	2.1	0

A comparison of flow velocities was undertaken for the existing network outfall to the Powerstown Stream under both the existing and proposed scenarios across the assessed rainfall events. The results indicate that flow velocities are broadly similar, with values converging at approximately 2.1 m/s under higher return periods. This shows that the proposed discharge does not materially alter flow conditions in the outfall pipe.

The results indicate that the proposed discharge from the stormwater lagoon is not expected to cause scour at the network outfall.

7. CONCLUSION

A hydraulic assessment of the existing stormwater drainage network was undertaken to determine whether it has sufficient capacity to accommodate the proposed discharge from the proposed stormwater lagoon during 1 in 30 year storm event and only when there is no capacity in the fire and process water tanks and in the stormwater lagoon and the water is confirmed as clean by the continuous monitoring emissions sensors.

The assessment demonstrated that, following the passage of peak flows, the existing network retains sufficient available capacity to receive the proposed discharge. Based on the network response, a discharge time of 125 minutes after the start of the rainfall event was adopted for the proposed scenario assessment.

The proposed scenario results show an increase in pipe water depth and a reduction in available pipe capacity compared to the existing condition. The greatest increase in pipe water depth was 0.065 m, and the greatest reduction in available capacity was 29%, resulting in an available pipe capacity of 52%, both recorded during the 1-in-100-year event.

Despite these changes, no surcharge or flooding was identified within the network under the assessed conditions.

It is therefore concluded that the existing stormwater drainage network has sufficient hydraulic capacity to accommodate the proposed discharge from the lagoon, without adversely affecting network performance, increasing flood risk, or causing scour at the network outfall, provided that the discharge is introduced 125 minutes after the onset of the rainfall event.

It is recommended that a pumped discharge system is provided to ensure the controlled release of water in accordance with this timing.

Therefore, a timer mechanism will delay pumping from the stormwater lagoon for 125 minutes after the onset of the storm

FEHILY
TIMONEY

**DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE**

www.fehilytimoney.ie