APPENDIX 5

CHAPTER 8: HYDROLOGY AND HYDROGEOLOGY, rEIAR

8. HYDROLOGY AND HYDROGEOLOGY

8.1 Introduction

8.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to provide a description and assessment of the residual direct and indirect effects of the peat extraction and ancillary activities at Ballydermot within the Allen Bog Group (at Ticknevin, Glashabaun North, Glashabaun South, Codd 1, Codd 2, Ballydermot North, Ballydermot South, Blackriver, Lullymore, Lullybeg, Barnaran, Killina, Derrybrennan and Lodge Bogs), located in Counties Kildare and Offaly (the 'Application Site') on the water aspects (hydrology and hydrogeology) of the receiving environment, from July 1988 to the present day. This chapter will also assess the potential effects of the proposed rehabilitation plans for the Application Site following the cessation of peat extraction in June 2020.

As stated in Chapter 4: Project Description of the rEIAR, July 1988 is the baseline environment as this is the year in which the EIA (Directive 85/337/EEC) Directive was required to be transposed into Irish Law. There is no legal requirement to complete a remedial Environment Impact Assessment (rEIAR) on any of the activities occurring at the Application Site prior to the required transposition of this Directive. Nevertheless, for completeness, we provide a brief overview of the activities occurring at the Application Site from 1935 and the onset of site preparation works up to July 1988. The baseline hydrological and hydrogeological (water) environment in July 1988 is then described in detail along with a description of the activities from July 1988 to the cessation of peat extraction in June 2020, the management of the Application Site since June 2020 and the activities intended to be carried out at the Application Site into the future.

This chapter presents:

- An assessment of effects of the peat extraction and all ancillary activities on the hydrological and hydrogeological environment (water environment);
- The baseline sensitivity of the receiving hydrological and hydrogeological environment has been assessed based on the baseline site conditions present in July 1988;
- The effects of the receiving hydrological and hydrogeological environment have been assessed over 3 no. phases of the life cycle of the Project. These phases include the Peat Extraction Phase (July 1988 – June 2020), the Current Phase (June 2020 – present day) and the Remedial Phase as described in Chapter 4;
- The monitoring and control measures that were implemented during the Peat Extraction Phase from July 1988 to June 2020;
- The monitoring and control measures during the Current Phase (June 2020 to the present day);
- The proposed mitigation measures associated with the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plans (Appendix 4-3) (Remedial Phase); and,
- The residual effects along with the cumulative effects from the proposed Ballydermot Wind Farm development and other relevant projects in the vicinity of the Application Site.

8.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience includes soils, subsoils and geology. We routinely complete impact assessments for land, soils and geology, hydrology and hydrogeology for a large variety of project types including wind farms and renewable energy projects on peatlands.

This chapter of the rEIAR was prepared by Nitesh Dalal, Conor McGettigan, Adam Keegan and Michael Gill.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India ad over 1 year environmental consultancy experience in Ireland. Nitesh holds a M.Sc. in Environmental Science from University College Dublin (2024), a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 5 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares the land, soils and geology chapters of environmental impact assessment reports for developments on peatlands. Conor prepared the land, soils and geology chapter of the rEIAR completed for the substitute consent applications for the peat extraction activities at the Ballivor Bog Group, Lemanaghan Bog and Littleton Bog.

Adam Keegan PGeo (B.Sc., M.Sc.) is a hydrogeologist with 7 years environmental consultancy experience in Ireland. Adam has been involved in Environmental Impact Assessment Reports (EIARs) for numerous projects including wind farms, grid connections, quarries and small housing developments. Adam holds an MSc in Hydrogeology and Water Resource Management. Adam has worked on several wind farm EIAR projects, including Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Fossy WF.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. For example, Michael has worked on the EIARs for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 120 other wind farm related projects across the country. Michael has also worked on rEIARs for Cleanrath WF, 41 no. BnMbogs, the Ballivor Bog Group, and also for a number of quarry sites.

8.1.3 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Section 2.5 of Chapter 2: Background of the rEIAR. Details of these scoping responses pertaining to hydrology and hydrogeology are listed below and outlined in Chapter 2 of this rEIAR.

Inland Fisheries Ireland

A scoping request was issued to Inland Fisheries Ireland (IFI) on the 21st February 2022. A response was received on the 16th March 2022. A summary of the response is provided in Chapter 2 Section 2.5.2 of this rEIAR, and a copy of the response is provided in Appendix 2-1. At a high level, the IFI's 2022 submission requests that the application must fully assess historic and ongoing impacts of peat extraction and associated activities on fisheries, water quality, river morphology, and protected habitats/species, and include clear restoration and mitigation measures. IFI's key message is that the EIAR must move beyond the peatland footprint itself and fully assess the downstream and historic impacts on river systems, fisheries, protected species, and habitat restoration needs.

Owing to the passage of time between the initial scoping request in February 2022 and the preparation of this rEIAR, a subsequent scoping request was issued to IFI on the 15th January 2026. A submission by IFI was received on the 11th February 2026, however the IFI were consulted regarding the *'the proposed development of a large windfarm on the same BnM lands recently and rather than redo another submission [they] have attached the IFI response to that, as [they] would be stressing the same points.'*

IFI's main concerns within the 2026 submission for the proposed wind farm relate to:

1. Protection of existing salmonid spawning and nursery habitats within the Cushaling, Figile, Crabapple, Lugherra and associated tributaries;
2. Avoiding further hydro-morphological damage in a catchment already severely degraded;
3. Preventing sediment mobilisation from peat soils and legacy silt traps;
4. Avoiding additional culverting or channel modification;
5. Restoring degraded watercourses as part of the project; and
6. Ensuring the EIAR fully assesses all fisheries-related impacts and integrates restoration into the design.

IFI want the EIAR to fully address hydrology and hydro-morphology, sediment transport and peat mobilisation, water quality impacts both within the site and beyond, construction-phase risks (specifically relating to the proposed wind farm roads, turbine bases, cabling), cumulative impacts with legacy peat extraction, and long-term ecological recovery potential.

Geological Survey of Ireland

A scoping request was issued to Geological Survey Ireland (GSI) on the 21st February 2022. A response was received on the 22nd February 2022. The response detailed what datasets should be used for the assessment and provided links to datasets for same. A summary of the response is provided in Chapter 2 Section 2.5.2 of this rEIAR, and a copy of the response is provided in Appendix 2-1.

Owing to the passage of time between the initial scoping request in February 2022 and the preparation of this rEIAR, a subsequent scoping request was issued to the GSI on the 15th January 2026. A submission by DCEE on behalf of the GSI was received on the 26th January 2026 recommending the use of their various publicly available datasets when conducting the EIAR, SEA, planning and scoping processes for developments, plans and policies. The response states; *'the publicly available data referenced/presented here, should in no way be construed as Geological Survey Ireland support for or objection to the proposed development or plan'.* No detailed information in relation to hydrology and hydrogeology was provided within the received response.

Environmental Protection Agency

A scoping request was issued to the Environmental Protection Agency (EPA) on the 21st February 2022. A response was received on the 16th March 2022. The EPA response (EPA Ref: 2509) contained copies of the scoping responses provided by Kildare County Council, IFI and GSI. Please note, these bodies were scoped with individually, as part of the scoping exercise in February 2022. IFI and GSI both responded directly to MKOs scoping request, therefore the responses provided by the EPA are the same as those received directly from those bodies. Kildare County Council (KCC) did not respond directly to MKO in 2022, but the response from the EPA included a response from KCC (addressed below).

The EPA response stated; *'having regard to the specific characteristics of the project and likely impact on the environment, the Agency is of the opinion that the scope and level of detail to be included in the remedial environmental impact assessment report should as a minimum:*

(i) address the matters raised in the responses received from the bodies detailed above;

(ii) have regard to the rehabilitation plan(s) required under Condition 10 of Licence Reg No. P0503 for any relevant bog areas;

(iii) consideration should be given to inclusion of any relevant bog areas in an enhanced rehabilitation scheme, e.g., under the Peatlands Climate Action Scheme (PCAS).

(iv) have regard to relevant water quality monitoring data. Any gaps in water quality data for receiving waters should be filled by a sampling programme over an appropriately representative period of time.'

A summary of the responses is provided in Chapter 2 Section 2.5.2 of this rEIAR, and a copy of the response is provided in Appendix 2-1.

Owing to the passage of time between the initial scoping request in February 2022 and the preparation of this rEIAR, a subsequent scoping request was issued to the EPA on 15th January 2026. A response was received on 11th of March 2026 which referred back to the response issued on 16th March 2022 (EPA Ref: 2509), stating that *'the Agency has no further observations'*.

Kildare County Council

A scoping request was sent to Kildare County Council (KCC) on the 21st February 2022. No direct response was received from KCC, however a response from KCC was included within the aforementioned EPA scoping response. The KCC response included the following points relating to the scope of the EIAR;

1. *The Plan needs to take into account the Water Framework Directive, and in particular the 3rd Cycle River Basin Management Plan 2022-2027 and how major infrastructure such as this will not impact on Water Bodies in the area. These very important documents do not seem to have been referenced at all.*
2. *The proposed Facility and associated infrastructure are located within the Figile_010 and*
   Abbeylough__010 waterbodies/sub-basins (Barrow catchment). These are upstream waterbodies/sub-basins of the Figile_020 waterbody/sub-basin. The status of these waterbodies is currently less than "Good" status with EPA biological assessments reporting Q3 and Q3-4 ratings at monitoring stations RS14F010050 (Br. S of Ticknevin) and RS14F010100 (Cushaling Br.) in 2020 respectively. It is necessary to assess the potential for further impact on these waterbodies and in particular any potential for siltation and/or enrichment of receiving waters during the construction phase and any future operational phase. All surface water features within the area of the site shall be properly surveyed and mapped showing any connectivity with the Figile and Abbeylough waterbodies. The location and details of any proposed mitigation/controls for the purpose of minimising impact on surface water/groundwater shall be provided. A developer shall not, in the performance of its functions, undertake those functions in a manner that knowingly causes or allows deterioration in the chemical status or ecological status of a body of surface water.

3. *While it is noted that Section 4 advises that the EIAR will include for a review of the "Waste Action Plan for a Circular Economy", it is more important that the proposed development actually takes into account the main principles of the new NWMP in terms of the need to reduce the volume of waste being produced, rather than merely planning around the landfilling of current waste levels.*
4. *Section 8.0 should also look at the potential increase in ammonia discharging to the surface waters as a result of peatlands, and*
5. *Section 9.0 should also include odour and dust assessment reporting with recommendations.*

Owing to the passage of time between the initial scoping request in February 2022 and the preparation of this rEIAR, a subsequent scoping request was issued to several divisions of KCC on 15th January 2026. A response was received from the Environment Department on the 21st January 2026.

The KCC response highlighted that the big impacts on surface waters associated with peat extraction is the release of sediment, ammonia and the lowering of pH levels. Furthermore, the response states that rewetting and blocking drainage channels to prevent discharges and sediment release will help to reduce these effects. Reference is made to the water quality monitoring being completed as part of the IPC licence conditions and this data is presented in Section 8.4.6 of the rEIAR. In addition, all historic Q-values, and trends in downstream watercourses have been used to inform the remedial impact assessment. The assessment presented in this chapter also, as requested by KCC, addressed the potential effects associated with activities which will be completed in the future at the Application Site i.e. the Remedial Phase.

A summary of the responses is provided in Chapter 2 Section 2.5.2 of this rEIAR, and a copy of the response is provided in Appendix 2-1

Offaly County Council

A scoping request was sent to Offaly County Council (OCC) on the 21st February 2022. No response was received.

Owing to the passage of time between the initial scoping request in February 2022 and the preparation of this rEIAR, a subsequent scoping request was issued to several divisions of OCC on 15th January 2026. No response was received, therefore a follow-up request was issued on the 10th February 2026. A response recognising receipt of the request was received from the OCC Heritage Department only. No further/follow-on response was received from the OCC Heritage Department. No response has been received from any other department in OCC with regards to the Ballydermot Substitute Consent Application to date.

Butterfly Conservation Ireland

A scoping request was sent to Butterfly Conservation Ireland (BCI) on 15th January 2026. A response was received on the 28th January 2026, which briefly mentions hydrology as it relates to habitats and water quality. The response states; *"rehabilitating of former industrial peat production bog will also in the longer-term support other ecosystem services such as such the development of new habitat to support biodiversity and attenuation of water flows from the bog, improving water quality."*

Please see Appendix 2-1 for scoping correspondences with consultees in relation to this rEIAR.

Health Service Executive

A scoping request was sent to the HSE on the 21st February 2022, however no response was received.

Owing to the passage of time between the initial scoping request in February 2022 and the preparation of this rEIAR, a subsequent scoping request was issued to the HSE on 15th January 2026. At the time of writing this rEIAR in April 2026, no response had been received.

Uisce Éireann

A scoping request was issued to Uisce Éireann (formerly known as Irish Water) on the 21st February 2022, however no response was received from Uisce Éireann.

Another scoping request was issued to Uisce Éireann on the 15th January 2026. A response was received on the 10th February 2026 under the reference PN26000036142.

The response notes the presence of the Figile River Well abstraction point near the village of Clonbulloge, Kildare approximately 2 kilometres from the Application Site, and outlined the zone of contribution for this asset is more proximate, extending to a point approximately 500 meters from the development's westernmost boundary. As such Uisce Eireann requested that any future EIAR consider the potential for impact on this asset or any other surface water or groundwater abstraction points where a potential hydrological and hydrogeological pathway exists should also be considered.

The response also goes on to list several aspects of water & wastewater services that should be addressed in the scope of an EIAR and planning proposals ahead of submission of a planning application. Please see Appendix 2-1 for scoping correspondences with consultees in relation to this rEIAR.

Waterways Ireland

A scoping request was sent to Waterways Ireland on the 21st February 2022. No response was received.

Another scoping request was sent to Waterways Ireland on the 15th January 2026. No response was received, therefore a follow-up request was issued on the 10th February 2026. No response has been received from Waterways Ireland with regards to the Ballydermot Substitute Consent Application to date.

National Parks and Wildlife Service (NPWS)

A scoping request was sent to the Development Application Unit (DAU) of the NPWS, a section of theDepartment of Housing, Local Government and Heritage on the 21st of February 2022. A response was received on 25th of February 2022 acknowledging receipt of scoping request, and stating that *'in the event of observations, you will receive a co-ordinated heritage-related response by email from Development Applications Unit (DAU)'.* No further response was received.

Owing to the passage of time between the initial scoping request in February 2022 and the preparation of this rEIAR, a subsequent scoping request was issued to NPWS on the 15th January 2026. No response was received, therefore a follow-up request was issued on the 10th February 2026. The following response was received on the 11th of February 2026;

> *"The Department is not in a position to make specific comment on this particular referral at this time. No inference should be drawn from this that the Department is satisfied or otherwise with the proposed activity.*
>
> *The Department may submit observations/recommendations at a later stage in the process."*

8.1.4 Relevant Legislation

The rEIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

The requirements of the following legislation are also complied with:

- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- S.I. No. 477/2011: European Communities (Birds and Natural Habitats) Regulations, implementing EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Directive 2009/147/EC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293/1988: Quality of Salmon Water Regulations;
- Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission Directive 2014/101/EU ("WFD").
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for the implementation of 'daughter' Groundwater Directive (2006/118/EC);
- S.I. No. 122/2014: European Union (Drinking Water) Regulations, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations;
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended;
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended; and,
- S.I. No. 99/2023: European Union (Drinking Water) Regulations.

8.1.5 Relevant Guidance

The Hydrology and Hydrogeology chapter of the rEIAR is carried out in accordance with the guidance contained in the following:

- Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- European Commission (2017): Environmental impact assessment of projects – Guidance on the preparation of the environmental impact assessment report (Directive 2011/90/EU as amended by 2014/52/EU);
- Environmental Protection Agency (2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (2006): Environmental Management in the Extractive Industry;
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;

- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001;
- OPW (2009): The Planning System and Flood Risk Management;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018);
- Offaly County Council (2021): Offaly County Development Plan (2021-2027); and,
- Kildare County Council (2021): Kildare County Development Plan (2023-2029).
- An Coimisiún Pleanála (2025), Guidance for Substitute Consent and Section 37L Applications (ACP 2025)

8.2 Methodology

8.2.1 Desk Study

A desk study of the Application Site and the surrounding area was completed in early 2021 to collect all relevant hydrological and hydrogeological data. The initial desk study was completed in advance of site walkover surveys and site investigations. The desk study was checked and updated, where necessary, March and April 2026. The desk study included consultation with the following data sources:

- Integrated Pollution Control Licence (IPC) Allen Bog Group (Ref: P0503-01) Environmental Protection Agency, Appendix 4-1;
- Annual Environmental Reports 2000-2025 (Appendix 4-3);
- IPC Licence P0503-01 Application (Available at EPA Headquarters on request);
- Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plans (2026), Appendix 4-2;
    - Ballydermot Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Barnaran Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Blackriver Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Codd Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Derrybrennan Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Glashabaun Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Killinagh Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Lullybeg Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Lullymore Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026);
    - Ticknevin Bog Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2026); and,
    - Lodge Bog Cutaway Bog Decommissioning and Rehabilitation Plan (2022).

- Inspection of production records at Ballydermot Works;
- BnM Reports (1946 to 2025) which contain information relevant to the Application Site such as peat depth databases and drainage;
- BnM Lidar data;
- Aerial Maps from 1973, 1988, 1995, 2004 and to 2020, Appendix 4-4;
- Environmental Protection Agency databases (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks and Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive "catchments.ie" Map Viewer (www.catchments.ie), including all relevant River Basin Management Plans (RBMPs);
- Bedrock Geology 1:100,000 Scale Map Series, Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- OPW Flood Mapping Databases (www.floodinfo.ie);
- Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie);
- Aerial Photography, 1:5,000 and 1:10,560 (6") base mapping; and,
- Myplan.ie: National Planning Applications Map Viewer (https://myplan.ie/national-planning-application-map-viewer).

8.2.2 Monitoring and Site Investigation Data

HES completed site inspections, walkover surveys, drainage mapping, and baseline monitoring/sampling at the Application Site as part of this rEIAR and to inform the proposed Ballydermot Wind Farm planning application. These site investigations comprised of peat probing, geological mapping and drainage mapping completed by HES on 6th, 15th and 22nd October 2020, 5th, 10th, 12th and 18th November 2020, 1st April 2021, 11th December 2025 and 15th May 2026. 3 no. rounds of surface water sampling, field hydrochemistry and flow monitoring was completed on 1st April 2021, 11th December 2025 and 15th May 2026 in the watercourses draining the Application Site.

In addition to the site investigations completed by HES, several additional site investigations have been completed at the Application Site to further inform this rEIAR and the proposed Ballydermot Wind Farm application. These site investigations included peat probing completed by MKO and Fehily Timoney and Company (FTC), trial pit excavations by FTC, trial pit excavations and borehole drilling by Irish Drilling Limited (IDL). The logs associated with these site investigations are attached to the Geotechnical and Peat Stability Assessment Report prepared for Ballydermot Wind Farm (FTC, 2026). This report will be appended to the Land, Soils and Geology chapter of the EIAR prepared for the Ballydermot Wind Farm application. The site investigation data refenced and described in that report has been used, where relevant, to inform this rEIAR chapter.

In summary, site investigations completed to address the hydrology and hydrogeology chapter of this rEIAR included the following:

- Detailed walkover surveys and hydrological mapping of the Application Site and the surrounding area were undertaken whereby water flow directions and drainage patterns were recorded;
- A total of 974 no. peat probes have been completed at the Application Site by HES, MKO and FTC;
- The excavation of 9 no. trial pits by FTC in May 2021, and laboratory analysis of recovered subsoil samples;
- The excavation of 53 no. trial pits by IDL in November 2021 (46 no. within the Application Site and 7 no. in agricultural lands adjacent to the bogs), and laboratory analysis of recovered subsoil samples;

- The drilling of 3 no. boreholes in agricultural lands adjacent to the Application Site by IDL in June 2021 and July 2022;
- Field hydrochemistry measurements (electrical conductivity, pH, dissolved oxygen and temperature) and surface water flow measurements were taken to determine the origin and nature of surface water flows surrounding the Application Site during 3 no. monitoring rounds (1st April 2021, 11th December 2025 and 15th May 2026); and,
- A total of 45 no. surface water grab samples were taken to determine the baseline water quality of the primary surface waters originating from the Application Site during the 3 no. monitoring rounds.

Site-specific data obtained by HES was supplemented with recent and historic site-specific data supplied by the Applicant (i.e. Bord na Móna Biomass Ltd). These included Lidar data of the Application Site and water quality monitoring from 2000 to 2025 in compliance with the IPC Licence requirements. Site-specific additional information relating to drainage was also provided in the rehabilitation plans.

8.2.3 Impact Assessment Methodology

The guideline criteria (EPA, 2022) for the assessment of likely significant effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable). The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Chapter 1: Introduction of this rEIAR.

In addition to the above methodology, the importance of the water environment receptors was assessed on completion of the desk study and site investigations. Levels of importance which are defined in Table 8-1 and Table 8-2 for the hydrological and hydrogeological environments are used to assess the effects that peat extraction may have had on them.

Table 8-1: Estimation of Importance of Hydrology Criteria (NRA, 2008)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation, e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5). Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for a wide range of leisure activities.
High	Attribute has a high quality or value on a local scale	Salmon fishery locally important potable water source supplying >1000 homes. Quality Class B (Biotic Index Q3-4). Flood plain protecting between 5 and 50 residential or commercial properties from flooding.

Importance	Criteria	Typical Example
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery. Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3). Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities. Local potable water source supplying <50 homes. Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 8-2: Estimation of Importance of Hydrogeology Criteria (NRA, 2008)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation, e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - NHA status. Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides a large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer. Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes.

8.2.4 Overview of Impact Assessment Process

The conventional source-pathway-target model (see Figure 8-1) was applied to assess the potential effects on downstream environmental receptors (see Figure 8-1) as a result of peat extraction and ancillary activities.

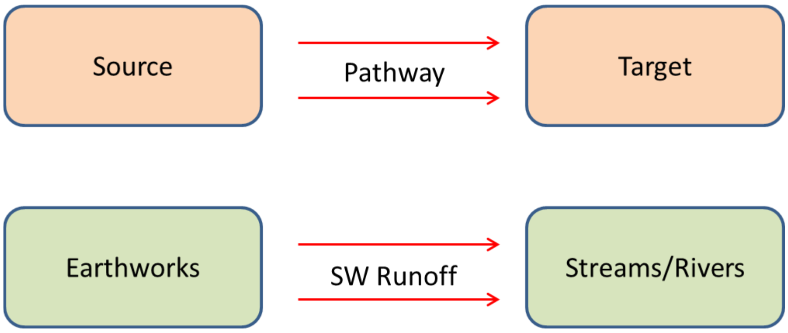

Figure 8-1: Conventional Source-Pathway-Target Model

The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Table 1-2 of Chapter 1 of this rEIAR. The description process clearly and consistently identifies the key aspects of any remedial impact source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

8.2.5 Study Area

The study area for the hydrological environment (surface water) is delineated by the surface water catchments within which the Application Site is located. The regional surface water catchments and sub-catchments within which the Application Site is located are detailed in Section 8.4.2.

The study area for the hydrogeological environment (groundwater) is delineated by the bedrock aquifers and groundwater bodies which are mapped beneath the Application Site. These bedrock aquifers and groundwater bodies are detailed in Section 8.4.7.

8.2.6 Limitations and Difficulties Encountered

Drainage works for peat extraction commenced at its earliest at the Application Site in 1935. The retrospective impact assessment has been carried out based on the reasonable availability of information relating to the peat extraction and ancillary activities. The retrospective assessment has been limited by the availability, completeness, accuracy and accessibility of historical baseline environmental data.

8.3 Site Land Use History Summary

8.3.1 Site Location

The Application Site is located 2.2km southeast of Edenderry, 3.3km west of Allenwood, 2.4km north of Rathangan and 1.7km east of Clonbullogue Village. The Application Site comprises 14. no. bogs located on the Offaly-Kildare County border. The bogs include: Ticknevin, Glashabaun North, Glashabaun South, Codd 1, Codd 2, Ballydermot North, Ballydermot South, Blackriver, Lullymore, Lullybeg, Barnaran, Killina, Derrybrennan and Lodge.

The Application Site has a total area of 5,448 hectares (ha) measuring approximately 10km in length from north to south, and approximately 10.7km from east to west, at its widest point. The Grid Reference co-ordinates for the approximate centre of the Application Site are E 266159, N 225145. The boundaries of the individual bogs are mainly defined by hedgerows, watercourses and laneways.

The Application Site is generally accessible via the local road network branching from the R402 to the north, R403 to the east, the R401 to the west and the R414 to the south, with the latter cutting through the southeast of the site.

Further details regarding the location of each individual bog comprising the Application Site are presented in Chapter 4 and Chapter 7: Land, Soils and Geology, Section 7.3.1, of this rEIAR.

8.3.2 Site Topography

The Application Site is located in a low-lying landscape rural in character. The topography of the Application Site has changed through time due to the historic peat extraction. As discussed in Chapter 7 the topography of the Application Site was estimated to range between 75 and 88mOD prior to the onset of any peat extraction or associated site preparation works (i.e. drainage and acrotelm removal). The topography has subsequently been lowered due to drainage related subsidence and in the historic peat extraction areas due to the removal of peat. The topography today ranges between 84 m above ordnance datum (AOD) at its highest point to approximately 68 m AOD at its lowest point. Full details on the topographic changes through time are presented in Section 7.3.2 of this rEIAR.

8.3.3 Historic Land Use Changes

The primary land-use change associated with peat extraction activities and all ancillary activities occurs during the initial drainage of the bog and the removal of vegetation in advance of peat extraction. Drainage ditches were constructed in the surface of the bog and drained the upper surface of the bog by lowering the local peat water table (full details on the drainage implemented at the Application Site are provided in Chapter 4). After the Application Site was drained, vegetation was removed from the bog surface, leaving only bare peat fields between the drains. Around this time and in the years that followed, ancillary features were also constructed including railway lines, workshops, welfare facilities and peat loading facilities.

During the Peat Extraction Phase of the Project, only minimal land use change occurred which was predominantly related to minor annual topographic changes caused by ongoing peat extraction and ancillary activities. Peat extraction and ancillary activities also prevented the revegetation and rehabilitation of the bog at that time, with the bog only beginning to rehabilitate once peat extraction ceased. Any land changes at the Application Site have been investigated using available aerial imagery dating from 1973 to 2020 (i.e. the year of the cessation of peat extraction). BnM Annual Reports were also consulted to help develop the timeline of changes across the Application Site.

Section 7.3.3 of this rEIAR discusses the change in the land environment at the Application Site from 1935 to the present day. The timing of the initial site preparation works (vegetation clearance and drainage insertion) varied across the Application Site in 1935. The site preparation works were first completed in 1935 at Lullymore, Lullybeg and Killina bogs, whilst the last bog which underwent site preparation works was Ticknevin Bog in 1973 (estimated date based on available aerial imagery). Peat extraction also commenced at Lullymore, Lullybeg and Killina bogs in 1935, with these bogs being the first to be subject to extraction. Ticknevin was the last bog to commence peat extraction in 1981 (estimated date based on available aerial imagery). Peat extraction ceased at most bogs comprising the Application Site in 2020, while it had ceased previously at Lullymore (1992), Lullybeg (2004), Derrybrennan (2015), Ticknevin and Codd 2 bogs (2019).

8.3.4 Existing Site Description and Topography

Corine land cover maps (2018) (www.epa.ie) show that the Application Site is predominantly comprised of 'peat bogs', located in a largely agricultural area.

Landcover and land use at the Application Site have been verified during the site walkover surveys completed by HES. The landcover and uses surrounding the Application Site comprises a mixture of forestry, agricultural land, cutover and cutaway peatland, one-off rural housing and small village settlements. Cutaway peatlands are those areas where all commercially viable volumes of peat have been extracted. Cutover peatlands are those areas where peat extraction has occurred, and commercially viable peat volumes remain. Since the cessation of peat extraction and ancillary activities in June 2020, the Application Site has begun to revegetate naturally. The degree of revegetation depends on the length of the time since peat extraction ceased as peat extraction ceased at different times across the different bogs. Meanwhile, enhanced rehabilitation works have been completed at Lodge Bog.

Full details are provided in Section 7.3.3 of this rEIAR.

The current topography of the Application Site is relatively flat with an elevation range of between approximately 68 and 84mOD.

8.4 Establishing the 1988 Baseline Environment

8.4.1 Water Balance

Long term Average Annual Rainfall (AAR) and evaporation data were sourced Met Éireann (www.met.ie).

The closest rainfall station to the Application Site is located at Lullymore (AGR.RES.STN) situated adjacent to Lullymore Bog. The data from this rainfall station indicates an AAR of 834mm. Met Éireann also provide a grid of AAR for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the 30-year AAR (1991-2020) assigned to location E267000, N226000 (close to the centre of the Application Site) is 880mm/yr. The monthly modelled rainfall data for this location are presented in Table 8-3.

Table 8-3: Local Average long-term Rainfall Data (mm)

Location: Application Site						X-Coord: 267000				Y-Coord: 226000		
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
80	65	60	60	58	69	72	78	70	91	91	86	880

The closest synoptic station where the average Potential Evapotranspiration (PE) is recorded is at Mullingar, approximately 30km northwest of the Application Site. The long-term average PE for this station is 445.8mm/yr. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the Application Site is estimated as 423.5mm/yr (which is 0.95 × PE).

The Effective Rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the Application Site is calculated as follows:

Effective rainfall (ER) = Average Annual Rainfall (AAR) – Actual Evaporation (AE)

= 880 mm/yr – 423.5mm/yr

ER = 456.5mm/yr

Based on groundwater recharge coefficient estimates from the GSI (www.gsi.ie), the Application Site has a groundwater recharge coefficient of 4%. This means that the hydrology of the Application Site is characterised by very high surface water runoff rates and very low groundwater recharge rates. This is supported by observations made during site walkover surveys with the Application Site and the surrounding area containing a high density of surface water features (field drains and main bog drains within the Application Site and streams in the surrounding lands). Therefore, conservative annual recharge and runoff rates for the Application Site are estimated to be 18.26mm/yr and 438.24mm/yr respectively.

The water balance presented above is unlikely to have changed significantly from 1988 to the data period covered by the 1991-2020 Met Éireann data. Raised peat bogs are an excellent store of water. Pre-development when the storage capacity of the peat is reached surface water runoff will occur whereby rainwater would have moved slowly across the bog before discharging to fens and other wetland habitats at the bog margin. In the July 1988 baseline and in the present day, however, drainage channels act as preferential flowpaths which allow surface water to leave the Application Site. These channels generally have a low gradient and the on-site drainage systems have some inherent storage and attenuation, and likely release runoff water at slightly higher rates than that of pre-development times. Meanwhile, the runoff rates between the July 1988 baseline and the present day are unlikely to have changed significantly as drainage had been inserted at the Application Site by July 1998. There may have been a very slight decrease in runoff rates due to the upgrade in silt ponds at the Application Site in the 1990s (refer to Section 8.4.4.3).

Met Éireann's Translate Project (https://www.met.ie/science/translate) provides projections for a range of future climate change scenarios, as Ireland's future climate will depend on global greenhouse gas emissions reductions. The severity of any future climate change will depend on the degree of future warming. In a 1.5°C world, average winter and summer precipitation rates are projected to be 3.08mm/day and 2.23mm/day respectively in Co. Offaly. Meanwhile, in a 4°C world, the average winter and summer precipitation rates in Co. Offaly are projected to be 3.37mm/day and 2.02mm/day respectively. In a 1.5°C world, average winter and summer precipitation rates are projected to be 2.78mm/day and 2.07mm/day respectively in Co. Kildare. Meanwhile, in a 4°C world, the average winter and summer precipitation rates in Co. Kildare are projected to be 3.03mm/day and 1.89mm/day respectively.

In addition to average rainfall data, extreme value rainfall depths are available from Met Éireann. Table 8-4 presents return period rainfall depths for the area of the Application Site. This data is taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year).

Table 8-4: Return Period Rainfall Depths (mm) for the Application Site

	Return Period			
Storm Duration	**1**	**5**	**30**	**100**
5 mins	4.4	8	14.9	21.9
15 mins	6.4	11.2	19.8	28.3
30 mins	8.1	13.8	23.8	33.3
1 hour	10.3	17	28.5	39.1
6 hours	19.3	29.4	45.4	59.4

	Return Period			
Storm Duration	1	5	30	100
12 hours	24.5	36.3	54.3	69.8
24 hours	31.2	44.8	65.1	82
2 days	37.6	52.7	74.5	92.3

8.4.2 Regional and Local Hydrology

Regionally the vast majority of the Application Site is located in the River Barrow surface water catchment within Hydrometric Area 14 of the South Eastern River Basin District. A small area in the north of the Ticknevin Bog located in the River Boyne surface water catchment within Hydrometric Area 07 of the Eastern River Basin District.

Regionally, within the River Barrow surface water catchment, the Application Site is located in 3 no. river sub-catchments. The majority of the Application Site is located within the Figile_SC_010 river sub-catchment, the southwest of the Application Site is located within the Figile_SC_020 river sub-catchment and the south and southeast are located within the Slate_SC_010 river sub-catchment.

Within the Figile_SC_010 river sub-catchment, the Application Site is mapped in 3 no. WFD river sub-basins: the Abbeylough_010, Figile_020 and Figile_030 WFD river sub-basins.

- Within the Abbeylough_010 WFD river sub-basin, the Abbeylough Stream (EPA Code: 14A01) flows to the west along the northern boundary of Derrybrennan Bog where it discharges into the Figile River (EPA Code: 14F01).
- Within the Figile_020 WFD river sub-basin, the Figile River flows to the west, between Glashabaun South and Glashabaun North bogs. A tributary of the Figile River, referred to by the EPA as the Lullymore East Stream (EPA Code: 14L11) is mapped to flow to the west from the western boundary of Lodge Bog. This stream dissects the northern sections of Lullymore and Lullybeg bogs and forms the boundary between Blackriver Bog to the west and Glashabaun South Bog to the east before it discharges into the Figile River. A smaller stream, referred to by the EPA as the Lullybeg Stream (EPA Code: 14L13), flows around the eastern, southern and western perimeter of Lullybeg Bog before it discharges into the Lullymore East Stream. Another stream, assigned the same name (Lullybeg) on the EPA database, flows from south to north through the western section of Blackriver Bog before it discharges into the Figile River.
- Within the Figile_030 WFD river sub-basin, the Figile River flows to the northwest, separating Codd 1 in the south from Codd 2 in the north. A small tributary of the Figile River, the Clonbrown Stream (EPA Code: 14C32) is mapped to flow to the north along the eastern boundary of Ballydermot North Bog before it discharges into the Figile River close to the east of Codd 1 Bog. The EPA also map a stream referred to as the Cloncant Stream (EPA Code: 14C41) to flow to the southwest, dissecting Codd 2 Bog before discharging into the Figile River. Further north, Ticknevin Bog is drained by 2 unnamed no. streams which merge at its southern boundary to form the Codd Stream (EPA Code: 14C44). The Codd Stream flows to the south, along the northwestern boundary of Glashabaun North before it flows to the west and discharges into the Ballyleakin Stream (EPA Code: 14B22). This stream discharges into the Figile River to the northwest of Codd 1 Bog.

Within the Figile_SC_020 river sub-catchment, the Application Site is mapped within the Figile_050 WFD river sub-basin. Within this WFD river sub-basin Figile River is mapped to flow to the south ~1.6km west of the Application Site. Several streams are mapped to originate at the western boundary of the Application Site. The Clonbulloge Stream (EPA Code: 14C53) to the west of Ballydermot North Bog and the Ballygarrett Stream (EPA Code: 14B30) to the west of Ballydermot South Bog. These streams merge just upstream of their confluence with the Figile River.

Within the Slate_SC_010 river sub-catchment, the Application Site is mapped within the Slate_050 and Slate_060 WFD river sub-basins. Within the Slate_050 WFD river sub-basin, the Killinagh Upper Stream (EPA Code: 14K17) is mapped to flow along the southeastern boundary of Lodge Bog before it discharges into the Slate River (EPA Code: 14S01). A second tributary of the Slate River is mapped to originate at the western boundary of Lodge Bog, referred to by the EPA as the Drumsru Stream (EPA Code: 14D19). The Slate River flows to the southwest, ~80m from the south of Lodge Bog. Within the Slate_060 WFD river sub-basin, the Slate River is located ~1km south of Barnaran Bog. There are no watercourses mapped in the immediate vicinity of the Application Site within this WFD river sub-basin.

Further downstream, the Slate River flows through Rathangan and confluences with the Figile River ~6.6km southwest of the Application Site. The Figile River continues to flow to the south before it discharges into the River Barrow to the north of Monasterevin.

Within the River Boyne surface water catchment, the Application Site is located within the Boyne_SC_010 river sub-catchment and the Boyne_010 WFD river sub-basin. The Clonkeen Stream (EPA Code: 07C36) is mapped to flow along the northern boundary of Ticknevin Bog before it flows to the northwest and discharges into the River Boyne (EPA Code: 07B04) ~2km north of the Application Site. The River Boyne continues to flow to the northwest before it veers to the northeast close to its confluence with the Yellow River (~7km northwest of the Application Site).

Table 8-5 summarises the location of Application Site with respect to WFD surface water catchments, sub-catchments and WFD river sub-basins. Regional and local hydrology maps are shown as Figure 8-2 and Figure 8-3 below.

The hydrological environment described above for the present day would have been the same as the July 1988 baseline hydrological environment. However, the nomenclature of the WFD classification (i.e. WFD catchments, sub-catchments and river sub-basins) has only existed since 2000. Meanwhile, the rivers have existed in their current form since post glacial times.

For the purposes of this rEIAR chapter, the names of rivers and streams correspond to those assigned in the EPA database. It is noted that some watercourses are identified by different names on local basemaps and OSI Discovery Series mapping. For example, the Figile River is referred to as the Cushaling River along the section flowing between Glashabaun North and Glashabaun South bogs. Similarly, the Lullybeg Stream which flows around the perimeter of Lullybeg Bog, is also known as the Crabtree River, while the Lullybeg Stream within Blackriver Bog is referred to as the Black River. The EPA nomenclature is used throughout this chapter as it represents the most up to date and authoritative hydrological database available within Ireland.

Table 8-5: WFD Catchments, sub-catchments and river-basins and receiving waterbodies

Bog	Catchment	Sub-Catchment	WFD River Sub-basin
Ballydermot North	River Barrow	Figile_SC_010	Figile_030
		Figile_SC_020	Figile_050
Ballydermot South	River Barrow	Figile_SC_010	Figile_020
			Figile_030
		Figile_SC_020	Figile_050

Bog	Catchment	Sub-Catchment	WFD River Sub-basin
		Slate_SC_010	Slate_060
Blackriver	River Barrow	Figile_SC_010	Figilie_020
			Figilie_030
		Slate_SC_010	Slate_060
Barnaran	River Barrow	Figile_SC_010	Figilie_020
		Slate_SC_010	Slate_050
			Slate_060
Lullybeg	River Barrow	Figile_SC_010	Figilie_020
Lullymore	River Barrow	Figile_SC_010	Figilie_020
Lodge	River Barrow	Figile_SC_010	Figilie_020
		Slate_SC_010	Slate_050
Killina	River Barrow	Figile_SC_010	Abbeylough_010
			Figilie_020
		Slate_SC_010	Slate_050
Derrybrennan	River Barrow	Figile_SC_010	Abbeylough_010
			Figilie_020
Glashabaun North	River Barrow	Figile_SC_010	Figilie_020
			Figilie_030
Glashabaun South	River Barrow	Figile_SC_010	Abbeylough_010
			Figilie_020
Ticknevin	River Boyne	Boyne_SC_010	Boyne_010
	River Barrow	Figile_SC_010	Figilie_030
Codd 1	River Barrow	Figile_SC_010	Figilie_020
			Figilie_030
Codd 2	River Barrow	Figile_SC_010	Figilie_030

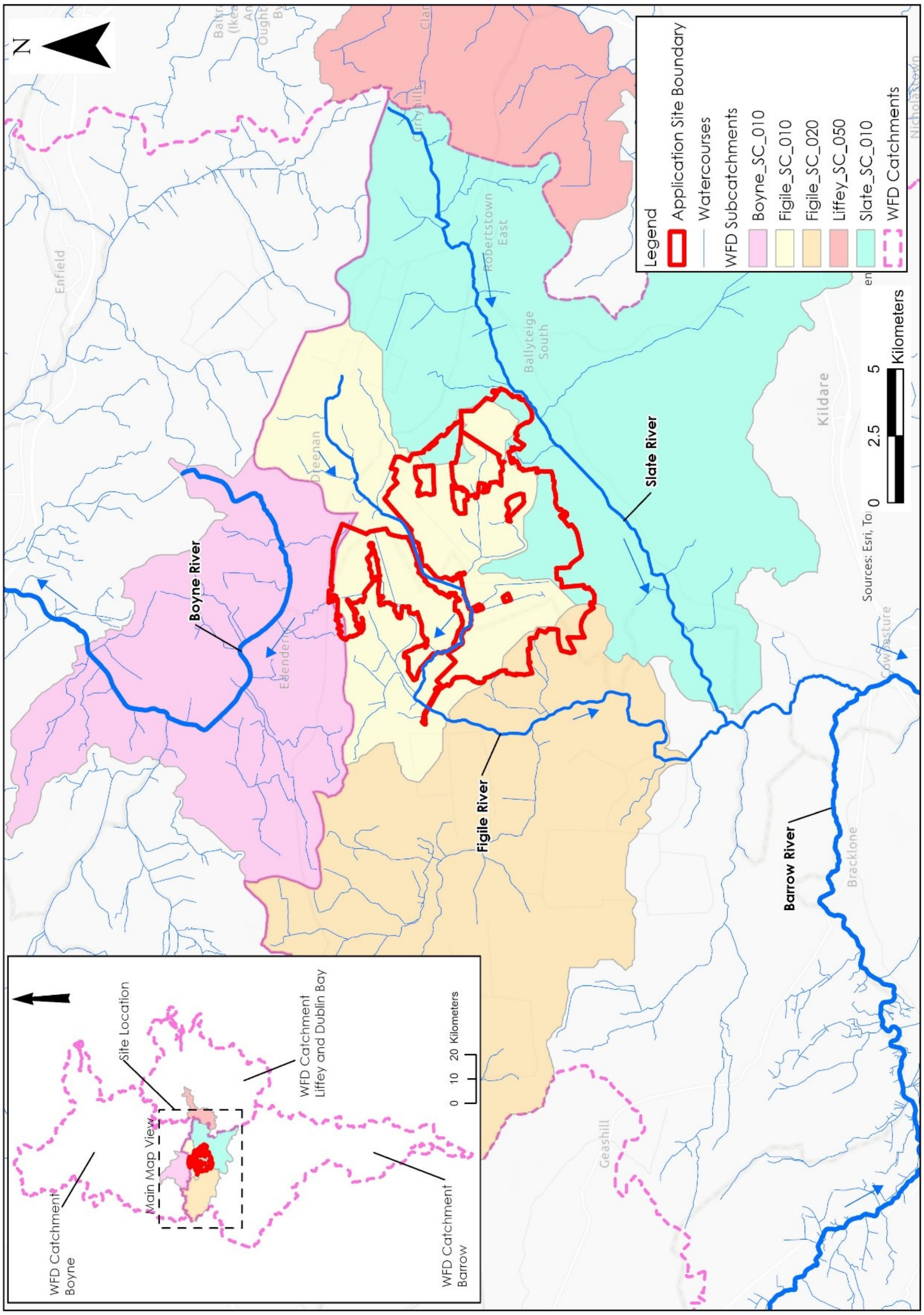

Figure 8-2: Regional Hydrology Map

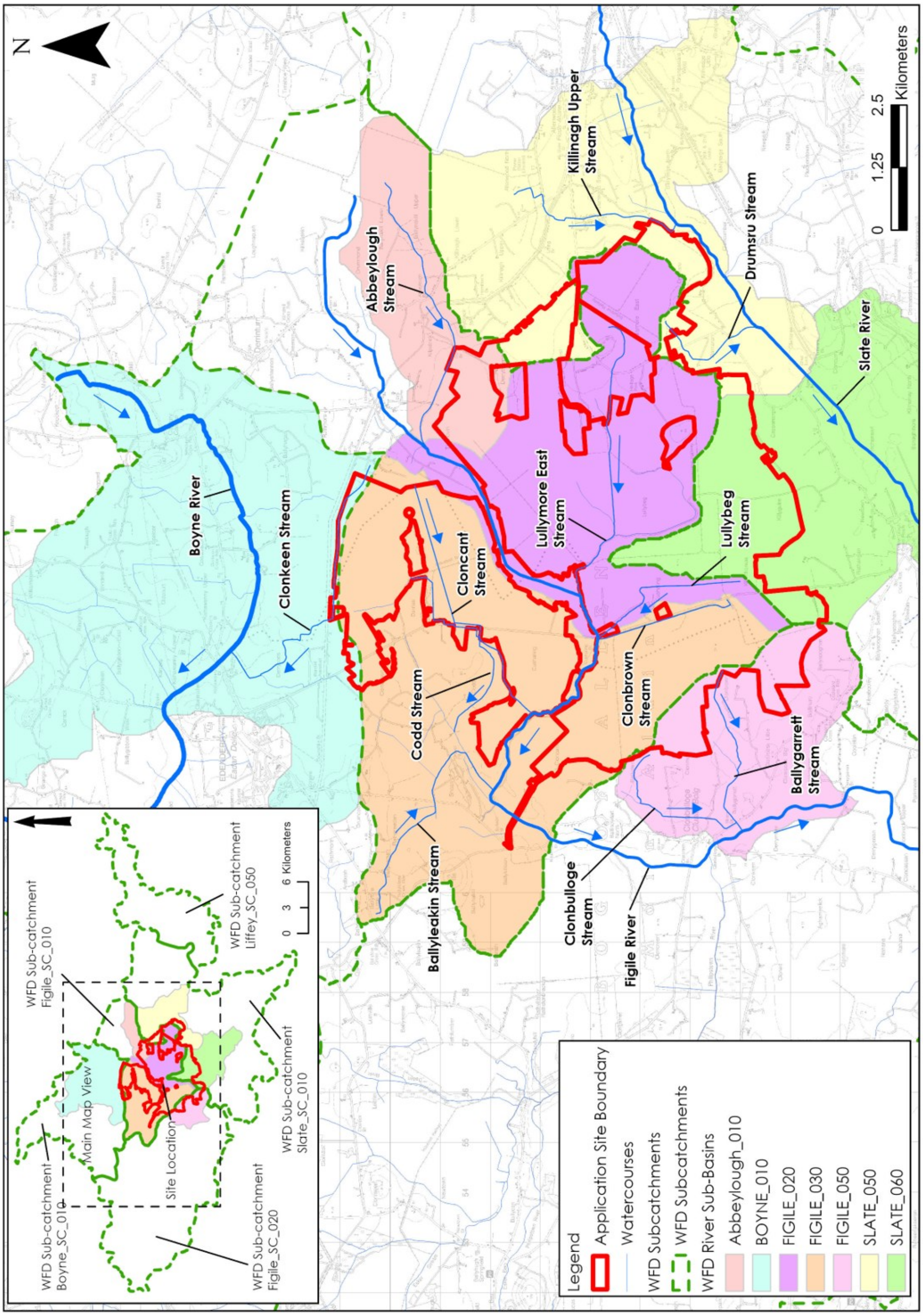

Figure 8-3: Local Hydrology Map

8.4.3 Surface Water Flows

Data on volumetric flow exceedance was acquired from OPW gauging stations (www.waterlevel.ie) for the Figile and Slate rivers downstream of the Application Site. The nearest downstream OPW gauging station located on Slate River is at Rathangan (Station ID: 14011). The 95%tile flow at this location is estimated to be 0.401m^3/s. A 95%tile flow relates to the flow which will be exceeded within the river 95% of the time *i.e.* a 95%tile flow of 0.401m^3/s would indicate that 95% of the time, the flow in that river is at or above 0.401m^3/s (401 l/sec). The nearest OPW gauging station downstream of the Application Site on the Figile River is located at Clonbulloge (Station Number: 14004). The 95%tile flow at this location is estimated to be 0.712m^3/s.

Table 8-6: Flow Volumes recorded at OPW Gauging Stations

	Flows equalled or exceeded for a given percentage of time (m^3/s) (Data derived for the period 1972 to 2026)						
Station No	1%	10%	25%	50%	75%	90%	95%
14004 (Clonbulloge)	16.154	8.135	4.961	3.084	2.045	1.447	0.712
14011 (Rathangan)	8.744	4.503	2.608	1.331	0.799	0.489	0.374

Given that no OPW gauging stations are located on the smaller watercourses in the immediate vicinity of the Application Site, the EPA's Hydrotool database, available on www.catchments.ie, was consulted. The Hydrotool dataset contains estimates of naturalised river flow duration percentiles. The 95%tile flow volumes on the Killinagh Upper Stream (Node: 14_587) and the Lullybeg Stream (Node: 14_1733) are estimated to be 0.041m^3/s and 0.035m^3/s respectively. These flows are considerably smaller than the flows in the Slate and Figile rivers. Similar flows are also expected in the other tributaries of the Slate and Figile Rivers which drain the Application Site. Further downstream, the flows increase signficantly in the Slate and Figile River. The 95%tile flow in the Figile River at Clonbullogе (Node: 14_996) is estimated to be 0.762m^3/s whilst the 95%tile flow in the Slate River downstream of Rathangan (Node: 14_1000) is estimated to be -.406m^3/s. The 95%tile flow in the River Barrow at Monasterevin (Node: 14_1611) is estimaed to be 2.264m^3/s.

The flow duration curve is presented for the EPA Hydrotool dataset in Figure 8-4.

Meanwhile, the flow volumes at the bog outfalls in the immediate vicnity of the Application Site range from 0.01 – 0.1m^3/s. Therefore, based on the above, the waterbodies in the vicinity of the Application Site, with smaller flow volumes, would have had the greatest potential to be impacted by peat extraction and ancillary activities. The potential for effects decreases progressively downstream due to the dilution effect associated with increasing flow volumes and larger upstream catchment areas.

The hydrological environment described above, in terms of surface water flow volumes and flow variations in response to rainfall events, for the present day would have been the same as the July 1988 baseline hydrological environment.

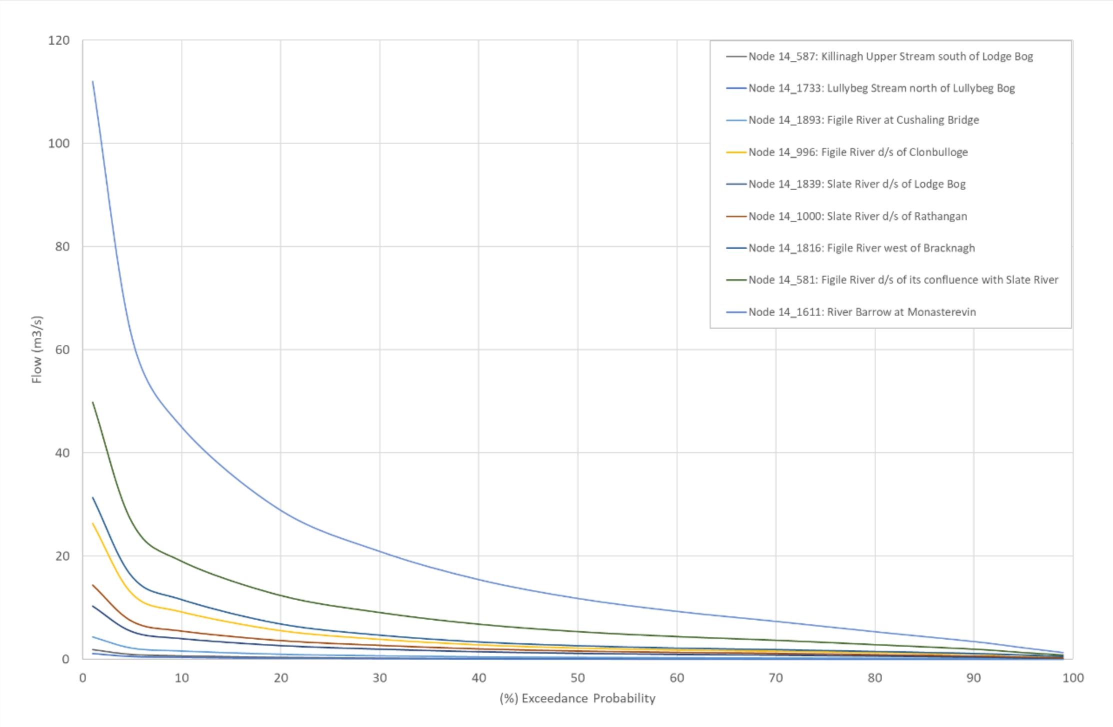

Figure 8-4: Flow Duration curves for Watercourses Downstream of the Application Site

8.4.4 Site Drainage

8.4.4.1 Pre – July 1988 Bog Drainage

Table 8-7 summarises the year of drainage and the year that peat extraction first began at the Application Site.

As part of the development of the Application Site for peat extraction, parallel surface water drains as per the methodology outlined in Section 4.2.2.1 of Chapter 4 were created by machine excavators at specific intervals, depending on whether milled or sod peat was being extracted. The strips of bog between these drains were retained to form peat extraction 'fields'. By 1988 drainage channels, silt ponds, outfalls and pumps were extant at the Application Site.

Peat was extracted by several different mechanisms across the Application Site including milled peat extraction, sod peat extraction, sod moss peat extraction and bin sod peat extraction. Full details on the methodology and associated drainage design are provided in Section 4.2.2 of Chapter 4.

Table 8-7: Peat Extraction Activity Timeline at the Application Site.

Bog Name	Bog Area (Ha)	Commencement of Site Preparation Works (Vegetation Clearance and drainage insertion)	Extraction Commenced	Extraction Ceased
Ballydermot North	456	1946	1950	2020
Ballydermot South	425	1946	1950	2020
Blackriver	732	1947	1950	2020

Bog Name	Bog Area (Ha)	Commencement of Site Preparation Works (Vegetation Clearance and drainage insertion)	Extraction Commenced	Extraction Ceased
Barnaran	486	1954	1959	2020
Lullybeg	267	1935	1935	2004
Lullymore	175	1935	1935	1992
Lodge	407	1947	1953	2020
Killina	257	1935	1935	2020
Derrybrennan	132	1959	1969	2015
Glashabaun North	515	1947	1951	2020
Glashabaun South	601	1947	1951	2020
Ticknevin	456	1973*	1981*	2019
Codd 1	247	1959*	1973*	2020
Codd 2	290	1973*	1981*	2019

*Estimated date indicated by available aerial imagery which are included in Appendix 4-4 of this rEIAR.

Silt Ponds

Following the establishment of the BnM silt committee, it was decided in 1974 to control all effluent by means of specially designed and construction silt ponds. A copy of the meeting minutes from the BnM Production Manager in March 1976 setting out the recommendations of the silt committee is included in Appendix 4-8, which directs that "*at all milled peat bogs in production, works should carry out surveys and select sites for silt ponds as recommended*". Further BnM records show that silt pond measures were introduced across all BnM bogs, including the Application Site, in the early to mid-1980s in response to the 1977 Water Pollution Act.

Silt ponds were installed to trap and reduce the emission of suspended solids to surface water bodies originating from activities associated with peat extraction, such as suspended peat particles generated from the production fields and collected in the bog drainage network as well as run-off from workshop areas.

The first silt ponds were constructed at the Application Site prior to 1988, with these ponds being designed with an upper limit of 100mg/l of silt runoff. The design of silt ponds is detailed in Section 4.3.6.9, with silt ponds typically being 8m in width, 1.5m deep and of variable length. In some locations, baffles have been installed within the ponds to reduce the energy in the flow and elongate the pond thereby increasing residence time and aiding settlement. The inlet and outlet pipes at the silt ponds control the flow velocity, with velocity within the silt pond being less than 0.1m/s. Silt ponds are cleaned twice a year and are all located hydraulically upgradient of discharge/outfall points.

8.4.4.2 1988 Baseline Bog Drainage

By 1988, the land use at the Application Site was well established as industrial peat extraction. The Application Site was drained with milled, sod moss and sod peat extraction were taking place across most of the Application Site in 1988.

<u>Ballydermot North Bog:</u> Aerial imagery indicates that by July 1988, approximately 456.4ha of the Ballydermot North Bog was subject to milled peat extraction. Drainage was already installed, predominantly in an east-west orientation. There were no silt ponds, pumps or surface water emission points located on Ballydermot North Bog.

<u>Ballydermot South Bog:</u> Aerial imagery from 1988 indicates that drainage was in place and extraction of milled peat was underway on approx. 326.8 ha in the majority of Ballydermot South Bog. A total of 98.2ha were not drained nor subject to peat extraction in the west and southeast of the bog. There were no silt ponds, pumps or surface water emission points located on Ballydermot South by 1988.

<u>Blackriver Bog:</u> By July 1988, milled peat extraction was underway across the majority of Blackriver Bog, (approx. 726.3 ha). Areas of undrained bog not subject to peat extraction were located in the northwest of the bog (approx. 15.7 ha). Drainage for milled peat was already installed. There were no silt ponds, pumps or surface water emission points located on Ballydermot South by 1988.

<u>Barnaran Bog:</u> By July 1988, sod moss extraction was underway across all of Barnaran Bog, (approx. 486ha). There are 3 no. silt ponds located in Barnaran Bog; all of which were installed by 1988. There are 2 no. surface water emission points which were installed at the same time as the silt ponds. There are no pumps on Barnaran Bog.

<u>Lullybeg Bog:</u> By July 1988 Lullybeg Bog had been drained and sod moss extraction was underway across 154 ha of the bog. An area of 113ha in the north of the bog had ceased peat extraction by this time. There were no silt ponds, pumps or surface water emission points located on Lullybeg by 1988.

<u>Lullymore Bog:</u> Drainage infrastructure was fully established for sod moss in 175ha of Lullymore Bog by 1988, as deduced from available aerial imagery. There were no silt ponds, pumps or surface water emission points located on Lullymore Bog by 1988.

<u>Lodge Bog:</u> Satellite imagery and annual reports indicate that by July 1988, approx. 383.1ha of Lodge Bog was undergoing sod moss peat extraction. A small area measuring approx. 23.9ha of remnant uncut raised bog was located in the southwest of the bog. Drainage was already installed, predominantly in a northeast-southwest orientation. There were no silt ponds, pumps or surface water emission points located on Lodge Bog by 1988.

<u>Killina Bog:</u> Aerial imagery from 1988 indicates that drainage was fully established across Killina Bog. A total of 88.5ha were drained but not subject to peat extraction in 1988. Sod moss extraction was ongoing in 1988 across 168.5 ha of Killina bog. There were 2 no. silt ponds on Killina Bog, both were installed between 1988 and 1995. There are 2 no. surface water emission points which were installed around 1988 and no pumps on the bog. The silt ponds and surface water emission points remain in situ today.

<u>Derrybrennan Bog:</u> By July 1988 Derrybrennan Bog had been drained and milled peat extraction was continuing across 132ha of the bog. There are 2 no. silt ponds, 2 no. surface water emission points and no pumps located on Derrybrennan Bog. Both of the silt ponds were installed between 1988 and 1995.

<u>Glashabaun North Bog:</u> Satellite imagery and annual reports indicate that by July 1988, the majority of Glashabaun North was subject to milled peat extraction, approx. 499ha. A small area measuring approx. 16.2ha of remnant uncut raised bog was located in the north of the bog. Drainage was already installed, predominantly in a west-east orientation. There were 2 no. silt ponds located in Glashabaun North Bog, 2 no. of which was installed by 1988. There are 2 no. pumps located on the south of the bog. The installation date of the pumps is not clear, but BnM records indicate the pumps were installed by 1988. There were no surface water emission points located on the bog.

Glashabaun South Bog: Aerial imagery from 1988 indicates that drainage was in place and extraction of milled peat was underway on approx. 419ha in the northern portion of Glashabaun South Bog. A total of 192.5ha were drained but not subject to peat extraction. 6 no. silt ponds and 6 no. surface water emission points were installed between 1988 and 1995 on Glashabaun South Bog. No pumps were installed on Glashabaun South Bog by 1988.

Ticknevin Bog: By 1988 sod moss extraction was underway across 417.8ha of Ticknevin Bog. Approximately 38.2ha was neither drained nor subject to peat extraction. 2 no. silt ponds were installed between 1988 and 1995 which remain in situ today. There are 2 no. pumps on Ticknevin Bog. The installation date of the pumps is not clear, but BnM records indicate the pumps were installed by 1988. There was no surface water emission points located on the bog by 1988.

Codd 1 Bog: Drainage infrastructure was established for milled peat extraction in 217ha of Codd 1 Bog by 1988, and 32.9 ha of the bog was drained but not yet subject to peat extraction as deduced from available aerial imagery. There were 5 no. pumps, 4 no. silt ponds and 3 no. surface water emission points installed on Codd 1 by 1988.

Codd 2 Bog: Drainage infrastructure was established for milled peat extraction in 290ha of Codd 2 Bog by 1988, as deduced from available aerial imagery. There was 4 no. silt ponds installed by 1988 and no pumps or surface water emission points located on Codd 2 by 1988.

8.4.4.3 Peat Extraction Phase Drainage (1988 – 2020)

After 1988, peat extraction was well underway at the Application Site. The deepening and maintenance of drainage channels continued beyond July 1988, up until the cessation of peat extraction in June 2020. As the areas subject to peat extraction from 1988 to June 2020 reduced in their extent and the depth of peat available was subsequently reducing after each harvest, the extent and number of drains requiring deepening and maintenance reduced accordingly.

Machinery used for drainage works would have been largely the same as that described in Chapter 4 with ever-improving engine efficiency in tractors and excavators.

Ballydermot North Bog: Drainage was fully inserted in Ballydermot North Bog by 1988, with the full extent of the drained area subject to milled peat extraction. A section in the southwest of Ballydermot North Bog known as Clonbrown was converted in 2017 and further in 2018 to expand the area of sod moss production at the Application Site. The production of sod moss had been taking place in the northwest of Ballydermot South Bog since 2001 and was expanded in 2017 and 2018 into Ballydermot North Bog. Peat extraction ceased by 2013 for milled peat in Ballydermot North Bog and sod moss extraction continued until 2020. There are no silt ponds, pumps or surface water emission points located on Ballydermot North.

Ballydermot South Bog: By 1988 Ballydermot South was drained for milled peat extraction. A section in the northwest of Ballydermot South Bog known as Clonbrown was converted in 1996 to produce sod moss. This area was first harvested in 2001, and the area was expanded into the southwest of Ballydermot North Bog in 2017 and again in 2018. A portion of the bog in the southwest of Ballydermot South known as Clonroosk was drained in 2013 but was never subject to peat extraction, restoration works to block the drains in Clonroosk were completed in 2014. All peat extraction ceased in 2020 on Ballydermot South. There are 2 no. silt ponds, and 2 no. pumps located in Ballydermot South. Both silt ponds were installed between 1996 and 2000. The installation date of the pumps is not clear, but BnM records indicate the pumps were installed with the silt ponds between 1996 and 2000.

Blackriver Bog: In 1988 milled peat extraction continued on Blackriver Bog with the associated milled drainage established. Several small areas of turbary remained, predominantly at the edges of the bog. An area of 5.7 ha to the southwest of Blackriver was never drained or subject to peat extraction. Peat extraction on the bog ceased in 2020. There are 4 no. silt ponds in Blackriver, all of which were installed between 1996 and 2000. 2 no. pumps are located on the bog, the installation date of the pumps is not clear, but BnM records indicate the pumps were installed with the silt ponds between 1996 and 2000. 2 no. surface water emission points are located on Blackriver Bog.

Barnaran Bog: In 1988 sod moss extraction was continuing in across Barnaran Bog. There are 3 no. silt ponds located in Barnaran Bog; all of which were installed by 1988. There are 2 no. surface water emission points which were installed at the same time as the silt ponds. There are no pumps on Barnaran Bog.

Lullybeg Bog: In 1988, sod moss extraction was ongoing in Lullybeg Bog. Peat extraction ceased on most areas of the bog by 1995 except for the south which ceased extraction by 2004. There are 2 no. silt pond and 2 no. surface water emission points in Lullybeg Bog all of which were installed between 1996 and 2000. There are no pumps on Lullybeg bog.

Lullymore Bog: In 1988, sod moss extraction continued on Lullymore Bog. Peat extraction ceased on Lullymore in 1992, aerial imagery from 1995 indicates that by that time revegetation was occurring. Between 2011 and 2013 infrastructure for the Lullymore Heritage and Discovery Park was placed on the east of the bog and 1 no. silt pond and 1 no. surface water emission point was installed during the same timeframe. There are no pumps located on Lullymore Bog.

Lodge Bog: By 1988 drainage had been inserted in Lodge Bog for sod moss extraction. A section of 23.9ha in the northwest was never drained or subject to peat extraction and remained intact as remnant raised bog. Peat extraction ceased on Lodge Bog by 2020. By the end of the Peat Extraction Phase in 2020, 5 no. silt ponds, 2 no. surface water emission points and 2 no. pump were in place. Of the 4 no. silt ponds installed at Lodge Bog, 2 no. were installed between 1995 and 1999, and 3 no. installed between 2001 and 2005. The installation date of the pumps is not clear, but BnM records indicate the pumps were installed with the silt ponds between 2001 and 2005.

Killina Bog: Drainage was fully inserted in Killina Bog in most areas by 1988, with the full extent of the drained area subject to sod moss extraction. It is not clear from records or aerial imagery when milled peat extraction ceased in the west of Killina, but aerial imagery indicates that by 1995, peat extraction had ceased in the majority of the bog, and revegetation was occurring. Any remaining peat extraction ceased by 2020. There are 2 no. silt ponds on Killina Bog, both were installed between 1988 and 1995. There are 2 no. surface water emission points which were installed pre-1995 and no pumps on the bog.

Derrybrennan Bog: In 1988, Derrybrennan Bog continued to be subject to milled peat extraction until peat extraction ceased in 2015. There are 2 no. silt ponds, 2 no. surface water emission points and no pumps located on Derrybrennan Bog. Both of the silt ponds were installed between 1988 and 1995.

Glashabaun North Bog: By 1988 drainage for milled peat was inserted in the majority of Glashabaun North with the full extent of the drained area subject to peat extraction. A small area measuring approx. 16.2 ha of remnant uncut raised bog is located in the north at the edge of the bog. Peat extraction ceased in the bog in 2020. There are 3 no. silt ponds located in Glashabaun North Bog, 2 no. of which was installed by 1988 and the remaining 1 no. installed between 2011 and 2013. There are 2 no. pumps located on the south of the bog . The installation date of the pumps is not clear, but BnM records indicate the pumps were installed by 1988. There are no surface water emission points located on the bog.

Glashabaun South Bog: By 1988 Glashabaun South was drained for milled peat extraction. Peat extraction ceased in Glashabaun South by 2020. There are 11 no. silt ponds in Glashabaun South and 6 no. surface water emission points. Of the 11 no. silt ponds installed at Glashabaun South, 6 no. were installed by 1988, the remainder were installed between 1996 and 2000. There are no pumps located on the bog.

Ticknevin Bog: Aerial imagery indicates sod moss extraction was ongoing on the bog by 1988. There is a section of bog 38.2 ha in the west that was never drained nor subject to extraction. Peat extraction ceased on Ticknevin Bog in 2019. There are 2 no. pumps on Ticknevin Bog. The installation date of the pumps is not clear, but BnM records indicate the pumps were installed by 1988. There are 7 no. silt ponds, 2 no. of which was installed between 1988 and 1995, 4 no. installed between 2001 and 2005, and 1 no. installed between 2011 and 2013. There are 1 no. surface water emission points located on the bog. To the south of Ticknevin Bog, an area has been designated as the Long Derries Special Area of Conservation [000925] in 2016 due to the presence of good quality dry, orchid-rich calcareous grassland.

Codd 1 Bog: Drainage was inserted in Codd 1 Bog by 1988, with the full extent of the drained area subject to milled peat extraction. An area in the north of the bog known as Cushaling was drained by 1995 to produce sod moss which commenced in 2011, and the first harvest was taken between 2012 and 2013. Peat extraction ceased on the bog in 2020, the east was the last area to cease extraction at this time. There are 5 no. pumps located in Codd 1 Bog; 2 no. screw pumps were replaced with 2 no. submersible pumps in 2016 however, the original pumps were installed by 1988. There are 5 no. silt ponds, 4 no. of which were installed by 1988 and 1 no. was installed between 2013 and 2018. There are 3 no. surface water emission points, all of which were installed by 1988.

Codd 2 Bog: By 1988, Codd 2 was subject to milled peat drainage. An area in the northeast of the bog was subject to initial drainage between 1987 and 1988 for the production of bin sod. The first harvest of bin sod from the north of the bog was taken in 2000. Extraction ceased on the bog in 2019. By the end of the Peat Extraction Phase, 11 no. silt ponds and 1 no. surface water emission point were in place, all of which remain in situ today. Of the 11 no. silt ponds installed at Codd 2 Bog, 4 no. were installed by 1988, 2 no. installed between 2001 and 2005, 2 no. installed between 2011 and 2013, and 3 no. installed between 2013 and 2017. There are no pumps located on Codd 2.

Silt Ponds

Several changes to the on-site bog drainage system occurred during this phase of the development. These changes were predominantly associated with silt ponds and attempts to reduce the concentrations of suspended sediment being discharged from the bog drainage systems to local surface watercourses. Upgrades to silt ponds were undertaken at the Application Site in the 1990s following the Harkins Internal Bord na Móna Report (1990) which highlighted the issue of elevated suspended sediment concentrations in discharge from the bog drainage network. The report revealed that a total of approximately 50m^3 of sludge per hectare of bog was being discharged to nearby surface watercourses every year (refer to Chapter 4). Following this, the silt ponds were designed to cater for the settling of sufficient amounts of silt providing the ponds were de-sludged at least twice per annum. A second pond was installed adjacent to the first to facilitate desludging (i.e., used as a backup when the first pond reached silt storage capacity and underwent desludging).

Since 2000, the bog drainage network has been operating in accordance with the existing Integrated Pollution Control Licences, with all drainage water from bog units in the licensed area discharged via an appropriately designed silt pond treatment arrangement. The silt ponds serving operation bogs have been sized in accordance with a condition in the existing Integrated Pollution Control Licence (P0503-01) which states:

> *Within three years of date of grant of this licence all existing silt ponds serving operational bogs shall achieve the following minimum performance criteria (flood periods excepted):*
>
> > *Maximum flow velocity < 10 cms-1*
> >
> > *Silt design capacity of lagoons, minimum 50m^3 per nett ha of bog serviced*

Silt ponds were generally designed and constructed with a width of 8 metres, however, in some cases, silt ponds are up to 12 metres in width. Silt ponds of 12m width are only provided in areas where access is available to both sides of the silt ponds for cleaning. The length of the silt pond will vary depending on the capacity required (i.e. proportional to the area of catchment being drained). In some locations, baffles have been installed within the ponds to reduce the energy in the flow and elongate the pond thereby increasing residence time and aiding settlement. Silt ponds are generally excavated to a depth of 1.5 metres below the pipe invert level, however in some locations, due to restricted space, the silt pond depth is greater than this. Low-velocity flow through the silt pond is generally controlled by inlet and outlet pipes at the silt ponds or upstream of the silt pond. These pipes control the velocity of the flow into and out of the silt ponds so that the velocity within the silt pond itself is less than 0.1 m/sec. The silt ponds are usually cleaned twice a year and are all located hydraulically upgradient of discharge/outfall points.

8.4.4.4 Current Phase Drainage (June 2020 – Present)

Due to the historic peat extraction activities at the Application Site, the site has been artificially drained in order to lower the peat water table. Drainage ditches were first inserted into the upper surface of each of the bogs comprising the Application Site prior to the commencement of peat extraction. The timing of drainage insertion varied across the Application Site with Killina, Lullybeg and Lullymore being the first bogs to be drained in 1935. The latest bogs to be drained were Ticknevin and Codd 2 which had been drained by 1973.

Currently surface water (or runoff water) is drained from the Application Site via a network of field drains typically spaced at 15 to 20m intervals, piped drains, main drains, headland drains, and silt ponds. Much of the site is drained by gravity however there are 15 no. pumps at 7 no. difference locations around the Application Site. These include pumping stations in each of the following bogs; Ticknevin Bog, (P37/010), Glashabaun North Bog(P37/008),Codd 1 Bog (P37/014), Ballydermot South (P37/011), Ballydermot North Bog (P37/012) and Blackriver Bog (P37/007). 2 no. pumps at Lodge Bog (P17/013) have been decommissioned. Following peat extraction activities, drainage by gravity in these areas of the site was no longer feasible as the water level in the surrounding streams were higher than the water level within the site. The field drains discharge to main drains which flow via gravity, or are pumped, towards the perimeter of the site where they discharge to larger headland drains. These headland drains eventually discharge to large silt (settlement) ponds. The silt ponds are used to trap sediment and prevent elevated levels of suspended sediment arising in effluent from the drained peatland. Treated surface water is then discharged at outfall points where the effluent flows into off-site drainage channels which in turn discharge into the local stream and river network.

Drainage of the Application site is currently operating under licence from the EPA (P0503-01). The drainage system has been operating in accordance with this existing Integrated Pollution Control (IPC) licence, with all drainage water from the bogs being discharged via an appropriately designed silt pond treatment arrangement.

A detailed hydrological audit of flowpaths from each bog to its eventual discharge point at the regional catchment scale was completed for each of the bogs comprising the Application Site. The drainage system is summarised on Figure 8-5 and the flowpaths from each bog to downstream watercourses are shown on Figure 8-6. Figure 8-7 below presents the existing drainage network at the Application Site.

There are a total of 26 no. surface water discharge locations across the Application Site. These discharge locations are situated downstream of settlement ponds, with the treated and attenuated water from the bog drainage system being discharged to outfall drains which in turn discharge to local watercourses. The vast majority of the bogs comprising the site discharge directly into the Figile River or smaller tributary streams which in turn discharge into the Figile River. Meanwhile, the drainage from Lodge Bog discharges into a local stream which is a tributary of the Slate River. Downstream of the

Application Site the Slate River also discharges into the Figile River. Therefore, all surface waters from the Application Site eventually end up in the Figile River, and the River Barrow further downstream.

Table 8-8 below presents the respective outfalls. Outfalls generally discharge into outfall drains with the flowpaths along these outfall drains to the nearest EPA mapped watercourse ranging from 15m to 1.32km. Note that SW68, SW69 and SW70 in Ticknevin Bog are located along an unnamed EPA mapped watercourse. These watercourses have been integrated into the existing bog drainage system. Similarly, SW65 and SW65A in Blackriver Bog are located in close proximity (15-20m) to the EPA mapped Lullybeg 14 Stream. Note that this stream is mapped to extend into the bog and has also been integrated into the existing bog drainage system, upstream of these outfall locations.

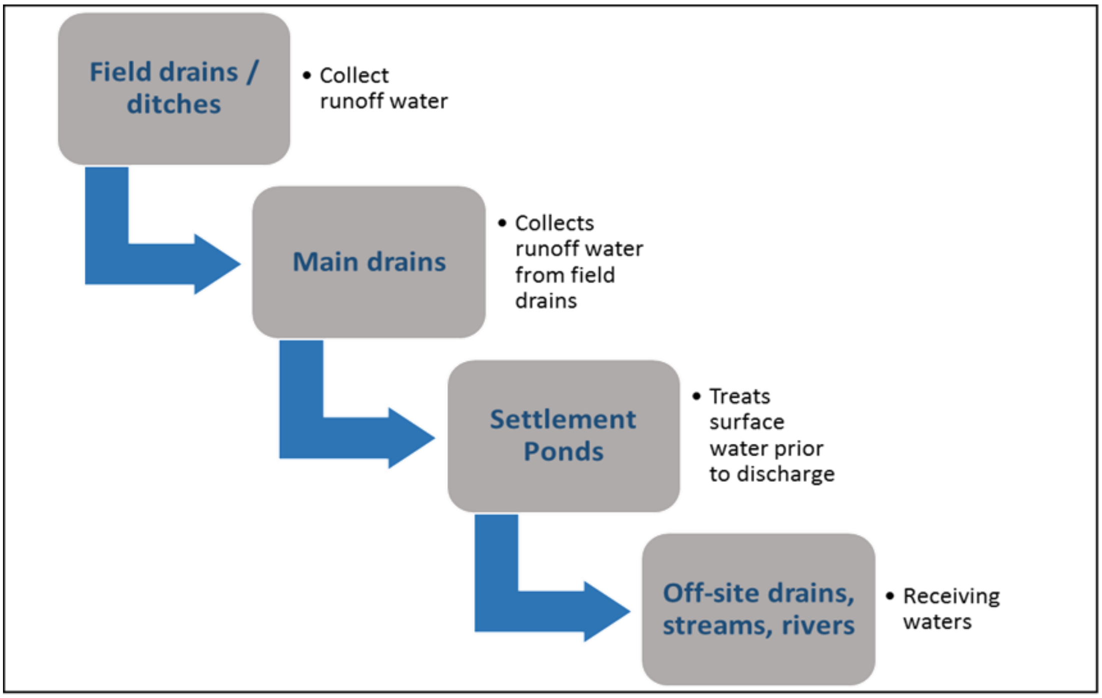

Figure 8-5: Existing Drainage System at the Application Site

Table 8-8: Site Drainage from the Application Site

Outfall ID	Easting	Northing	Outfall Elevation (mOD)	Bog Name	Receiving EPA Mapped Watercourse	Length of Flowpath from Outfall to Watercourse (m)
SW45	663527.78	726653.71	66.16	Codd 1	Figile River	95
SW45A	662256.19	726971.90	68.40	Codd 1	Figile River	1,325
SW47	669131.73	728060.14	72.70	Glashabaun South	Figile River	780
SW48	668758.20	728217.78	71.12	Glashabaun South	Figile River	1,040
SW49	668988.62	728084.73	71.94	Glashabaun South	Figile River	1,190
SW50	669212.32	727966.35	72.47	Glashabaun South	Figile River	1,300
SW51	666403.40	726805.68	67.45	Glashabaun South	Figile River	320
SW52	666465.51	726531.67	67.30	Glashabaun South	Lullymore East Stream	380
SW53	666612.12	726351.97	67.63	Glashabaun South	Lullymore East Stream	240
SW56	668389.31	725645.95	68.36	Lullybeg	Lullymore East Stream	20
SW60	673194.35	724739.05	72.46	Lodge	Killinagh Upper Stream	140
SW61	673091.43	724411.58	71.43	Lodge	Killinagh Upper Stream	55
SW62	667936.06	723654.44	67.94	Barnaran	Lullybeg Stream	480
SW65	665875.07	724954.12	67.0	Blackriver	Lullybeg Stream	15
SW65A	665458.68	725293.01	66.54	Blackriver	Lullybeg Stream	20
SW67	664392.87	725678.79	66.91	Codd 1	Figile River	450
SW67A	664442.55	723287.69	67.50	Ballydermot South	Ballygarrett Stream	140
SW68	666729.17	729690.42	70.66	Ticknevin	Unnamed Stream	0
SW69	666201.27	729620.71	71.64	Ticknevin	Unnamed Stream	0
SW70	665703.89	729959.63	69.58	Ticknevin	Unnamed Stream	0
SW71	664995.88	728219.88	69.26	Glashabaun North	Cloncant Stream	25

Outfall ID	Easting	Northing	Outfall Elevation (mOD)	Bog Name	Receiving EPA Mapped Watercourse	Length of Flowpath from Outfall to Watercourse (m)
SW72	664234.47	727749.54	68.22	Codd 2	Cloncant Stream	20
SW73	663537.72	727291.52	66.42	Codd 2	Cloncant Stream	40
SW74	663647.75	726742.12	65.91	Codd 2	Figile River	55
SW75	663766.63	726597.55	65.81	Codd 2	Figile River	130
SW76	664406.66	726320.81	65.59	Codd 2	Figile River	140

Table 8-9: Pumping Stations at the Application Site

Pump Station ID	No. Pumps	Easting	Northing	Bog Name	Year of Installation	Status
P37/014	2	663656	726455	Codd 1	Unknown	Existing
P37/007	2	666025	724944	Blackriver	Unknown	Existing
P37/008	2	665251	728217	Glashabaun North	Pre July 1988	Existing
P37/010	2	666212	729630	Ticknevin	Unknown	Existing
P37/011	2	664498	723400	Ballydermot South	Pre July 1988	Existing
P37/012	3	665029	725617	Boundary of Codd 1 and Ballydermot North	Unknown	Existing
P37/013	2	673081	724538	Lodge	Unknown	Decomissioned

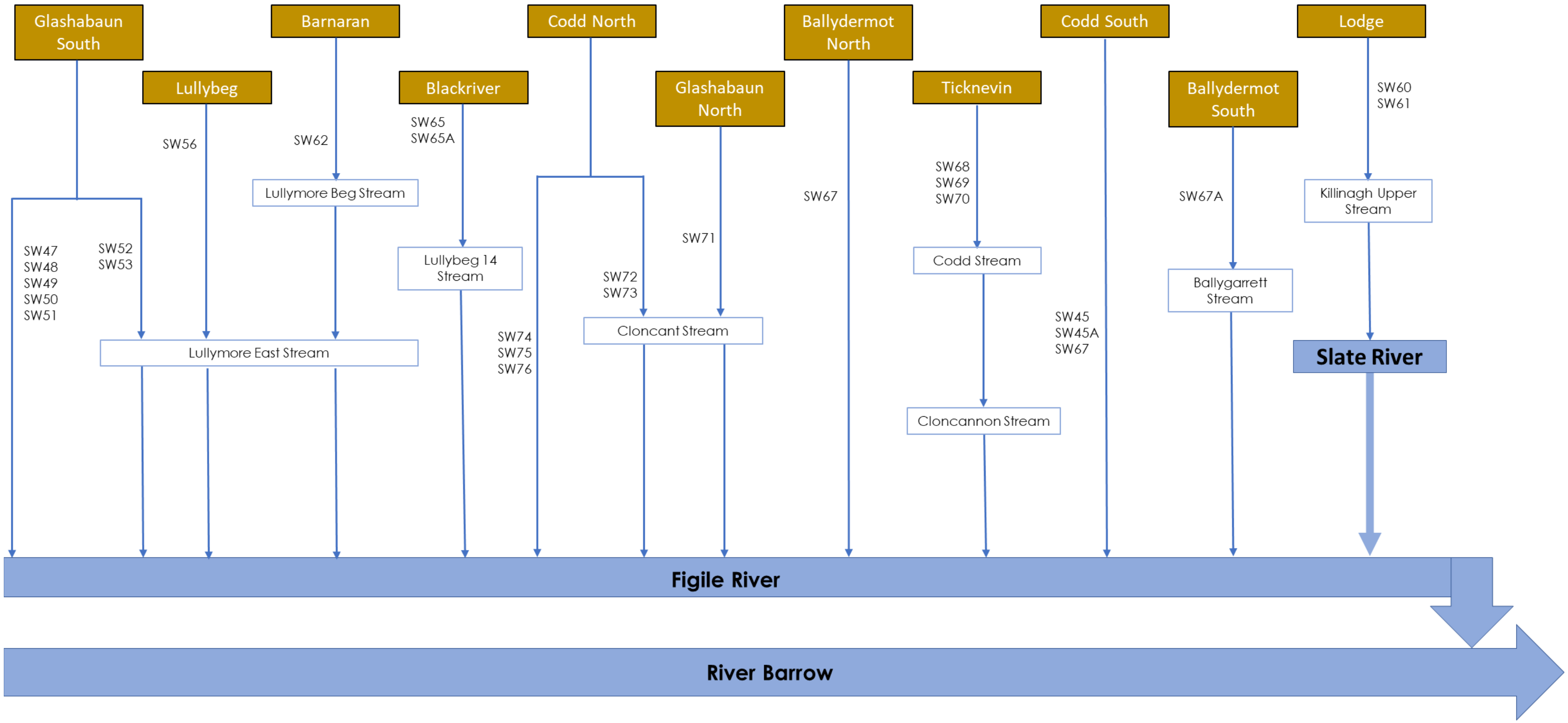

Figure 8-6: Flow Pathways from Bogs Comprising the Application Site

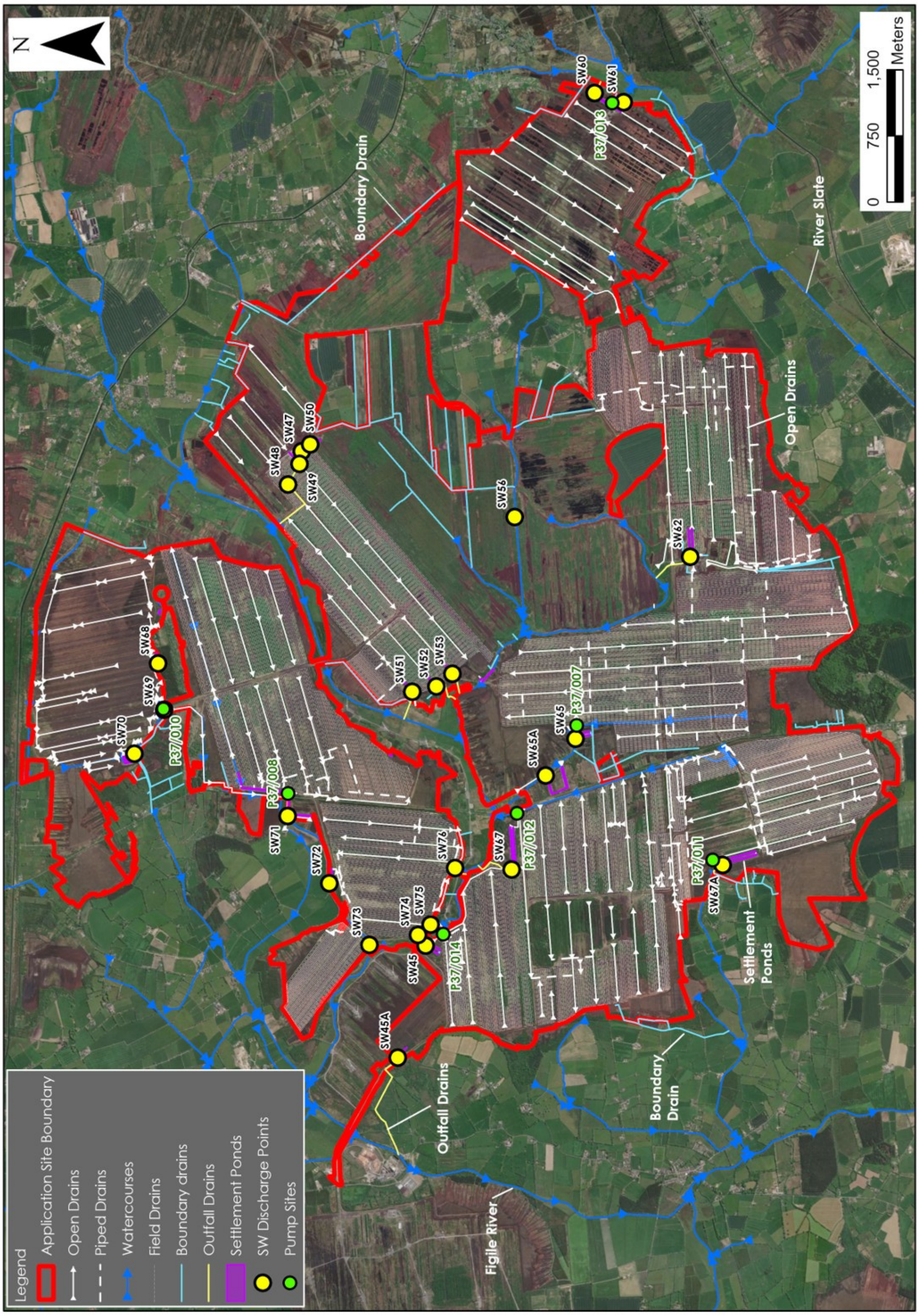

Figure 8-7: Existing Site Drainage Network

8.4.5 Flood Risk Assessment

This section presents an overview of the Flood Risk Assessment (FRA) undertaken for the Application Site. The full FRA for the Application Site is provided in Appendix 8-1.

To identify those areas as being at risk of flooding, OPW's indicative river and coastal flood map (www.floodinfo.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.floodinfo.ie) and historical mapping (i.e. 6" and 25" base maps) were consulted. Identifiable map text on local available historical 6" or 25" mapping for the Application Site do not identify any lands that are "liable to flood".

Based on the EPA/GSI soil map for the area no regions of alluvium are mapped within the Application Site Boundary. However, some alluvium (fluvial deposits) is recorded along many of the local streams and rivers in the lands surrounding the Application Site.

No recurring or historic flood incidents were identified within the Application Site from the OPW's Past Flood Events Map. However, there are few recurring flood incidence and past flood event mapped around the Application site. The flooding events recorded around the application site are:

- Recurring flood event (Flood ID: 1486) at Cloncumber Pluckerstown is mapped ~2km south of the Lodge Bog;
- Recurring flood event (Flood ID: 1485) at Slate Cloncurry is mapped ~1.8km south of the Barnaran Bog;
- Recurring flood event (Flood ID: 1484) at Slate Rathangan is mapped ~1.9km south of the Blackriver Bog;
- Recurring flood event (Flood ID: 2772) at Figile Derrygarran is mapped ~1.9km southwest of the Ballydermot South Bog;
- Recurring flood event (Flood ID: 2769) at Figile Clonbulloge is mapped ~1.8km west of the Ballydermot North Bog;
- Past flood event (Flood ID: 10599) at Philipstown Clonbullogue on 16/08/2008 is mapped ~1.6km west of the Ballydermot North Bog;
- Recurring flood event (Flood ID: 2785) at Blundell Aqueduct, Edenderry is mapped ~800m northwest of the Ticknevin Bog;
- Past flood event (Flood ID: 2786) at Grand Canal, Edenderry on 01/01/1989 is mapped ~1km northwest of the Ticknevin Bog; and,
- Recurring flood event (Flood ID: 1280) at Killinagh is mapped ~1.6km east of the Killina Bog.

Where complete, the CFRAM OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the PFRA maps. No CFRAM mapping has been completed for the area of the Application Site. An area adjacent to the southeastern boundary of Lodge Bog is mapped as CFRAM flood zone. This flood zone is associated with the Slate River but does not encroach upon the Application Site. CFRAM fluvial flood zones are also mapped downstream of the Application Site along the Figile River near Clonbullogue. More widespread flood zones are mapped near the confluence of the Slate and Figile rivers.

The OPW's National Indicative Flood Maps (NIFM) shows that some of the Application Site to be located in Fluvial Flood Zone A and B, associated with flooding along the Figile River and its tributaries. Flood zones mapped along the Figile River as it flows between Glashabaun North and Codd 2 bogs to the north and Derrybrennan, Glashabaun South, Blackriver and Codd 1 bogs to the south. Flood zones are also mapped along some tributaries of the Figile River including the Lullymore East and Lullybeg Streams. For the most part the medium probability flood zones do not encroach any significant distance from the mapped river/stream channels. However some of the lower peat fields are mapped to flood in Codd 1 and Derrybrennan bogs. Meanwhile, the low probability flood zones cover large area of Glashabaun North and Blackriver bogs.

However, the vast majority of the Application Site is mapped outside of the 1 in 100-year and 1 in 1,000 year flood zones and is deemed to be at low risk of fluvial flooding (Fluvial Flood Zone C).

The GSI's Winter 2015/2016 Surface Water Flood Map records the flood zones during this flood event which was the largest flood event in record in many areas. This flood map records areas of surface water flooding within Codd 1, the eastern section of Ballydermot North, the western section of Glashabaun North, with smaller localised flooding mapped in Lodge, Derrybrennan, Blackriver and Lullymore bogs.

Site walkover surveys indicate that the surface of the cutover bog contains an extensive network of peat drains with surface water outflows from the bog. This existing drainage network has reduced the risk of pluvial flooding across much of the Application Site.

8.4.6 Surface Water Quality

8.4.6.1 EPA Biological Q-Rating Monitoring

The Biological Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from 0-1 (Poor) to 4-5 (Good/High). EPA Q-rating monitoring (i.e. biological monitoring data) of river waterbodies began in the early 1970s and continues to the present day. The result of this monitoring provides an indication of water quality trends in the streams and rivers downstream of the Application Site.

8.4.6.1.1 *Pre-1988*

Prior to July 1988, historic Q-data is available from 1971 to 1986 for the Figile, Slate and Boyne rivers in the vicinity and downstream of the Application Site. Table 8-10 shows that the historic Q-values ranged from Q1 (Bad Status) to Q5 (High Status) during this time period.

Within the Figile_SC_010 river sub-catchment, Q-ratings are available for this period on the Figile River in the vicinity of the Application Site at Cushaling Bridge (Station Code: RS14F010100) and at Kilcumber Bridge (Station ID: RS14F010200). The Figile River achieved a Q3-4 rating (Moderate Q-status) at both of these stations in 1986. There are no Q-ratings available for watercourses upstreams of the Application Site for the period predating 1988.

Within the Figile_SC_20 river sub-catchment, EPA Q-ratings are available on the Figile River at Clonbulloge (RS14F010300). During this period Q-rating at this station ranged from Q3-4 (Moderate Q-status) in 1975 to Q4 (Good Q-status in 1986). Further downstream at Ardra Bridge (Station Code: RS14F010500) near Bracknagh, the status ranged from Q4 (Good Q -status) in 1976 and 1986 to Q5 (High Q-status) in 1979.

Within the Slate_SC_10 river sub-catchment, the Q-rating of the Slate River at Agar Bridge (Station ID: RS14S010100) ranged from Moderate Q-status in 1985 to High Q-status in 1978 and 1980. The Slate River 100m upstream of Spencer Bridge in Rathangan (Station ID: RS14S010200) achieved a Q-rating of Q3-4 (Moderate Q-status) in 1976 and 1985 and Q4 (Good Q-status) in 1978 and 1980. The Slate River 100m downstream of Spencer Bridge (Station ID: RS14S010210) achieved Q-rating of Q1(Bad Q-status) in 1976, Q3 (Poor Q-status) in 1978 and Q4 (Good Q-status) in 1980 and 1985. Further downstream and upstream of its confluence with the Figile River, the Slate River (Station ID: RS14S010300) achieved a Q-rating of Q3-4 (Moderate Q-status) in 1976 and 1985, Q4-5 (High Q-status) in 1978 and Q4 (Good Q-status) in 1980.

Within the Boyne_SC_10 river sub-catchment, the River Boyne at River Bridge (Station ID: RS07B040100), upstream of the Application Site, achieved Q-rating of Q3-4 (Moderate Q-status) in

1981. The River Boyne at Boyne Bridge (Station ID: RS07B040200), downstrem of the Application Site, achieved a Q-rating of Q3-4 (Moderate Q-status) in 1973 and 1975, Q3 (Poor Q-status) in 1977 and Q4 (Good Q-status) in 1979 and 1981.

The available Q-rating data does not indicate any signficant detioration in water quality during the period prior to July 1988.

Table 8-10: EPA Q-Rating Status (Pre-1988)

River	Station ID	Location	EPA Q-Ratings				
Figile_SC_010 river sub-catchment							
Figile River	RS14F010100	Cushaling Bridge	1986 – Q3-4				
Figile River	RS14F010200	Kilcumber Bridge	1986 – Q3-4				
Figile_SC_020 river sub-catchment							
Figile River	RS14F010300	Bridge in Clonbullogge	1975 -Q3-4	1976 – Q4	1979 – Q4	1986 – Q4	
Figile River	RS14F010500	Ardra Bridge	1976 – Q4	1979 – Q5	1986 – Q4		
Slate_SC_010 river sub-catchment							
Slate River	RS14S010100	Agar Bridge	1976 – Q4	1978 – Q5	1980 – Q4-5	1985 – Q3-4	
Slate River	RS14S010200	Slate - 100m u/s Spencer Bridge	1976 – Q3-4	1978 – Q4	1980 – Q4	1985 – Q3-4	
Slate River	RS14S010210	Slate - 100m d/s Spencer Bridge	1976 – Q1	1978 – Q3	1980 – Q4	1985 – Q4	
Slate River	RS14S010300	River Bridge	1976 – Q3-4	1978 – Q4-5	1980 – Q4	1985 – Q3-4	
Boyne_SC_010 river sub-catchment							
Boyne River	RS07B040100	River Bridge	1981 – Q3-4				
Boyne River	RS07B040200	Boyne Bridge	1973 – Q3-4	1975 – Q3-4	1977 – Q3	1979 – Q4	1981 – Q4

8.4.6.1.2 *July 1988 Baseline*

Biological Q-rating data is not specifically available for the year of 1988 at all EPA monitoring locations in the vicinity and downstream of the Application Site. This is to be expected as the EPA do not complete annual monitoring but rather across intervals of several years. Therefore, for locations where no monitoring was completed in 1988, the Q-ratings from other years was taken as the baseline Q-rating. This is specified in Table 8-11.

Within the Figile_SC_010 river sub-catchment, the Figile River was assigned a Q-rating of Q3-4 (Moderate Q-status) at Cushaling Bridge (Station ID: RS14F010100) and Kilcumber Bridge (Station ID: RS14F010200) in 1986.

Within the Figile_SC_020 river sub-catchment, The Figile River at a bridge in Clonbulloge (Station ID: RS14F010300), at Derrygarran Bridge (Station ID: RS14F010400) and at Ardra Bridge (Station ID: RS14F010500) achieved Q4 (Good Q-status) in 1986.

Within the Slate_SC_010 river sub-catchment, the Slate River achieved a Q3-4 rating (Moderate Q-status) at Agar Bridge (Station ID: RS14S010100), 100m upstream of Spencer Bridge (Station ID: RS14S010200) and upstream of its confluence with the Figile River (Station ID: RS14S010300) in 1985.

The Slate River 100m downstream of Spencer Bridge (Station ID: RS14S010210) achieved a Q4 Rating (Good Q-status) in 1985.

Within the Boyne_SC_010 river sub-catchment, the River Boyne River was assigned a Q-rating of Q4 (Good Q-status) upstream of the Application Site at River Bridge (Station ID: RS07B040100), and downstream of the Application Site Boyne Bridge (Station ID: RS07B040200) and Kinnafad Bridge (Station ID: RS07B040300) in 1986. Note that by 1988, all drainage within Ticknevin Bog was directed to settlement ponds, located at the south of the bog which discharged to the Codd Stream, a tributary of the Figile River. There was no discharge to the River Boyne or any of its tributaries.

Table 8-11: Baseline (July 1988) Q-ratings

River	Station ID	Location	EPA Q-Ratings
Figile_SC_010 river sub-catchment			
Figile River	RS14F010100	Cushaling Bridge	1986 – Q3-4
Figile River	RS14F010200	Kilcumber Bridge	1986 – Q3-4
Figile_SC_020 river sub-catchment			
Figile River	RS14F010300	Figile - Bridge in Clonbulloge	1986 – Q4
Figile River	RS14F010400	Derrygarran Bridge	1986 – Q4
Figile River	RS14F010500	Ardra Bridge	1986 – Q4
Slate_SC_010 river sub-catchment			
Slate River	RS14S010100	Agar Bridge	1985 – Q3-4
Slate River	RS14S010200	Slate - 100 m u/s Bridge near Spencer Br	1985 – Q3-4
Slate River	RS14S010210	Slate - 100 m d/s Bridge near Spencer Br	1985 – Q4
Slate River	RS14S010300	River Bridge	1985 – Q3-4
Boyne_SC_010 river sub-catchment			
Boyne River	RS07B040100	River Bridge	1986 – Q4
Boyne River	RS07B040200	Boyne Bridge	1986 – Q4
Boyne River	RS07B040300	Kinnafad Bridge	1986 – Q4

8.4.6.1.3 Peat Extraction Phase (July 1988 – June 2020)

EPA Q-rating monitoring has been completed at several dates and at multiple locations on the Figile, Slate and Boyne rivers in the vicinity and downstream of the Application Site during the Peat Extraction Phase (July 1988 to June 2020). The Q-values over this period are summarised in Table 8-12.

Within the Figile_SC_010 river sub-catchment, the Figile River upstream of the Application Site at a bridge southwest of Killeaskin (Station ID: RS14F010010) achieved a Q-Rating of Q2-3 to Q3 (Poor Q-status) in 1989, 1993 and 2019. The Q-status of the Figile River at a bridge south of Ticknevin Bridge (Station ID: RS14F010050), also upstream of the Application Site, ranged between Q1 (Bad Q-Status) to Q3 (Poor Q-Status) during the Peat Extraction Phase. This data indicates that the water quality upstream of the Application Site was poor. In the vicinity of the Application site, the status of the Figile River at Cushaling Bridge (Station ID: RS14F010100) ranged between Q2 (Bad Q-status) and Q3-4

(Moderate Q-status). At Kilcumber Bridge (Station ID: RS14F010200) the status ranged between Q3 (Poor Q-status) and Q3-4 (Moderate Q-status).

Within the Figile_SC_020 river sub-catchment, the status of the Figile River at Clonbulloge (Station ID: RS14F010300) ranged from Q3-4 (Moderate Q-status) to Q4-5 (High Q-status). The status of the Figile River at Derrygarran Bridge (Station ID: RS14F010400) ranged from Q3 (Poor Q-status) to Q4 (Good Q-status) whilst at Ardra Bridge (Station ID: RS14F010500) the Q-rating ganged from Q3-4 (Moderate Q-status) to Q4(Good Q-status).

Within the Slate_SC_010 river sub-catchment, the Q-rating of the Slate River upstream of the Application Site at Quigley's Bridge (Station ID: RS14S010020) ranged between Q2 (Bad Q-status) and Q3 (Poor Q-status), whilst at Ford Bridge (Station ID: RS14S010050) the Q-rating ranged from Q2-3 and Q3 (Poor Q-status). Downstream of the Application Site, the Q-rating of the Slate River at Agar Bridge (Station ID: RS14S010100) ranged between Q3 (Poor Q-status) and Q3-4 (Moderate Q-status). Further downstream, the Q-rating ranged from Q-Rating of Q3-4 (Moderate Q-status) to Q4 (Good Q-status) 100m upstream of Spencer Bridge (Station ID: RS14S010200). At River Bridge (Stations ID: RS14S010300) the Q-status ranged between Q3-4 (Moderate Q-status) and Q4 (Good Q-status).

Within the Boyne_SC_010 river sub-catchment, the Q-rating of the River Boyne upstream of the Application Site ranged between Q3 (Poor Q-Status) and Q4 (Good Q-status). Downstream of the Application Site (Station ID: RS07B040200) the status of the River Boyne ranged between Q2-3 (Poor Q-status) and Q4 (Good Q-Status). At Kinnafad Bridge (Station ID: RS07B040300) the Q-status ranged between Q1 (Bad Q-status) and Q3 (Poor Q-status). During the Peat Extraction Phase there was no discharge to the River Boyne or any of its tributaries.

Table 8-12: Summary of Q-Ratings During the Peat Extraction Phase (July 1988 – June 2020)

River	Station ID	Location	EPA Q-Rating (Years)	Q-Value Status Range	
Figile_SC_010 river sub-catchment					
Figile River	RS14F010010	Figile - Bridge SW of Killeaskin	2.5 – 3 (1989 – 2019)	Poor	
Figile River	RS14F010050	Bridge S of Ticknevin Bridge	1 – 3 (1989 – 2020)	Bad	Poor
Figile River	RS14F010100	Cushaling Bridge	2 – 3.5 (1989 – 2020)	Bad	Moderate
Figile River	RS14F010200	Kilcumber Bridge	3 – 3.5 (1989 – 2020)	Poor	Moderate
Figile_SC_020 river sub-catchment					
Figile River	RS14F010300	Figile - Bridge in Clonbulloge	3.5 – 4.5 (1989 – 2020)	Moderate	High
Figile River	RS14F010400	Derrygarran Bridge	3 – 4 (1989 – 2020)	Poor	Good
Figile River	RS14F010500	Ardra Bridge	3.5 – 4 (1989 – 2020)	Moderate	Good
Slate_SC_010 river sub-catchment					
Slate River	RS14S010020	Quigley's Bridge	2 – 3 (1989 – 2020)	Bad	Poor
Slate River	RS14S010050	Ford Bridge	2.5 – 3 (1989 – 2020)	Poor	
Slate River	RS14S010100	Agar Bridge	3 – 3.5 (1989 – 2020)	Poor	Moderate
Slate River	RS14S010150	E Bridge Rathangan (Opp Church)	3.5 – 4 (1997 – 2020)	Moderate	Good
Slate River	RS14S010200	Slate - 100 m u/s Bridge near Spencer Br	3.5 – 4 (1989 – 1993)	Moderate	Good

River	Station ID	Location	EPA Q-Rating (Years)	Q-Value Status Range	
Slate River	RS14S010210	Slate - 100 m d/s Bridge near Spencer Br	3 – 3.5 (1989 – 2020)	Poor	Moderate
Slate River	RS14S010300	River Bridge	3.5 – 4 (1989 – 2020)	Moderate	Good
Boyne_SC_010 river sub-catchment					
Boyne River	RS07B040100	River Bridge	3 – 4 (1990 – 2003)	Poor	Good
Boyne River	RS07B040200	Boyne Bridge	2.5 – 4 (1990 – 2020)	Poor	Good
Boyne River	RS07B040300	Kinnafad Bridge	1.5 – 3.5 (1994 – 2020)	Bad	Moderate

8.4.6.1.4 *EPA Q-Ratings During Current Phase (June 2020 - Present)*

The most recent Q-rating data for EPA monitoring points on the Figile, Slate and Boyne rivers are shown in Table 8-13 below.

Within the Figile_SC_010 river sub-catchment, the Figile River achieved a Q2-3 rating (Poor Q-status) upstream of the Application Site at Ticknevin Bridge (Station Code: RS14F010050) and a Q3-4 rating (Moderate Q-status) downstream at Cushaling Bridge (Station Code: RS14F010100) and at Kilcumber Bridge (Station ID: RS14F010200) of the Application Site in 2023.

Within the Figile_SC_020 river sub-catchment, the Figile River achieved a Q3 rating (Poor Q-status) downstream of the Application Site in Clonbullogge (Station Code: RS14F010300) in 2024 and at also at Derrygarran Bridge (Station ID: RS14F010400) in 2023.

Within the Slate_SC_010 river sub-catchment, the Slate River achieved a Q3 rating (Poor Q-status) upstream of the Application Site at Quigley's Bridge (Station Code: RS14S010020) and at Ford Bridge (Station ID: RS14S010050). Downstream of the Application Site the Slate River achieved a Q3-4 rating (Moderate Q-status) at Agar Bridge (Station Code: RS14S010100), at a bridge opposite the church in Rathangan (Station ID: RS14S010150), 100m downstream of Spencer Bridge (Station ID: RS14S010210) and upstream of its confluence with the Figile River (Station ID: RS14S010300) in 2023.

Within the Boyne_SC_010 river sub-catchment, the River Boyne achieved a Q3-4 rating (Moderate Q-status) downstream of the Application Site at Boyne Bridge (Station Code: RS07B040200) and at Kinnafad Bridge (Station ID: RS07B040300) in 2024. During the Current Phase there was no discharge to the River Boyne or any of its tributaries.

A map of EPA monitoring locations for the most recent round of monitoring is shown as Figure 8-9.

Table 8-13: Most Recent (2021-2024) Q-ratings downstream of the Application Site

River	Station ID	Location	EPA Q-Rating (Year)	Q-Value Status
Figile_SC_010 river sub-catchment				
Figile River	RS14F010050	Bridge S of Ticknevin Bridge	2023	Q2-3 (Poor)
Figile River	RS14F010100	Cushaling Bridge	2023	Q3-4 (Moderate)
Figile River	RS14F010200	Kilcumber Bridge	2023	Q3-4 (Moderate)
Figile_SC_020 river sub-catchment				
Figile River	RS14F010300	Figile - Bridge in Clonbullogge	2024	Q3 (Poor)

River	Station ID	Location	EPA Q-Rating (Year)	Q-Value Status
Figile River	RS14F010400	Derrygarran Bridge	2023	Q3 (Poor)
Slate_SC_010 river sub-catchment				
Slate River	RS14S010020	Quigley's Bridge	2023	Q3 (Poor)
Slate River	RS14S010050	Ford Bridge	2023	Q3 (Poor)
Slate River	RS14S010100	Agar Bridge	2023	Q3-4 (Moderate)
Slate River	RS14S010150	E Bridge Rathangan (Opp Church)	2023	Q3-4 (Moderate)
Slate River	RS14S010210	Slate - 100 m d/s Bridge near Spencer Br	2023	Q3-4 (Moderate)
Slate River	RS14S010300	River Bridge	2023	Q3-4 (Moderate)
Boyne_SC_010 river sub-catchment				
Boyne River	RS07B040200	Boyne Bridge	2024	Q3-4 (Moderate)
Boyne River	RS07B040300	Kinnafad Bridge	2024	Q3-4 (Moderate)

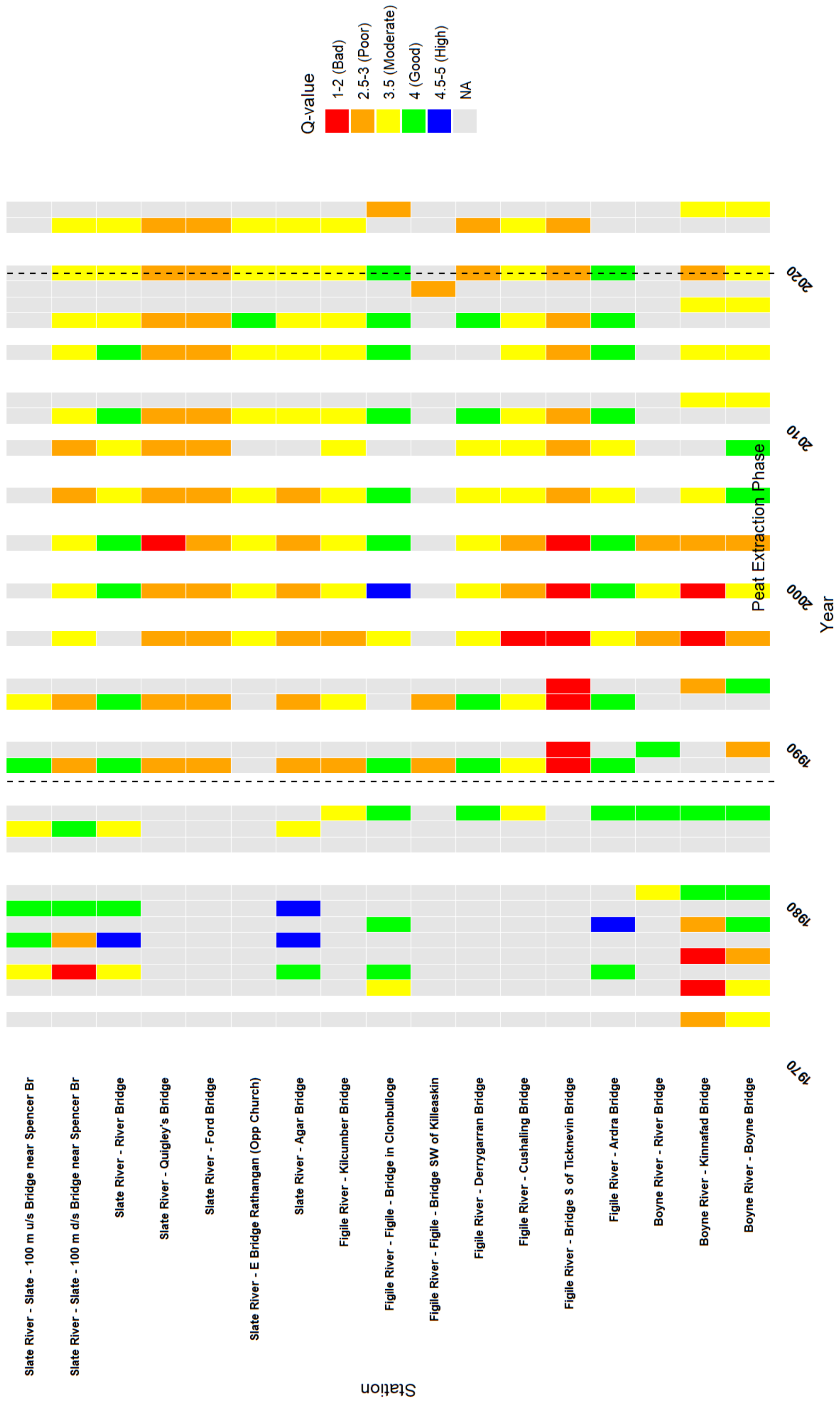

Figure 8-8: Biological Q-Rating Changes through time

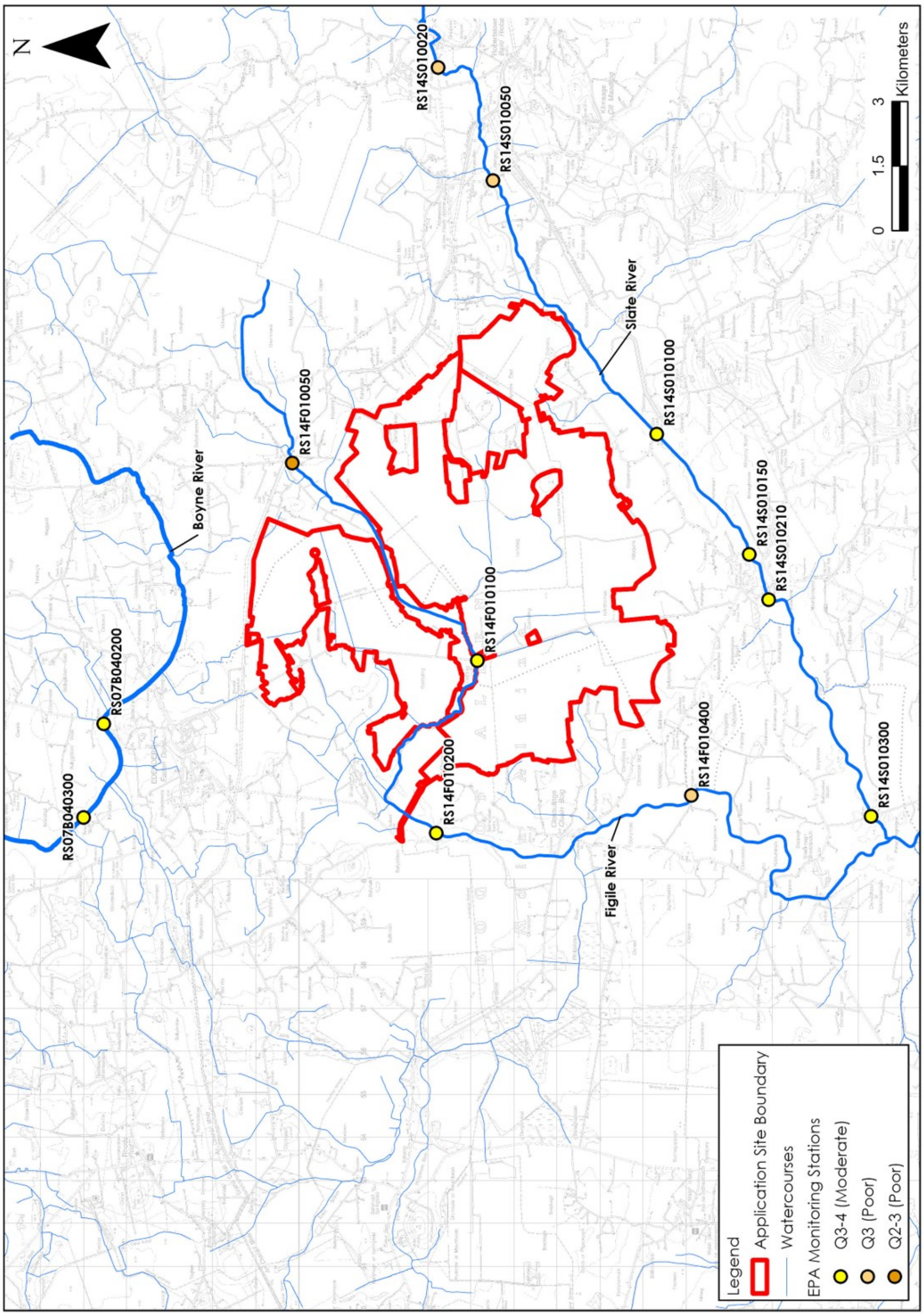

Figure 8-9: EPA Monitoring Locations

8.4.6.2 BnM Monitoring

8.4.6.2.1 *Pre - 2000*

Before the implementation of the IPC Licence requirements and associated monitoring discussed in Section 8.4.6.2.2 below, limited monitoring of surface water quality and emissions was completed at the Application Site by the Applicant.

However, as discussed in Chapter 4 several mitigation measures designed to protect surface water quality were in place prior the IPC Licence. These measures related to the storage and maintenance of vehicles, refuelling procedures, the maintenance of internal drains, pumps and waste management. No records of surface water quality monitoring exist from this time period.

Silt ponds were constructed at the Application Site in the mid-1980s, with no water/silt control measures present before this date. These silt ponds were constructed with an upper design limit of 100mg/l of suspended sediment.

8.4.6.2.2 *IPC Licence Monitoring (2000-Present)*

The Applicant has been conducting monitoring of emissions to water from the Allen Bog Group from 2000 to the present as set out in IPC Licence P0503-01. Annual monitoring was not completed at the Application Site, as the monitoring was rotated between the different bogs which comprise the larger Allen Bog Group. However, monitoring data from the Application Site is available for 26 no. years between 2000 and 2025. A summary of the results is presented in Table 8-14.

Stormwater (i.e. rainwater run-off from roof and non-process areas such as carparks) derived on-site is released into a local waterbody following basic treatment. The IPC licence requires that stormwater (from roof and non-process areas such as carparks) is managed to ensure that no pollutants are released into the receiving environment. Where run-off comprises of only roof water it is directed directly to a drain. Runoff from other areas such as carparks is passed through a hydrocarbon interceptor before discharge. Discharges (from roof and non-process areas such as carparks) are inspected and sampled on a monthly basis. The primary treatment criteria used to define adequate treatment of stormwater is COD mg/l. Monthly sampling was completed with results being generally well below the COD trigger levels. Occasionally elevated concentrations occurred when machinery had been washed down immediately prior to sampling and subsequent results returned to satisfactory levels.

The IPC licence has also required that wastewater at the Application Site be managed to ensure no pollution results when wastewaters were discharged into local surface waterbodies. Two types of wastewaters were produced at the Application Site: process wastewater from the activities associated directly with peat extraction operations, and sanitary wastewater from toilets and canteens. All process wastewater from peat extraction areas is treated via a silt pond drainage system which has been inspected and maintained in accordance with Condition 6 of the IPC Licence (P0503-01). Treated wastewater is released into the Ballygarrett, Cloncant, Lullybeg, Killinagh Upper and an unnamed stream. IPC Licence requirements comprise of quarterly grab samples on a select number of silt pond outlets across the Allen Bog Group.

A total of 226 no. grab samples have been taken at the outfalls from the Application Site (between Q4 2000 and Q2 2025). These samples have been analysed for COD, pH, Ammonia, Total Phosphorous, Suspended Solids, Total Solids and Colour. The emission limit values are 35mg/l suspended solids, 3.7mg/l total ammonia, and 100mg/l COD.

As shown in Figure 8-10, 3 no. exceedances have been recorded above the IPC Licence trigger limit of 3mg/l total Ammonia from the available data. Concentrations of ammonia ranged from 0.017 to 27mg/l, with an average of 0.96mg/l.

As shown in Figure 8-11, the concentrations of suspended solids ranged from 2 to 92mg/l, with an average concentration of 9.54mg/l. A total of 6 no. exceedances are reported for the period from 2000-2025 which comprised a total of 226 no. samples. However, these exceedances are outliers with 97.34% of all data being well below the 35mg/l threshold.

As shown in Figure 8-12, 9 no. exceedances of COD have been recorded in outfalls from the Application Site. The mean concentration of COD lies below the IPC Limit of 100mg/l. The mean concentration of COD was 75.42mg/l. Reduced flow and increased temperature can influence COD concentrations.

Other parameters recorded during the sampling included ortho-phosphate and pH. Total phosphorus remained relatively stable across the monitoring period and with concentrations ranging from 0.05 to 0.19. pH values were generally within the recommended 6 – 9 range. No pH values were outside of this range. pH values emanating from peat extraction areas remain relatively constant and in line with background levels.

8.4.6.2.3 *Incidents Reporting*

The EPA Leap Database (https://leap.epa.ie/licence-profile/P0503) records a total of 6 no. incidents relating to surface water quality at the Application site between 2019 and 2025. 5 of these incidents related to the exceedance of the 100mg/l trigger level for COD. The exceedances were recorded at Ballydermot Bog (116mg/l in February 2019), Glashabaun South (SW49 – 125mg/l in September 2020), Glashabaun South (SW51 and SW52 – 102 and 106mg/l in April 2022) and Codd 1 (SW45 – 228mg/l in January 2024). There was also an incident reported with respect to the beaching of the 3mg/l trigger level for ammonia at Lullybeg Bog (SW56 – 3.9mg/l) in February 2019. These incidents are all categorised as “minor” with the cause of the incidents listed as being either unknown or due to adverse weather. The impact on the environment is listed on the Leap database as “no impact”. No additional significant incidents or contamination events were recorded in the AERs.

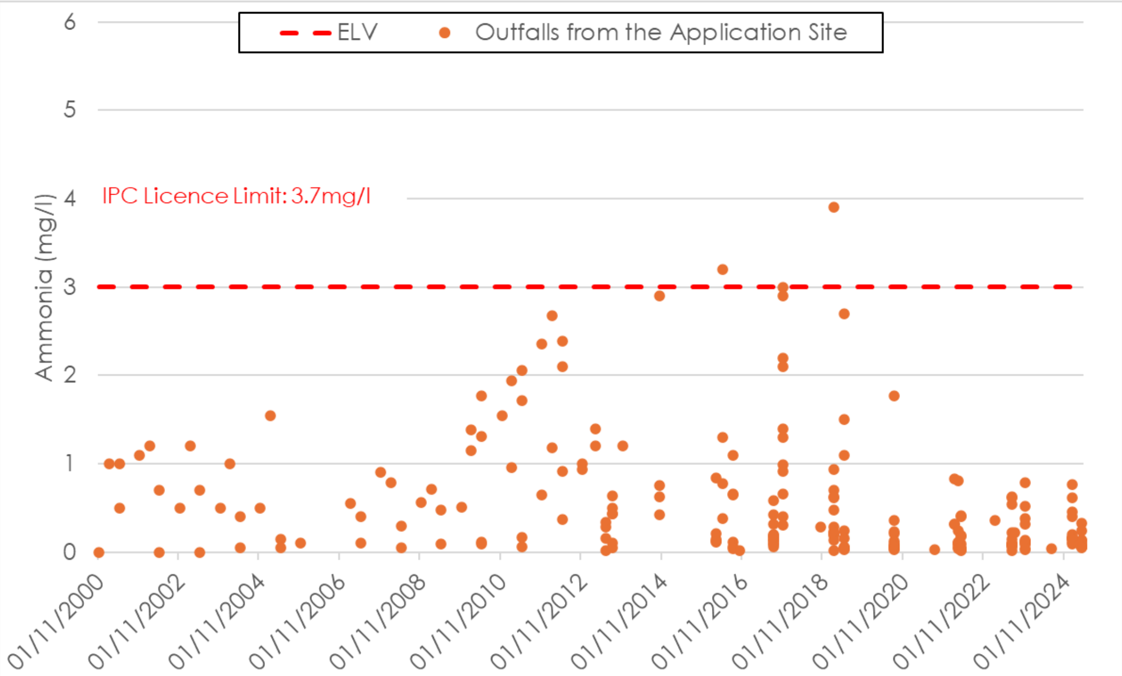

Figure 8-10: Bord na Móna Ammonia Monitoring (2000-2025)

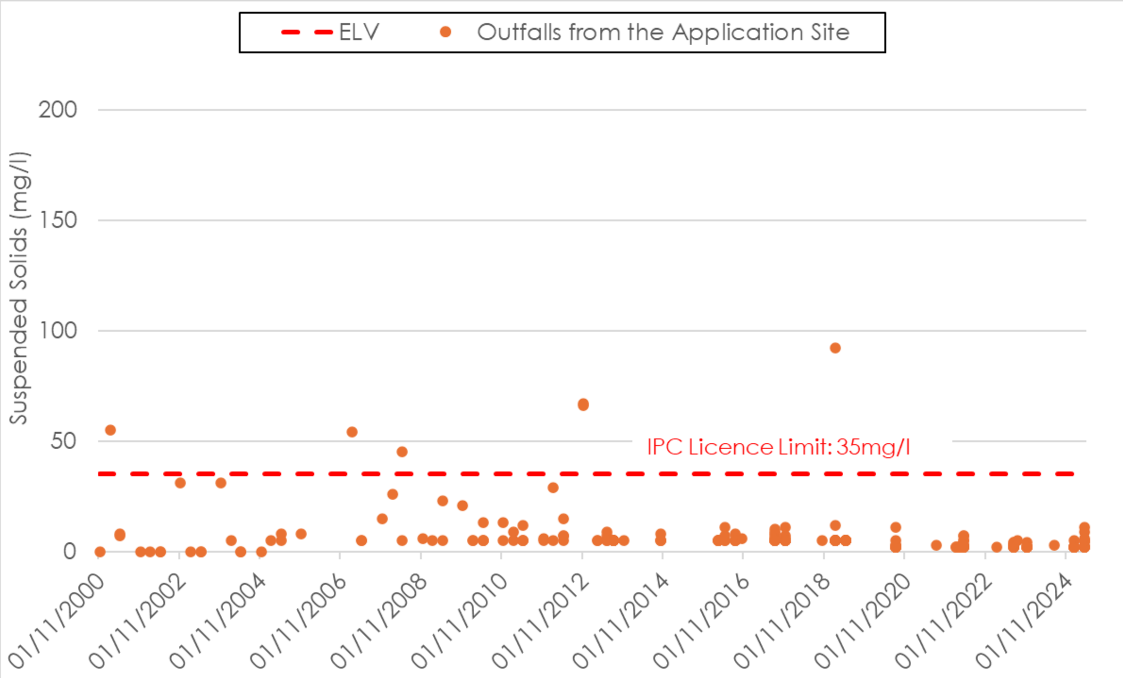

Figure 8-11: Bord na Móna Suspended Solids Monitoring (2000-2025)

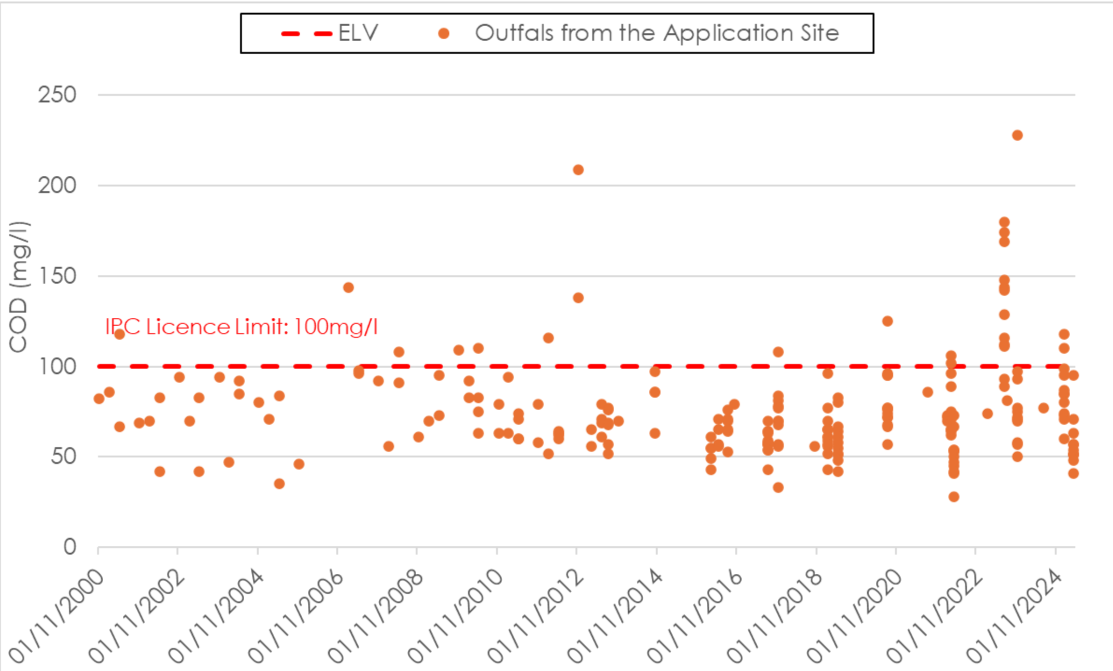

Figure 8-12: Bord na Móna COD Monitoring (2000-2024)

Table 8-14: Bord na Móna water quality monitoring data (2000-2025)

Application Site	COD (mg/L)	pH [H+]	Ammonia (mg/L)	Total Phosphorous (mg/L)	Suspended Solids (mg/L)
Range	28 – 228	6.2 – 8.8	0.017 – 27	0.05 – 0.19	2 – 92
IPC Licence Limit	100	6 – 9	3	-	35
n - (number of sample results)	226	226	226	226	226
No. Exceedances	9	0	3	N/A	6
% Compliant	96.02%	100%	98.67%	N/A	97.35%

8.4.6.3 HES Surface Water Quality Monitoring (2021 - 2026)

Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at 15 no. surface water sampling locations on 01st April 2021, 11th December 2025 and 15th May 2026. The results of the field hydrochemistry are listed in Table 8-15. The monitoring locations cover a range of watercourses, from bog outfall and drainage channels to larger watercourses such as the Slate and Figile rivers. and are shown on Figure 8-13.

The surface water samples indicate a basic type surface water, with pH ranging from 7.02 to 8.14. Dissolved oxygen ranged from 5.76 to 13.39mg/l, specific electrical conductivity ranged from 169 to 801µS/cm, turbidity ranged from <0.01 to 90.1 NTU and temperate ranged from 7.8 to 11.7°C.

Table 8-15: Field Parameters - Summary of Surface Water Chemistry Measurements (01/04/2021, 11/12/2025 and 15/05/2026)

Location ID	Temp °C	DO (mg/l)	SPC (µS/cm)	pH	Turbidity
SW1	8.5 – 11.3	8.72 – 13.39	286 – 572	7.8 - 8.1	1.97 – 8.54
SW2	9 – 10	8.75 – 12.39	589 – 776	7.5 - 8.1	<0.01 – 2.85
SW3	8.4 – 11.3	10.24 – 11.08	287.3 – 542	7.81 – 8.02	0.96 – 23.3
SW4	7.8 – 8.6	10.21 – 10.94	288 – 478	7.55 - 7.71	0.73 – 6.4
SW5	8.4 – 11.6	9.25 – 10.31	277 – 534	7.72 – 7.88	1.33 – 4.7
SW6	8.7 – 10	8.2 – 10.52	321 – 712	7.56 - 7.77	1.4 – 5.07
SW7	9.2 – 11.7	9.48 – 10.1	263 – 637	7.47 – 7.93	0.87 – 6.03
SW8	8.9 – 10.5	5.76 – 9.9	299 – 569	7.36 - 7.61	2.54 – 90.1
SW9	9.1 – 9.8	6.4 – 10.78	667 – 801	7.45 - 7.65	4.71 – 38.1
SW10	9.1 – 10.8	8.18 – 10.89	578 – 710	7.31 – 8.14	1.77 – 13.9
SW11	9.1 – 10.6	7.87 – 10.37	169.1 – 638	7.02 – 7.99	1.29 – 7.3
SW12	8.7 – 9.7	8.23 – 10.42	475 – 719	7.54 – 7.84	2.5 – 8.75
SW13	8.3 – 12.1	9.7 – 9.81	472 – 702	7.77 – 8.07	2.73 – 6.52
SW14	8.2 – 10.5	7.74 – 9.8	304 – 521	7.24 – 7.45	4.2 – 6.42
SW15	8.8 – 10.6	9.59 – 11	449 – 725	7.94 – 8.05	0.99 – 4.41

Surface water grab samples were also taken at these locations for laboratory analysis on 01st April 2021, 11th December 2025 and 15th May 2026. Results of the laboratory analysis are shown alongside relevant water quality regulations in Table 8-16 below. The laboratory reports are attached as Appendix 8-2.

Suspended solid concentrations ranged from <5 to 420mg/l. Suspended solid concentrations were below the S.I 293/1988 threshold limit of 25mg/l in all samples except for SW1, SW4 and SW8 on 01st April 2021 and SW4, SW8 and SW14 on 15th May 2026. The elevated levels of suspended solids in these samples can be attributed to disruption of the streambed during sampling, and due to the preceding heavy rainfall, which occurred prior to the May 2026 sampling.

A total of 22 of the 45 no. samples (approx. 48%) achieved 'High' status with respect to ammonia concentrations (i.e. ≤0.04mg/l). Meanwhile, 7 no samples (approx. 15%) were below the 'Good' status threshold (i.e. ≤0.065mg/l). Biological Oxygen Demand (BOD) achieved 'Good' status, in 6 no. samples, with regards to the threshold of ≤1.5mg/l. 39 no. samples (86%) achieved 'Good' status with respect to ortho-phosphate (≤0.035mg/l). Nitrate concentrations ranged from <5.0- 59.3mg/l. Chloride concentrations ranged from 10.5 to 66.2mg/l.

Elevated ammonia and BOD concentrations are considered to reflect the natural hydrochemical characteristics of the peatland catchment which these watercourse drain. Peatlands are typically rich in organic matter and dissolved organic carbon, and the decomposition of peat under waterlogged conditions can result in elevated background concentrations of ammonium and oxygen-demanding substances within receiving waters.

Table 8-16: Laboratory Data (01/04/2021, 11/12/2025 and 15/05/2026)

Location ID	Suspended Solids (mg/l)	BOD5 (mg/l)	Orthophosphate (mg/l)	Nitrate (mg/l NO3)	Ammonia (mg/l)	Chloride (mg/l)
EQS	≤25([1])	≤ 1.3 to ≤ 1.5([2])	≤ 0.035 to ≤0.025([2])	-	≤0.065 to ≤0.04([2])	-
SW1	<5 – 40	2 - 4	<0.02 – 0.02	<5 – 7	<0.02 – 0.2	12 - 12.9
SW2	<5 – 12	1 – 8	<0.02 – 0.03	<5.0 – 17.8	0.03 – 0.2	14 – 66.2
SW3	<5 – 18	2 – 4	<0.02 – 0.02	<5 – 23.8	0.07 – 0.12	11.1 – 15.2
SW4	<5 – 420	<5 – 10	<0.10 – 0.33	<5.0 – 6.6	0.03 – 0.07	10.8 – 18.4
SW5	<5 - 15	2 - 9	<0.02 – 0.02	<5 – 24.6	<0.02 – 0.12	9.1 – 18.6
SW6	<5 – 21	1 – 9	0.02 – 0.03	<5 – 32.9	0.02 – 0.11	17.6 – 18.6
SW7	5 – 8	2 – 5	0.02 – 0.03	<5.0 – 11.5	0.02 – 0.23	13.6 – 17.6
SW8	<5 – 347	2 – 24	<0.02 – 0.03	<5.0 – 6.3	0.12 – 0.58	9.1 – 13.2
SW9	<5 – 9	<5 – 8	0.02 – 0.24	5.3 – 59.3	0.08 – 1.16	12.3 – 27.6
SW10	<5 – 14	<2 - 2	<0.02 – 0.03	6.1 – 14.2	<0.02 – 0.39	22.5 – 26.4
SW11	<5 - 6	2 - 4	<0.02 – 0.03	<5.0 – 12.4	0.03 – 0.12	13.6 – 16.6
SW12	<5 – 12	1 – 4	<0.02 – 0.03	<5 – 11.9	0.04 – 0.11	12 – 23.2
SW13	<5 – 7	2 – 4	<0.02 – 0.04	7.8 – 14.2	0.03 – 0.12	17.2 – 34.2
SW14	<5 – 27	2 – 4	<0.02 – 0.3	<5.0 – 16.4	0.03 – 0.56	13 – 27

[1] *S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations*
[2] *S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy).*

Location ID	Suspended Solids (mg/l)	BOD5 (mg/l)	Orthophosphate (mg/l)	Nitrate (mg/l NO3)	Ammonia (mg/l)	Chloride (mg/l)
SW15	<5 – 6	1 – 5	<0.02 – 0.02	10.2 – 13.3	<0.02 – 0.06	15.6 – 16.6

(+) S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations, 1988.
(*) S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended).

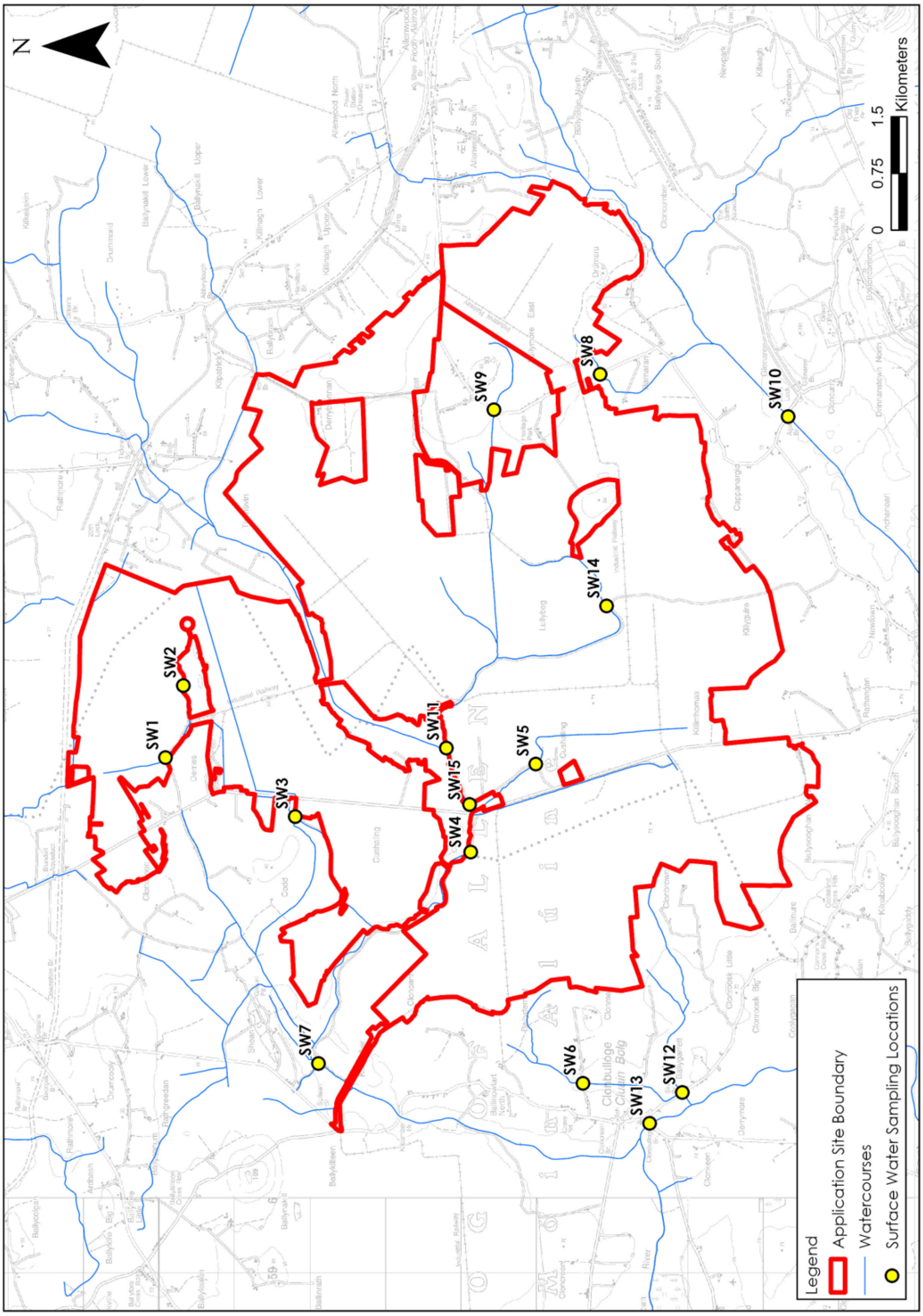

Figure 8-13: HES Surface Water Sampling Locations (2021-2025/2026)

8.4.7 Hydrogeology

8.4.7.1 Regional Hydrogeology

As stated in Section 7.3.5.1 of Chapter 7, the Application Site is underlain by several mapped bedrock geological formations including the Lucan Formation, Ballyadams Formation, Allenwood Formation, Waulsortian Limestones and Boston Hill Formation. The Lucan Formation is classified as Locally Important Aquifer - Bedrock which is Generally Moderately Productive (Lm) and Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll). The Ballyadams Formation is classified as Regionally Important Aquifer - Karstified (diffuse) (Rkd) and the Waulsortian Limestones and Boston Hill Formation are classified as Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll). A bedrock geology aquifer map is attached as Figure 8-14.

In terms of Groundwater Bodies (GWBs), the western part of the Application Site is mapped within the Cushina GWB (IE_SE_G_048), the central part of the Application Site is mapped within the Bagenalstown Upper GWB (IE_SE_G_153), the eastern part of the Application Site is mapped within the Kildare GWB (IE_SE_G_077) and the northern part of the Application Site is mapped within the Trim GWB (IE_EA_G_002).

The GSI's Cushina GWB Characterisation Report (GSI, 2003) states that this GWB is located in eastern Co. Offaly but also extends into counties Laois and Kildare. The topography in the area is extremely low lying to the north with some small hills in the south. In general, the land surface slopes to the centre and south of the body towards the River Figile. The boundaries of this GWB are defined by the extent of the Calp and Ballyadams Formations in this area. The boundary to the north is the topographic boundary between the South Eastern and Eastern River Basin Districts. The GWB is composed primarily of low permeability rocks, although localized zones of enhanced permeability do occur. It appears likely from investigation that the pure bedded limestones can be encountered beneath the Calp. Recharge occurs diffusely through the subsoils and via outcrops. The aquifers within the GWB are generally unconfined, but may become locally confined where the subsoil is thicker and/or lower permeability. Most flow in this aquifer will occur near the surface. In general, the effective thickness of this aquifer is likely to be about 10m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, deep water strikes in more isolated faults/ fractures can be encountered at 50-70mbgl. Regional groundwater flow is from north to south, but on a local scale, groundwater discharges to the streams and rivers crossing the aquifer. Flow path lengths are variable and will depend on the degree of karstification of the limestone and hence its purity. Groundwater discharges to the numerous small streams crossing the aquifer, and to the springs and seeps.

The GSI's Bagenalstown GWB Characterisation Report (GSI, 2003) states that the Barrow Valley has been divided into three areas (Daly & Wright 1979): (i) A recharge area along the slopes of the Castlecomer Plateau where the water table is 15 – 30mbgl. and there is an annual water level fluctuation of 10-20m. (ii) An intermediate area where the aquifer is covered by extensive till deposits of 10-20m thickness, the water table is usually within 5-15m of the surface with an annual fluctuation of less than 7.5m. Both confined and unconfined conditions exist here, depending on the subsoil. (iii) A discharge zone occurs where the aquifer comes in contact with the Barrow River either directly or through the overlying sands and gravels. Here the water table is within 5m of the surface and fluctuations will be less than 2.5m and mostly controlled by the levels in the river.

The GSI's Kildare GWB Characterisation Report (GSI, 2003) states that this aquifer is located northwest of Kildare town. The area is defined by the South Eastern River Basin District – Eastern River Basin District boundary to the northeast and elsewhere by the extent of the Waulsortian and Boston Hill formations. Recharge to the GWB will be highest in exposed areas and there may also be some flow of groundwater into the aquifer from adjacent groundwater bodies. Groundwater flow will be through a poorly developed karstic system over most of the area. The extent of the karstic development will depend partly on the nature and thickness of the overlying strata. There are numerous hydrogeological settings in the area due to the variation in subsoil (bog, till, outcrop and major gravel aquifers), the degree of structural deformation (from intense faulting in the area of Allenwood to little or none in the south) and the variety of rock type and hence aquifer types. Such variations make broad statements fallible and individual site investigation will be essential to understanding any given location of interest.

The GSI's Trim GWB Characterisation Report (GSI, 2003) states that this GWB is extends from northeast Offaly through Meath and narrows towards Navan and Slane. The area is generally low-lying with some hillier areas to the southeast. The aquifers are classified as Locally important aquifer which is generally moderately productive (Lm) and there are small areas of Regionally important karstified aquifer dominated by diffuse flow (Rkd), Locally important aquifer which is moderately productive only in local zones (LI) and Poor aquifer which is generally unproductive except for local zones (PI) aquifers. The Lm aquifer is comprised of the Edenderry Oolite and the Lucan formation. The boundaries of the GWB are defined by the extent of the Calp, which is classified as Lm, which is in turn determined by the location of a region of higher structural deformation (Dumphy 1993). The variety in the structural deformation of the rock increases the complexity of the conceptual model for the area. Firstly the area northeast of Navan including the highly fractured Lucan formation will have a different groundwater flow system than the low-lying aquifer, which comprises the remainder of the GWB. This difference in geological structure can be seen in all aspects of the conceptual model i.e. recharge, groundwater flow and discharge. The intense structural deformation in the northeast of the GWB has given rise to the development of karstic groundwater flow systems. Although karst features can be expected throughout the GWB, it is in the northeast with the more fractured bedrock where karstification will be greatest. Both point and diffuse recharge occur over the area of this GWB. Point recharge is known to occur at the contact between the non-calcareous rocks and the limestones. This form of recharge is most likely to occur over the more clean and fractured limestones. Diffuse recharge is a more widespread process occurring over the entire area of the GWB. This will be the main recharge process in the large lowland areas of this GWB. Groundwater flow will be from local areas of high recharge e.g. areas of thin subsoils in the uplands, to the main surface water bodies overlying the aquifer, such as the Boyne. Where overlying quaternary deposits consist of thick limestone tills, they can act as a confining layer, thus producing artesian supplies. This occurs, for example at Kilmoon, Dunshaughlin and Longwood public water supplies in County Meath. Discharge from the aquifer is also varied. Water will leave the aquifer in a diffuse nature as baseflow along riverbeds and also as point source at springs. The development of a karstic groundwater system has a key influence on the transportation of pollutants to receptors. Groundwater flow will be faster and more concentrated along karstic conduits.

8.4.7.2 Local Hydrogeology

The hydrogeological regime at the Application Site is characterised by high rates of surface water runoff and low rates of groundwater recharge.

The hydrogeological regime has been characterised by a comprehensive dataset which included extensive site walkover surveys and drainage mapping, the completion of 794 no. peat probes, the excavation of 62 no. trial pits (55 no. at the Application Site and 7 no. in the lands to the west of Codd 1 Bog) and the drilling of 2 no. boreholes (to the west of Codd 1 Bog). These site investigations revealed that the Application Site is overlain by low permeability peat which ranged in thickness from 0 to >6m. Approximately 90% of peat depth probes recorded peat depths of less than 3.0m. A number of localised readings were recorded where peat depths were >3.5. The peat is underlain by lacustrine clay, described as light grey to brown, soft to stiff gravelly SILT/CLAY with some cobbles and boulders . These low permeability soils/subsoils create a setting of low groundwater vulnerability whereby the underlying bedrock aquifers are protected by the overburden. The overburden restricts groundwater recharge and water leaves the Application Site as surface water runoff. Therefore, local surface waters were the primary sensitive receptor throughout the Peat Extraction Phase.

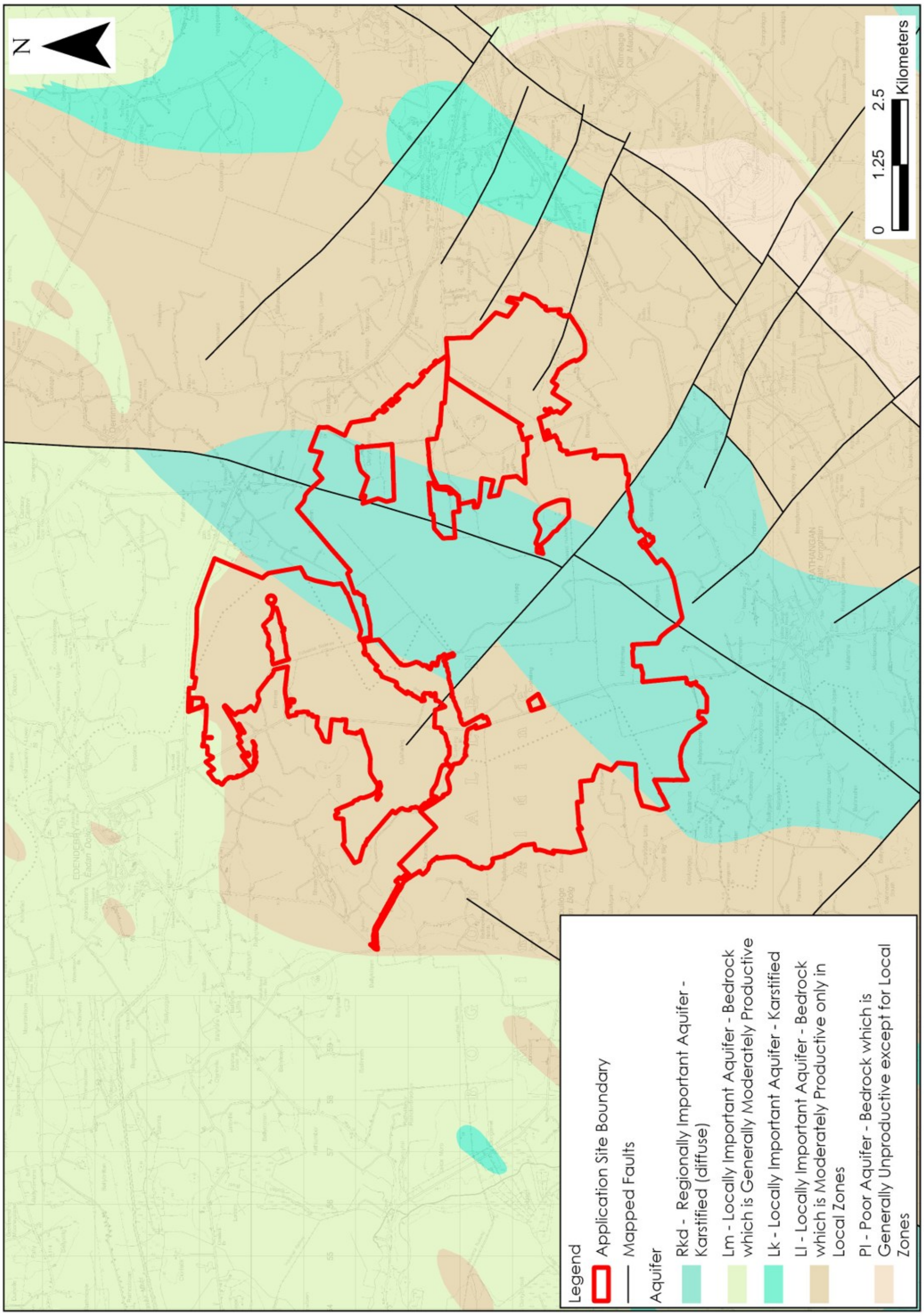

Figure 8-14: Bedrock Geology Aquifer Map

8.4.8 Groundwater Vulnerability

The GSI describe groundwater vulnerability as a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability embodies the characteristics of the intrinsic geological and hydrogeological features at a site that determine the ease of groundwater contamination. Groundwater vulnerability is related to recharge acceptance, whereby in areas where recharge occurs more readily, a higher quantity of contaminants will have access to groundwater.

The GSI mapped groundwater vulnerability rating of the bedrock aquifers underlying Application Site ranges from 'Low' to 'High'. The vast majority of the Application Site is mapped as having 'Low' and 'Moderate' groundwater vulnerability. Meanwhile, a very small, isolated pocket of 'High' groundwater vulnerability is mapped in the centre and northeast of the Application Site within the Lullybeg, Lullymore, Glashabaun South and Derrybrennan bogs.

Based on site walkover surveys and site investigations (974 no. peat probes, 62 no. trial pits (55 no. within he Application Site and 7 no. to the west of Codd 1 Bog) and 2 no. boreholes (to the west of Codd 1 Bog)), the Application Site is overlain by peat deposits with an average thickness of 1.6m. The peat is underlain by lacustrine clay, described as light grey to brown, soft to stiff gravelly SILT/CLAY with some cobbles and boulders. No bedrock was encountered in any of the trial pits excavated at the Application Site which extended to depths of 4.7mbgl. Given the presence of low permeability peat at the surface of Application Site which is in turn underlain by low permeability lacustrine clay and till, the groundwater vulnerability at the Application Site is considered to be predominantly 'Low'. Some local areas of 'Moderate' or 'High' groundwater vulnerability may occur where the overburden deposits are thin (refer to Table 8-17).

Groundwater recharge at the Application Site will be low and surface water is considered to be the main sensitive receptor. Therefore local surface water features, such as drains and streams, are more vulnerable to pollution than groundwater at the Application Site.

Table 8-17: Groundwater Vulnerability and Subsoil Permeability and Thickness (Groundwater Protection Schemes Report 1999)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable.
(2) Precise permeability values cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

8.4.9 Karst Features

Karst features are mapped by the GSI and available through the GSI online viewer (www.gsi.ie).

Groundwater vulnerability is extremely high in karst areas due to the high degree of interconnection between surface and groundwaters in these areas. The Application Site is mapped to be underlain by a Karst Aquifer - areas of Ballydermot North, Ballydermot South, Blackriver, Barnaran, Lullybeg, Lullymore, Killina, Derrybrennan, Glashabaun North and Glashabaun South bogs. However, the GSI do not map the presence of any karst features within the Application Site. Furthermore, no karst features were recorded during the site walkover surveys or site investigations (974 no. peat probes, 62 no. trial pits and 2 no. boreholes).

There are no karst features mapped within or in the immediate vicinity of the Application Site. There are a few karst features mapped to the southwest of the Application Site in the townlands of Clonbulloge and Clonkeen. The nearest Karst feature is a spring mapped ~2km west of the Ballydermot North Bog and some superficial solution features are also mapped ~2.5km west of the Ballydermot North Bog. Local GSI mapped karst features are shown in Figure 8-15.

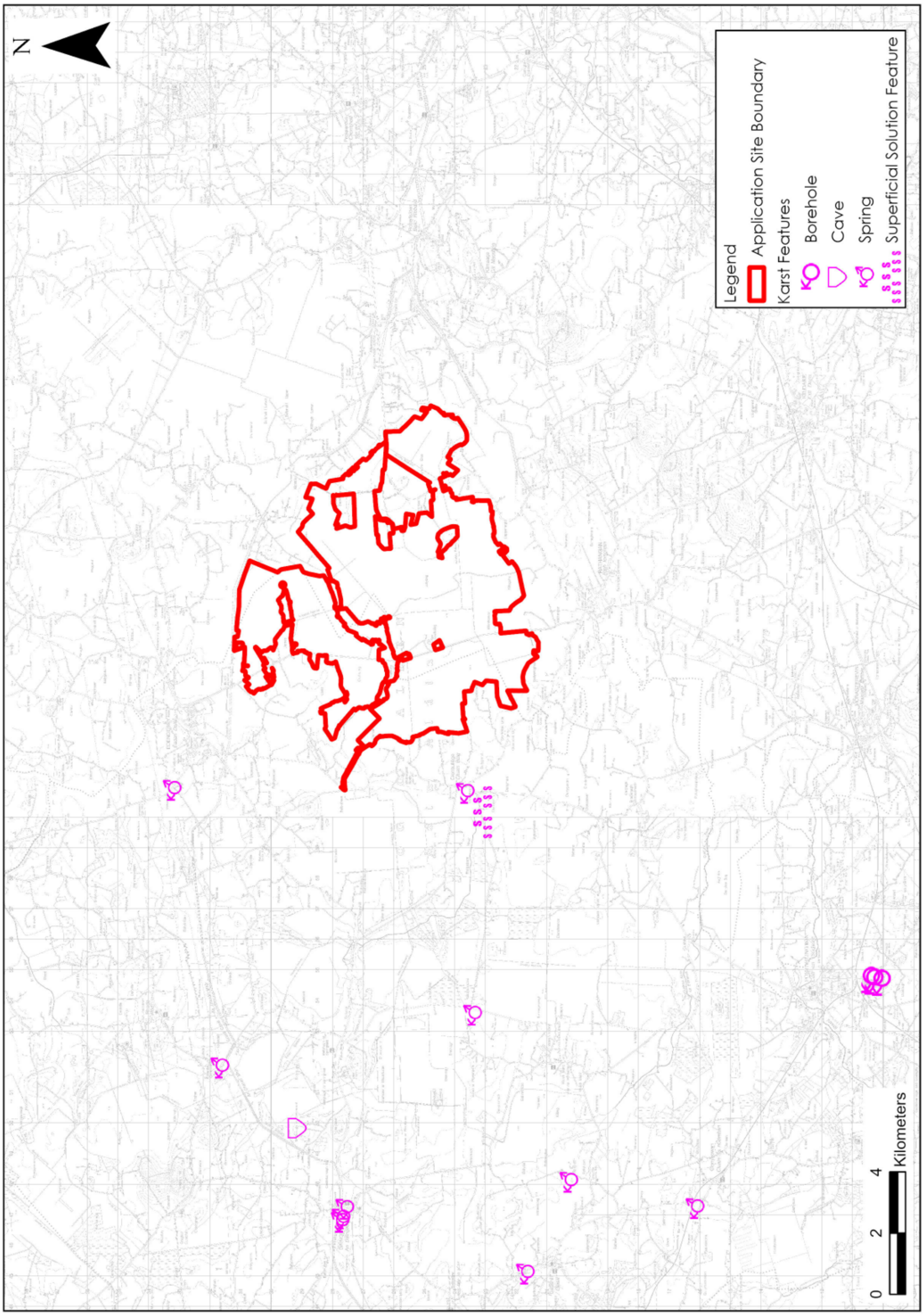

Figure 8-15: GSI Mapped Karst Features

8.4.10 Groundwater Hydrochemistry

There is no groundwater quality data for the aquifers underlying the Application Site. Groundwater sampling would generally not be undertaken during the process of peat extraction, as groundwater quality impacts would not be anticipated given the shallow nature of the peat extraction works, the presence of low permeability soils and subsoils which restrict groundwater recharge, and the low potential for groundwater dispersion and movement within the aquifer as outlined in the preceding sections. Consequently, no groundwater sampling was required as part of the IPC licence conditions for the extraction of peat at the Application Site.

The GSI's Cushina GWB Characterisation Report (GSI, 2003) states that the groundwater samples from the Lough PWS indicate a hard (350-400 mg/l CaCO3) water with a calcium bicarbonate hydrochemical signature. This reflects the fact that the groundwater feeding the boreholes has passed through limestone rock and limestone (Wright 2000).

The GSI's Bagenalstown GWB Characterisation Report (GSI, 2003) states that the bedrock strata of this aquifer are Calcareous.

The GSI's Kildare GWB Characterisation Report (GSI, 2003) states that there are both siliceous and calcareous bedrock strata in this GWB. The few details available show elevated electrical conductivity levels.

The GSI's Trim GWB Characterisation Report (GSI, 2003) states that the Durov Plot for this GWB shows that monitored sources consistently show a calcium bicarbonate hydrochemical signature. Values for electrical conductivity throughout the GWB range from 500 to 800µS/cm, with moderately hard to very hard waters with alkalinities between 150 to 350mg/l. Spring waters may be softer, as throughput can be quicker with less time for the dissolution of minerals into the groundwater. Like hardness, groundwater alkalinity is variable, but is often high. Typical groundwater electrical conductivities are high, but may be less if there is rapid infiltration of surface water and then quick throughput to a spring.

8.4.11 Water Framework Directive Water Body Status & Objectives

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("WFD"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003).

The Water Action Plan 2024 was published in September 2023 and is Ireland's 3rd River Basin Management Plan. It's objectives include the following:

- Ensure full compliance with relevant EU legislation;
- Build on the achievements of the 2nd Cycle;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at restoring impacted waters and protecting waters from deterioration.

Our understanding of these objectives is that surface waters, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status at all. Furthermore any development must not in any way prevent a waterbody from achieving at least good status by 2027.

We note that there is no requirement to assess the peat extraction and ancillary activities at the Application Site which pre-date 2003 and the required transposition of the WFD Directive into Irish Law. The impacts of the activities on the WFD status of downstream and underlying waterbodies are assessed in Appendix 8-3.

8.4.12 Groundwater Body Status

Local GWB status and risk results are available from (www.catchments.ie) and are summarised in Table 8-18 below. This status is defined based on the quantitative status and chemical status of each GWB.

All GWBs underlying the Application Site achieved 'Good' status in all WFD cycles (2010-2015, 2013-2018, 2016-2021 and 2019-2024). These GWBs have been deemed to be "not at risk" of failing to meet their respective WFD objectives except for Trim GWB which is "at risk". No significant pressures have been identified to be impacting upon the Cushina, Bagenalstown or Kildare GWBs. The Trim GWB is listed to be under significant pressure from agriculture, anthropogenic and domestic wastewater.

Table 8-18: WFD Groundwater Body Status

Groundwater body	Status 2010-2015	Status 2013-2018	Status 2016-2021	Status 2019-2024	3rd Cycle Risk Status	WFD Pressures
Cushina	Good	Good	Good	Good	Not at risk	None
Bagenalstown Upper	Good	Good	Good	Good	Not at risk	None
Kildare	Good	Good	Good	Good	Not at risk	None
Trim	Good	Good	Good	Good	At risk	Agriculture, Anthropogenic and Domestic Waste water

8.4.13 Surface Water Body Status

A summary of the WFD status and risk result of Surface Water Bodies (SWBs) in the vicinity and downstream of the Application Site are shown in Table 8-19 below. Note that the first management cycle (Cycle 1) began in 2010, for the period 2010-2015, which established baseline status.

Within the Figile_SC_010 river sub-catchment, the status of the Abbeylough_010 SWB improved from "Poor" (2013-2018) to "Moderate" (2016-2021 and 2019-2024) while the status of the Figile_010 SWB was "Poor" in all WFD cycles. The Figile_020 and Figile_030 SWBs have remained at "Moderate" across all WFD cycles. These SWBs are 'at risk' of failing to achieve their respective WFD objectives. Peat drainage and extraction is identified as significant pressure on the Abbeylough_010, Figile_020 and Figile_030 SWBs. Hydromorphology, industry, urban wastewater and peat drainage and extraction are identified significant pressures on the Figile_010 SWB.

It is worth nothing that the Figile_010 SWB, located upstream of the Application Site achieved "Poor" status in all WFD cycles, is deemed to be 'at risk' and is listed as being under significant pressure from peat extraction activities. Given its location upstream of the Application Site, the peat extraction and ancillary activities cannot be attributed to contributing to this "Poor" status. The WFD status of the Figile_020 and Figile_030 SWBs, in the immediate vicinity of the Application Site and downstream of the Figile_010 SWB have never achieved "Poor" status. These SWBs are of "Moderate" status and therefore WFD status improves in the vicinity of the Application Site in comparison to that recorded upstream.

Within the Figile_SC_020 river sub-catchment, the status of Figile_040 SWB declined from "Moderate" (2013-2018 and 2016-2021) to "Poor" (2019-2024) status. The Figile_050 SWB declined from "Good" (2013-2018) to "Poor" (2016-2021 and 2019-2024) status whilst the status of the Figile_060 SWB was "Good" in all WFD cycles. The Figile_040 and the Figile_050 SWBs are 'at risk' of failing their WFD objectives while the Figiel_060 SWB is 'not at risk'. Peat drainage and extraction is identified significant pressure on Figile_040 SWB while agriculture and peat drainage and extraction are identified significant pressures on the Figile_050 SWB.

It is worth noting that there are no surface water outfalls from the Application Site to the Figile_040 SWB. The deterioration in status between the Figile_030 and the Figile_040 SWBs likely results from water quality issues in the catchment of the Esker Stream. This stream drains several areas of cutover bog which are located to the east of Daingean and the stream discharges into the Figile River near Clonbullogue.

Within the Slate_SC_010 river sub-catchment, the Slate_050 to 070 SWBs achieved "Moderate" status in the 3 no. latest WFD cycles and are 'at risk' of failing to achieve their WFD objectives. Hydromorphology and peat drainage and extraction are identified as the significant pressures on the Slate_050 SWB, urban run-off is the identified significant pressure on the Slate_060 SWB and agriculture, hydromorphology, urban wastewater and peat drainage and extraction are the identified significant pressures on the Slate_070 SWB.

It is worth nothing that the Slate_040 SWB, located upstream of the Application Site achieved "Poor" status in all WFD cycles, is deemed to be 'at risk' and is listed as being under significant pressure from peat extraction activities. Given its location upstream the peat extraction and ancillary activities at the Application Site cannot be attributed to contributing to this "Poor" status. The WFD status of the Slate_050 and Slate_060 SWBs, in the immediate vicinity of the Application Site and downstream of the Slate_040 SWB have never achieved "Poor" status. These SWBs are of "Moderate" status and therefore WFD status improves in the vicinity of the Application Site in comparison to that recorded upstream.

Within the Boyne_SC_010 river sub-catchment, the status of the Boyne_010 SWB declined from "Moderate" to "Poor" status in the latest cycle. The status of the Boyne_020 SWB declined from "Moderate" (2013-2018) to "Poor" (2016-2021) before it improved to "Moderate" (2019-2024). The status of the Boyne_030 SWB improved from "Moderate" (2013-2018) to "Good" (2016-2021 and 2019-2024). The Boyne_010 and Boyne_020 SWBs are 'at risk' of failing to achieve their WFD objectives while the Boyne_030 SWB is 'not at risk'. Domestic wastewater, hydromorphology and peat drainage and extraction are identified significant pressures on the Boyne_010 SWB. Agriculture, hydromorphology and urban run-off are identified significant pressures on the Boyne_020 SWB.

In terms of Heavily Modified Waterbodies (HMWBs) in the vicinity of the Application Site, the Grand Canal Main Line (Boyne), Grand Canal Main Line East (Barrow) and the Grand Canal Barrow Line all achieved Good Ecological Potential in the 3 no. recent WFD cycles. The Grand Canal Main Line (Boyne) and the Grand Canal Main Line East (Barrow) are not at risk whilst the risk status of the Grand Canal Barrow Line is under review.

A full WFD Compliance Assessment is attached as Appendix 8-3.

Table 8-19: Summary WFD Information for Surface Water Bodies

River Waterbody	Status 2010-2015	Status 2013-2018	Status 2016-2021	Status 2019-2024	3rd Cycle Risk Status	WFD Pressures
Figile_SC_010 river sub-catchment						
Abbeylough_010	Unassigned	Poor	Moderate	Moderate	At Risk	Peat Drainage and Extraction
Figile_010 (Upstream of Proposed Wind Farm)	Poor	Poor	Poor	Poor	At Risk	Hydromorphology, Industry, Urban Wastewater and Peat Drainage and Extraction
Figile_020	Moderate	Moderate	Moderate	Moderate	At Risk	Peat Drainage and Extraction
Figile_030	Moderate	Moderate	Moderate	Moderate	At Risk	Peat Drainage and Extraction
Figile_SC_020 river sub-catchment						
Figile_040	Moderate	Moderate	Moderate	Poor	At Risk	Peat Drainage and Extraction
Figile_050	Good	Good	Poor	Poor	At Risk	Agriculture and Peat Drainage and Extraction
Figile_060	Good	Good	Good	Good	Not at Risk	None
Slate_SC_010 river sub-catchment						
Slate_010	Unassigned	Moderate	Poor	Poor	At risk	Hydromorphology, anthropogenic and urban runoff
Slate_020	Poor	Poor	Poor	Poor	At risk	Agriculture and urban wastewater
Slate_030	Unassigned	Poor	Poor	Poor	At risk	Agriculture and forestry
Slate_040	Poor	Poor	Poor	Poor	At risk	Hydromorphology and Peat Drainage and Extraction
Slate_050	Moderate	Moderate	Moderate	Moderate	At Risk	Hydromorphology and Peat Drainage and Extraction
Slate_060	Moderate	Moderate	Moderate	Moderate	At Risk	Urban run-off

Slate_070	Good	Moderate	Moderate	Moderate	At Risk	Agriculture, Hydromorphology, Urban Wastewater and Peat Drainage and Extraction
Boyne_SC_010 river sub-catchment						
Boyne_010	Moderate	Moderate	Moderate	Poor	At Risk	Domestic Wastewater, Hydromorphology and Peat Drainage and Extraction
Boyne_020	Moderate	Moderate	Poor	Moderate	At Risk	Agriculture, Hydromorphology and Urban Run-off
Boyne_030	Good	Moderate	Good	Good	Not at Risk	None
Liffey_SC_050 river sub-catchment						
Awillyinish Stream_010	Unassigned	Unassigned	Moderate	Moderate	Under review	None
Liffey_100	Moderate	Moderate	Good	Good	Not at risk	None
Heavily Modified Waterbodies						
Grand Canal Main Line (Boyne)	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Not at risk	None
Grand Canal Main Line East (Barrow)	Unassigned	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Not at risk	None
Grand Canal Barrow Line	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Good Ecological Potential	Under review	None

8.4.14 Designated Sites and Habitats

Within the Republic of Ireland designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (pNHAs), candidate Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

The Long Derries, Edenderry SAC and pNHA (Site Code: 000925) partially overlaps with the Application Site (i.e. Glashabaun North). The Long Derries, Edenderry SAC/pNHA is located in the lands between the cutover bogs at Glashabaun North and Ticknevin. The SAC/pNHA comprises a gravel (esker) ridge) which is designated for orchid-rich calcareous grasslands and supports several species of conservation interest (refer to Chapter 6: Biodiversity). The Long Derries was formerly used as a BnM gravel pit during the construction of the railway network at the Application Site.

The Grand Canal pNHA (Site Code: 002104) is also mapped adjacent to the north of the Ticknevin Bog. The Application Site does not encroach upon the mapped extent of this pNHA.

The River Barrow and River Nore SAC (Site Code: 002162) is located ~9.8km southwest of the Application Site. This SAC is located downstream and downgradient of the Application Site. The length of the hydrological flowpath between the Application Site and the SAC is ~17km.

The River Boyne and River Blackwater SAC (Site Code: 002299) and SPA (Site Code: 004232) is located ~14.3km to the north of the Application Site. This SAC/SPA is downstream of the Application Site along the River Boyne. The length of the hydrological flowpath between the boundary of the Application Site and the SAC/SPA is ~22km. However it is noted that there is no surface water outfall from the bog with this catchment. All water from Ticknevin Bog is directed to the south and discharges via several settlement ponds to the Codd Stream, a tributary of the Figile River.

Other designated sites within 10km of the Application Site are as follows:

- Carbury Bog NHA (Site Code: 001388), approx. 4.2km to the north of the Ticknevin Bog. This NHA is located upstream and upgradient of the Application Site;
- Ballina Bog (Site Code: 000390), approx. 9.9km north of the Ticknevin Bog. There is no hydrological connection between the Application Site and this pNHA;
- Black Castle Bog NHA Site Code: 000570), approx. 6.2km northwest of the Ticknevin Bog. There is no hydrological connection between the Application Site and this NHA;
- Hodgestown Bog NHA Site Code: 001393), approx. 7.8km east of the Derrybrennan Bog. There is no hydrological connection between the application site and this NHA;
- Ballynafagh Lake SAC and pNHA (Site Code: 001387), approx. 9.4km east of the Killina Bog. This SAC and pNHA is located upstream and upgradient of the Application Site;
- Ballynafagh Bog SAC and pNHA (Site Code: 000391), approx. 8.1km east of the Lodge Bog. This SAC and pNHA is located upstream and upgradient of the Application Site;
- Mounds Bog SAC and pNHA (Site Code: 002331), approx. 5.9km southeast of the Lodge Bog. There is no hydrological connection between the Application Site and this SAC and pNHA;
- Pollardstown Fen SAC and pNHA (Site Code: 000396), approx. 7.6km south of the Lodge Bog. This SAC and pNHA is located upstream and upgradient of the Application Site; and,
- Curragh (Kildare) pNHA (Site Code: 000392), approx. 8.5km southeast of the Lodge Bog. There is no hydrological connection between the application site and this SAC and pNHA.

A map is local designated sites is shown as Figure 8-16.

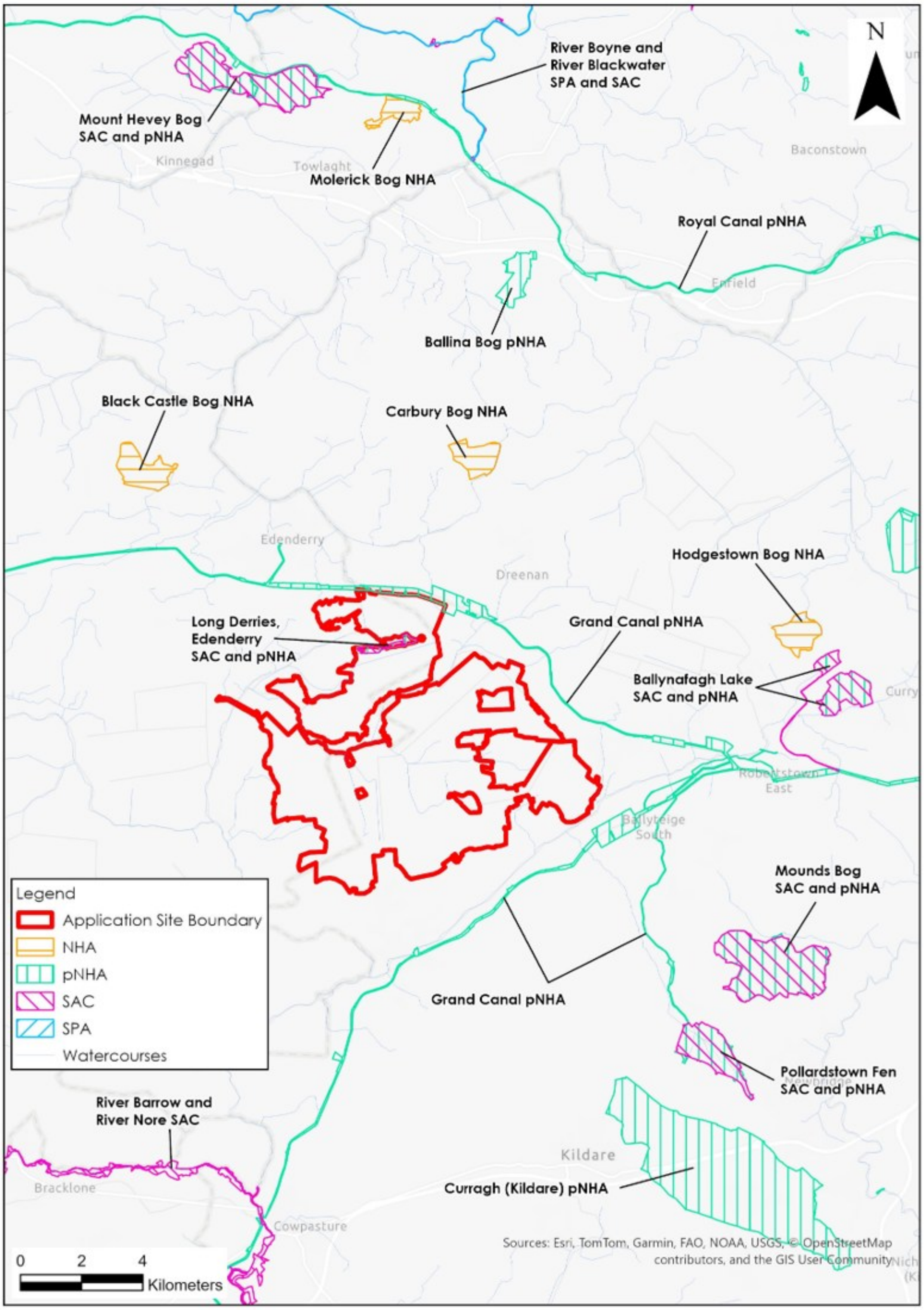

Figure 8-16: Map of Local Designated Sites

8.4.15 Water Resources

8.4.15.1 Groundwater Resources

There are no mapped Public Water Supplies (PWS) or Group Water Schemes (GWS) within the Application Site. Local groundwater resources are shown on Figure 8-17.

Several GWSs and PWSs are mapped by the GSI in the lands surrounding the Application Site. However, the delineated source protection areas for these GWSs and PWSs do not overlap with the Application Site:

- The source protection area associated with the Ballykilleen GWS is located approximately 0.8km west of Ticknevin Bog.
- The outer source protection area associated with the Clonbullogе PWS is located approximately 0.5km west of Codd 1 Bog. The inner source protection area is mapped ~1.8km from the Application Site close to the centre of Clonbullogue village.
- The outer source protection area associated with the Edenderry PWS is located approximately 1.8km northwest of Ticknevin Bog. The inner source protection area is ~2.2km from the Application Site.
- The source protection area associated with the Bracknagh Rech GWS is mapped ~0.5km south of Ballydermot South Bog.
- The inner source protection area associated with the Rathangan PWS is mapped ~3.3km to the south of Blackriver Bog. The outer source protection area extends to the south, away from the Application Site.
- The outer source protection area associated with the Robertstown PWS is mapped ~5.5km to the east of Lodge Bog.

A search of private well locations (wells with location accuracy of 1–50m were only sought) was undertaken using the GSI well database (www.gsi.ie). There are 33 no. wells mapped within 1km of the Application Site with a location accuracy of the less than 50m. Out of these 33 wells, 18 no. wells are used for agriculture and domestic purposes, 8 no. wells are used for Public Supply and Group Schemes and 7 no. wells are used for unknown purposes. The wells identified as being for public and group schemes correspond with the GSI mapped GWSs and PWSs in the lands surrounding the Application Site.

To overcome the poor accuracy problem of other GSI mapped wells it is conservatively assumed (for the purpose of assessment only) that every private dwelling in the area has a well supply and this impact assessment approach is described further below. (Please note wells may or may not exist at each property, but our conservative rationale here is that it is better to assume a well may exist at each downgradient property and assess the potential impacts from the Application Site on such assumed wells, rather than make no assessment and find out later that groundwater wells do actually exist).

An information request was submitted to Uisce Éireann for the location of all Uisce Éireann groundwater abstraction locations within 5km of the Application Site was submitted. A total of 13 no. Uisce Éireann groundwater abstraction points were identified within 5km of the Application Site.

- An abstraction point is mapped at the centre of the GSI's Edenderry PWS mapped inner source protection area. According to the UÉ database this abstraction is associated with the Kisawanny scheme but is currently out of service.
- An additional 2 no. UÉ abstraction points are located at the south eastern boundary of the GSI's Edenderry PWS outer source protection area. These boreholes are referred to on the

UÉ database as Edenderry Borehole 1 and 2 and are listed as being in service, supplying the Edenderry PWS.

- An additional 2 no. UÉ abstraction point, listed as being out of service, are mapped to the northwest of the Application Site, in the Edenderry area.
- An abstraction point is mapped within the GSI's Clonbulloge PWS mapped inner source protection area. According to the UÉ database this abstraction, referred to as the Figile River Well, is in service, supplying the Clonbulloge PWS.
- 7 no. UÉ abstraction points are located within the GSI's Rathangan PWS inner source protection area. According to the UÉ database all 7 of these boreholes are in service (Rathangan 1 – 7).

8.4.15.2 Surface Water Resources

In terms of surface waters, several SWBs downstream of the Application Site have been listed in Article 7 Abstraction for Drinking Water.

There are no Drinking Water Protected Areas (DWPAs) identified within or in the immediate vicinity of the Application Site. The nearest DWPA mapped downstream of the Application Site is the Barrow_130 DPWA. This DWPA is associated with the Tegral Building Products Limited for industrial use and Uisce Éireann's abstraction for the Barrow Water Supply. The maximum daily abstraction volume for Tegral Building Products Limits is 418m^3/day and for Uisce Éireann is 40,850m^3/day. The length of the hydrological flowpath between the Application Site and this DWPA is ~35km.

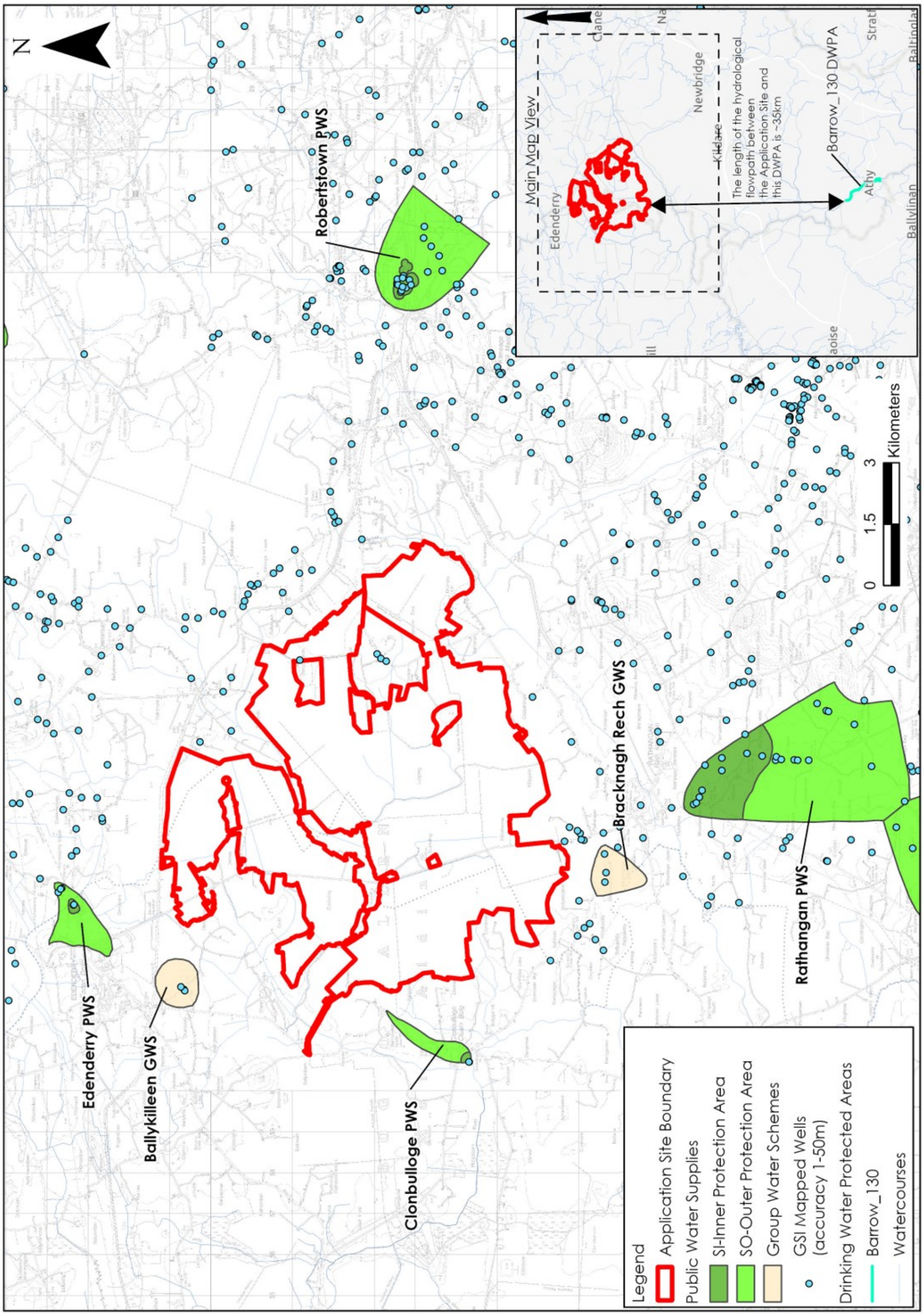

Figure 8-17: Groundwater Resource Map

8.4.16 Receptor Sensitivity

Due to the nature of peat extraction and ancillary activities, being near surface activities, impacts on groundwater quality and quantity are generally negligible as there is still considerable depths of peat remaining at the Application Site, although deep perimeter drains may have local drainage impacts on surrounding land. Surface water quality is the main sensitive receptor as drainage of the Application Site will potentially have altered the local natural hydrological regime.

Based on the criteria set out in Table 8-2 above, the Locally and Regionally Important Aquifers underlying the Application Site can be classed as being of Medium Importance. The primary risks to groundwater during peat extraction and ancillary activities, would have been from hydrocarbon spillage and leakages from plant serving and facilitating the peat extraction and ancillary activities. The Application Site is covered in cutover peat which in turn is underlain by lacustrine clay and/or silt dominated glacial deposits and these layers act as a protective cover to the underlying bedrock aquifers. The glacial deposits are not mapped as an aquifer in this area, but they are likely to be used locally as a water supply and therefore they can also be classed as sensitive to groundwater pollution. However, due to the presence of the peat and silt/clay layers (which have low permeability and act as a barrier to infiltration), any contaminants which may be accidentally released on-site are more likely to travel to nearby streams within surface runoff.

For the purposes of a conservative assessment the following groundwater receptors are included in the impact assessment:

- The Locally and Regionally Important Bedrock Aquifers underlying the Application Site;
- The WFD status of the underlying Cushina, Bagenalstown Upper, Kildare and Trim GWBs;
- The Ballykilleen and Bracknagh GWSs and the Clonbulloge, Robertstown, Edenderry and Rathangan PWSs; and,
- All private groundwater wells supplies in the lands surrounding the Application Site.

Surface waters are the main sensitive receptors associated with the Project given that the Application Site discharges via several surface water outfalls to the Figile and Slate rivers and their associated tributaries. At the beginning of the assessment period i.e., the July 1988 baseline, the Figile and Slate Rivers in the vicinity of the Application Site were of High to Very High Importance due to their baseline 'Moderate' and 'Good' biological Q-ratings. The River Boyne, which is located to the north of the Application Site, was of Very High Importance. During peat extraction and ancillary activities, the main risks to local surface water quality would have been increased concentration of suspended solids and increased flow volumes downstream. In addition, hydrocarbon spillage and leakages would have been a constant potential threat to water quality during peat extraction and ancillary activities. It is noted that there was no direct discharge from the Application Site to the River Boyne or its tributaries. However, the Clonkeen Stream flows along the boundary of Ticknevin Bog and is therefore included for the purposes of a conservative impact assessment.

The following surface water receptors are included in the impact assessment:

- The Figile River and its tributaries including the Abbeylough, Lullymore East, Lullybeg, Clonbrown, Cloncant, Codd, Ballyleakin, Clonbulloge and Ballygarrett streams;
- The Slate River and its tributaries including the Killinagh Upper and Drumsru streams;
- The River Boyne and the Clonkeen Stream; and,
- The WFD status of all receiving SWBs downstream of the Application Site.

In terms of designated sites, the Long Derries, Edenderry SAC and pNHA is included due to its location within the Application Site. The Grand Canal pNHA is included due to its location immediately adjacent to Ticknevin Bog whilst the River Barrow and River Nore SAC is included in the impact assessment given its hydrological connectivity to the Application Site. All other designated sites have been screened out of the impact assessment given their distant location and the lack of hydrological or hydrogeological connectivity with the Application Site.

The River Boyne and River Blackwater SAC/SPA is screened out of the remedial impact assessment due to its distance from the Application Site and the lack of any surface water emission points from the bogs within the catchment to the River Boyne. Ticknevin Bog discharges to the south, into a tributary of the Figile River.

The surface water abstraction associated with the Barrow_130 DWPA has been screened out of the remedial impact assessment due to its distant location from the Application Site. There was no potential for the peat extraction and ancillary activities at the Application Site to impact this abstraction, located ~35km downstream.

8.5 Characteristics of the Project

8.5.1 Peat Extraction Phase (July 1988 – June 2020)

This rEIAR is prepared in support of an application for Substitute Consent for peat extraction and ancillary activities carried out by BnM on lands at the Application Site since July 1988. The Application Site is comprised of 5,448 hectares across 14 no. bogs located within Counties Offaly and Kildare as outlined in Chapter 1, Figure 1-1.

The peat extraction and ancillary activities undertaken at the Application Site, which comprise the Project for which Substitute Consent is being sought and for which this rEIAR is prepared, consist of the following:

- Installation of surface water drainage infrastructure at Allen Bog Group, specifically within the Application Site (Ticknevin, Glashabaun North, Glashabaun South, Codd 1, Codd 2, Ballydermot North, Ballydermot South, Blackriver, Lullymore, Lullybeg, Barnaran, Killina, Derrybrennan and Lodge Bogs) to facilitate peat extraction activities from 1988 to June 2020;
- Vegetation clearance to facilitate peat extraction activity from 1988 to June 2020;
- Industrial scale peat extraction (including milled peat, sod peat, sod moss and bin sod);
- Use and maintenance of pre-existing ancillary supporting infrastructure and services to facilitate peat extraction (e.g., fixed fuel tanks, drainage (drains, silt ponds, pumps), machine passes etc.), from 1988 to June 2020;
- Control Measures associated with the above, inclusive of the IPC Licence measures (Ref. P0503-01) which commenced from 2000 onwards to the present day; and,
- All associated site development and ancillary activities.

For the purposes of this rEIAR, the Project is defined under three different timeframes termed 'phases':

- 'Peat Extraction Phase': peat extraction activities and all ancillary activities at the Application Site from July 1988 to the cessation of peat extraction in June 2020 (July 1988 – June 2020). The Peat Extraction Phase is described in detail in Section 4.7 of Chapter 4.
- 'Current Phase': the management of the Application Site since June 2020 (June 2020 to present). The Current Phase is described in detail in Section 4.8 of Chapter 4.

- ‘Remedial Phase’: the activities intended to be carried out at the Application Site into the future. The Remedial Phase is described in detail in Section 4.9 of Chapter 4.

A full description of the Project and all works completed at the Application Site post-dating July 1988 are described in detail in Chapter 4.

8.6 Assessment of Significant Effects and Control/Mitigation Measures

8.6.1 Do -Nothing Scenario

As outlined in the EPA Guidelines (May 2022), the description of ‘Do-Nothing Effects’ relates to the environment as it would be in the future should the project not be carried out. As described in Chapter 1, the assessment period of this rEIAR commenced in 1988, a time at which peat extraction was already well-established at the Application Site. In the context of this rEIAR, the Project has been ongoing since the baseline assessment year of 1988. As outlined in Section 4.3.1, peat extraction activities commenced at the Application Site in 1935 (refer Table 8-7 for the dates relating to the individual bogs comprising the Application Site) with the installation of drainage.

The ‘Do-Nothing’ scenario is defined as the Project having ceased at the Application Site in 1988.

In the event of the cessation of the Project at the Application Site in 1988, it is assumed that those lands within the Application Site, which by that point had not been subject to the installation of drainage and peat extraction would have remained as a relatively intact raised bog with varying raised bog habitats (such as bog woodland, fen, sphagnum mosses).

Subsequently, other land-use practices may also have taken place on the Application Site such as agricultural or commercial forestry, or other commercial or non-commercial uses. Under this ‘Do-Nothing’ option, the IPC licence (Ref. P0503-01) and associated ongoing decommissioning and planned rehabilitation would not have occurred.

For those lands which as of 1988 had been subject to the installation of drainage in preparation for peat extraction but not peat extraction itself, it is assumed in the ‘do-nothing’ scenario that drainage would have remained in situ. Maintenance works to keep established drainage channels clear would have ceased as of 1988 in the ‘Do-Nothing’ scenario. It is likely that these areas would have been subject to natural recolonisation of the bog surface. Minor third party turbary activities likely would have occurred along the intact bog edges as was common practise at sites such as the Application Site.

Peat extraction and ancillary activities were underway at the Application Site prior to the required date for the transposition of the EIA Directive in 1988. If peat extraction and related activities ceased from 1988 onwards, then the various residual effects, described throughout this rEIAR, would not have occurred.

However, consideration must be given to the following:

- The legislative mandate given to BnM in the form of the Turf Development Act 1946, as amended) to acquire and develop peatlands; and,
- The uncertainty with respect to the planning status of the activity did not arise until 2020 and was not evident in 1988.

Therefore, this ‘Do-Nothing’ scenario was not the chosen option. Peat extraction and ancillary activities have occurred at the Application Site from July 1988 onwards. A decision to cease peat extraction at the

Application Site was taken in 2020 and the Application Site needs to be considered in the context of regularising (without prejudice) the planning status of the lands to facilitate future development (subject to planning consent as required). The Application Site has and will continue to revegetate, and there will be a change from areas of cutover peatland to revegetated, as described in Section 4.8 of Chapter 4. These are described in the individual chapters of the rEIAR.

In the event that Substitute Consent is not granted in effect, the "Do Nothing" scenario represents the current situation as at the date of the application for Substitute Consent. As part of BnM's statutory obligations under IPC Licence requirements, a Cutaway Bog Decommissioning and Rehabilitation Plan will continue to be implemented for the Application Site separate to, and independent of, the Substitute Consent application. The implementation of this plan is included in the impact assessment below.

The role of cutaway/cutover peatlands such as the Application Site as a significant potential resource for amenity, tourism, biodiversity enhancement and conservation, improvement in air quality, climate mitigation, renewable energy development and education are part of BnM's vision for the Application Site. The regularisation of the planning status of the Application Site is a significant facilitator in ensuring the sustainable use and management of these peatlands. If this does not occur, the opportunity to continue employment and alternative use of the Application Site for the potential resources and activities mentioned above will be significantly restricted.

8.6.2 Identification of Impacts

8.6.2.1 Peat Extraction Phase (July 1988 – June 2020)

The Peat Extraction Phase of the Project includes all peat extraction and ancillary activities undertaken from July 1988 to the cessation of peat extraction in June 2020.

8.6.2.1.1 *Effects of Bog Drainage on Bog Hydrogeology*

Impacts on bog hydrogeology can occur through drainage, both by surface water drainage and by groundwater drainage. Surface water drainage (increased frequency of drains and deeper perimeter drains) can impact peat water levels and have an indirect impact on surface vegetation. Increased drainage can also lead to increased runoff volumes from bog units, and this can alter the hydrology (by increased flow volumes, and increased magnitude of downstream flooding events) of the downstream receiving waters. Deep perimeter (bog perimeter) drains can alter the local underlying groundwater hydrogeology as they often intersect the mineral soil layers below the bog.

To determine likely Zones of Influence (ZoI) of bog drainage infrastructures HES has previously completed a Peatland Hydrology Study as defined in Appendix 8-4. From that study, the following conservative ZoIs are defined for the Applicant's bog units:

- Field drains can have a ZoI on peat water levels at a distance of up to 30m;
- Deep perimeter bog drains can have a ZoI on peat water levels at a distance of <100m;
- The ZoI of facebank drains depends on the height of the facebank. But a conservative ZoI for a 1.5m high facebank drain is 60m; and,
- The ZoI of BnM's pumping stations (which are generally <5m deep) on local groundwater levels is likely to be <300m (Please note that 15 no. pumping stations were located at the Application Site during the Peat Extraction Phase (2 at Ballydermot South, 2 at Blackriver, 2 at Glashabaun North, 2 at Ticknevin, 2 at Codd 1, 3 at the boundary between Codd 1 and Ballydermot North and 2 at Lodge)).

These ZoIs are used in the assessment below, and also in the assessment of impacts on designated sites and groundwater supplies.

By 1988 the vast majority of the Application Site had been drained and was subject to peat extraction. In 1988 approximately 5,251ha (96.38% of the Application Site) had been drained, with industrial peat extraction ongoing across ~4,828ha (88.61% of the Application Site) with landcover consisting of drained bare or vegetated peat fields separated by field drains. Only small areas of remnant raised bog existed around the periphery of the Application Site (197ha or 3.6% of the Application Site).

Following the initial drainage, which preceded July 1988, there would have only been minor annual changes in local bog hydrology and hydrogeology associated with the annual removal of peat and the deepening of drains if required. According to figures supplied by the Applicant, the total volume of peat removed from the Application Site from July 1988 to June 2020 is estimated to be 11,174,206 tonnes (average of 349,194 tonnes extracted per year). The depths of peat removed from each area of the Application Site would vary as each area has experienced its own unique history of peat extraction. As peat can act as a hydraulic sponge providing storage of water, the removal of peat potentially acts to reduce the [water] storage capacity of the Application Site. However, when peat water levels within the Application Site were reduced historically through initial bog drainage, the [water] storage capacity of the top ~0.5 – 1m of peat (dependent on the depth of drains) was essentially removed.

As such, the primary and significant hydrological and hydrogeological changes commenced when the initial drainage occurred and the development of ancillary activities was installed (e.g. railway lines, canteen structures, work sites, welfare facilities, mobile fuel tanks, fixed fuel tanks). These works largely predate July 1988.

Drainage was only inserted across small sections of the Application Site during the Peat Extraction Phase (~100ha). These included an area known as Clonbrown in the southwest of Ballydermot North (drained in 2017 and 2018), Clonbrown in the northwest of Ballydermot South (drained in 1996), Clonroosk in the southwest of Ballydermot South (drained in 2013) and Cushaling in the north of Codd 1 Bog (drained by 1995). A significant effect on local bog hydrogeology would have occurred within these areas of the Application Site but the change was in line with the trends across the wider Application Site. These areas only represented ~1.8% of the total area of the Application Site.

Pathways: Groundwater volume and water level drawdown.

Receptors: Peat Bog Hydrogeology.

Assessment of effects in the absence of control measures: As the vast majority of the Application Site was already drained by July 1988, the effect of continuing peat extraction activities until the June 2020 would not have resulted in any major alteration of the local hydrogeological regime. The peat water table and underlying groundwater table at the bog had already been locally lowered during their initial draining which pre-dated July 1988. Only minor annual changes would have occurred during this phase of the Project. The effects on bog hydrogeology in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.1.1 *i.e.* permanent, moderate, negative, direct, long-term likely effect on the bog hydrogeology.

The effects on bog hydrogeology in Clonbrown, Clonroosk and Cushaling which were drained during the Peat Extraction Phase would have been similar to the residual effect i.e. a permanent, significant, direct, long-term effect.

Control Measures:

The following measures were in place to mitigate against the effects of groundwater drainage of the bog on the bog hydrogeology:

- Field drains with low gradients and shallow depths (<1.0m);

- Silt ponds, as well as being a control measure for sediment from the bog, also acted as attenuation measures for higher flows during peak rainfall events. Each metre length of silt pond provides ~12m^3 of water storage, which aided in slowing down the discharge from the bog units;
- Silt ponds were cleaned at least twice a year to maintain adequate storage and treatment (sedimentation/settlement) capacity; and,
- Pipeline capacities were designed based on a runoff rate of 1.7l/s/Ha, which is equivalent to the greenfield runoff rates.

8.6.2.1.2 Effects of Bog Drainage on Downstream Surface Water Hydrology/Quality

Hydrological changes at the Application Site commenced when the initial drainage occurred. The initial implementation of the bog drainage was at that time a significant change to the local hydrology. Peat can act as a hydraulic sponge providing storage of water. However, with the implementation of bog drainage, the water levels in the peat bog are lowered and the capacity of the bog to store water is reduced. The available water storage within the bog would have provided a small buffer for downstream flooding.

In terms of surface water quality, the primary potential negative impact on surface water quality would be the increase in suspended solid entrainment in surface waterbodies. The greatest risk of suspended sediment entrainment occurs during times of major earthworks, such as during the removal of vegetation and the construction of the bog drainage network. This potential pathway would pose a significant risk to local surface water quality downstream of the Application Site.

By July 1988 the vast majority of the Application Site was already artificially drained. Consequently, the continued drainage of the bog during the Peat Extraction Phase of the Project would have been limited in its potential to alter the hydrological regime in downstream watercourses. However, during the Peat Extraction Phase, there was an ongoing risk of elevated concentrations of suspended solids making their way into downstream surface watercourses from the erosion of peat sediment via the bog drainage network. This potential pathway would pose a significant risk to local surface water quality, particularly as the Figile, Slate and Boyne rivers were all of High to Very High Importance in 1988. Other water quality parameters of concern are ammonia and Chemical Oxygen Demand (COD).

The main potential for effects was on the tributaries of the Figile and Slate rivers which received discharge from the drainage system at the Application Site. The potential for effects would have been reduced further downstream in the SWBs due to the increased flows in these watercourses (refer to Section 8.4.3). there was limited potential for effects on the Clonkeen Stream and the River Boyne as there was no outfall from the bog to these watercourses (they are conservatively included in the assessment due to the proximity of the Clonkeen Stream to Ticknevin Bog).

Pathway: Drainage and surface water discharge routes.

Receptor: Surface water quality and quantity in the receiving streams (Lullymore East, Lullybeg, Cloncant, Codd, Ballygarrett, Killinagh Upper streams) and down gradient rivers (Figile and Slate rivers).

Assessment of effects in the absence of control measures: In the absence of the control measures relating to surface water management, the effect could potentially have been significantly greater than the residual effect described in Section 8.6.3.1.2. The effect would have been a significant, long-term, negative and indirect likely effect on downstream surface water quality and a significant, long-term, negative and indirect effect on downstream surface water quantity (i.e. river flows). The greatest effects would have occurred in the smaller receiving streams closer to the Application Site, with the significance of effects decreasing progressively downstream along each waterbody.

Control Measures:

Pre-IPC Licence

Prior to the regulation of activities at the Allen Bog Group by the EPA which commenced in 2000, the Applicant was implementing several control measures to protect surface water quality in downstream waterbodies. These measures primarily relate to the concentrations of suspended sediments in discharge from the bog and are summarised below:

- Internal drains cleaned on a regular basis in suitable weather. This was completed to remove sludge from the bottom of ditches, allowing them to retain full functionality. The sludge was disposed of by spreading it on the adjacent production fields where it was dried and harvested;
- Drain maintenance was carried out using draglines and excavators, ensuring that these drains were fit for purpose;
- Drain maintenance was carried out mainly prior to and post the harvesting season.
- Silt ponds were utilised to control the amount of sediment being discharged at outfalls. At this time, silt ponds were designed for an upper limit of 100mg/l suspended sediment;
- Silt ponds were upgraded in the 1990s to cater for the settling of sufficient amount of silt. This often included the construction of a second silt pond adjacent to the first, which was used as a backup and to facilitate desludging of the primary pond; and,
- Silt ponds were desludged twice per annum.

Active IPC Licence:

The Application Site has been regulated by the EPA under IPC Licence Registration No. P0503-01 since 2000. The drainage system in place at the bog comprises field drains, main drains, piped drains, silt ponds upstream of outfall locations, is designed to prevent the release of elevated concentrations of suspended sediments into nearby surface waterbodies. As part of the IPC Licence, there is a limit of 35mg/l for suspended solids. Monitoring only recorded 6 no. exceedances at the Application Site from a total of 226 no. samples from 2000 to 2025).

Existing control measures which were implemented under the IPC licence (IPC Condition 6) are also designed to limit runoff rates from the bog units. These include:

- Silt ponds providing attenuation limited runoff during periods of intense rainfall; and,
- Continuous mitigation included maintaining the schedule of cleaning the silt ponds at a minimum of twice per year.

8.6.2.1.3 Contamination of Groundwater by Leakages and Spills

Accidental spillage during refuelling of machinery and plant (static and mobile) with petroleum hydrocarbons is a pollution risk. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk over time. Hydrocarbons have a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects (i.e., contamination of peat, subsoils and pollution of the underlying aquifer) on the geological and water environment.

Discharges from wastewater systems (septic tanks) at office buildings, and at welfare facilities and workshops could potentially have caused groundwater contamination. Activities and features associated with peat extraction include railway lines, machine passes, canteen structures, work sites, welfare facilities, mobile fuel tanks, fixed fuel tanks, and peat loading facilities. These potential impacts existed across the Application Site, but we understand from a review of available AERs (Annual Environmental Reports submitted to the EPA under the IPC licences) reports that no significant pollution events/spills to groundwater have occurred since 2000.

Pathway: Infiltration through pore space in peat, subsoil and bedrock.

Receptor: Local Groundwater Quality.

Assessment of effects in the absence of control measures: In the absence of the control measures the effect could have been a potentially greater effect than the residual effect described in Section 8.6.3.1.3. However, there is no knowledge of significant groundwater contamination across the Application Site, and given the nature of the local hydrogeological regime with very limited groundwater recharge rates no significant effects would have occurred. The effect in the absence of control measures would have been a slight, long-term, negative, indirect and unlikely effect on groundwater quality.

Control Measures:

<u>Pre-IPC Licence:</u>

Prior to the regulation of activities at the Application Site by the EPA which commenced in 2000, the Applicant was implementing several control measures to reduce the risk of contamination by spills and leakages. These measures primarily relate to the storage of peat harvesting machinery, refuelling procedures and waste management. These measures are summarised below and outlined in full in Chapter 4 at Section 4.6:

- All machinery were stored at the Ballydermot Works at the end of each workday;
- All machinery were regularly inspected, serviced and cleaned. Cleaning was completed at a wash bay which drained towards an interceptor tank and associated soak pit;
- Where possible all refuelling was completed at the Ballydermot Works;
- In the event that on-site refuelling was required, it was done with a mobile fuelling unit;
- In the event of an emergency spill, the following procedures were in place:
    - The General Manager (GM) was immediately informed of the incident.
    - The spill was assessed by the GM to assess the potential for environmental and/or health consequences.
    - The spill would have been sourced, isolated and contained with polystyrene booms or dry peat.
    - Every effort would have been made to prevent the spill from entering the nearest drain or outfall.
    - Once the spill was contained, a suitable absorbent (typically dry peat) was used to soak the spillage.
    - Follow up measures were taken to prevent such a spillage recurring in the future.
    - In the event of a spillage the GM notified the local authority.
- All waste oil and break fluids drained from machinery were collected in drums and emptied into a waste oil storage tank which were transported off-site by a licenced disposal contractor;
- All used oil and fuel filters and used batteries were collected by licenced disposal and battery collection contractors respectively; and,
- All washing from the self-contained machine parts washer was collected within a sludge tank at the Ballydermot Works.

Active IPC Licence:

The refuelling procedures and control measures implemented by the Applicant were upgraded and enhanced in order to comply with IPC licence conditions with the Application Site being regulated by the EPA under IPC Licence Registration No. P0503-01 since 2000. No additional control measures, other than compliance with the control measures regulated by the EPA, are considered necessary in terms of protecting groundwater quality. The list below outlines control measures conditioned under the IPC licencing regime(IPC Licence Condition 9), as regulated by the EPA:

- Effective spill/leak management of mobile fuelling units was undertaken;
- Replacement (and remediation where necessary) of all underground fuel tanks was undertaken;
- There was no other emissions to water of environmental significance;
- All tank and drum storage areas were rendered impervious to the materials stored therein. In addition, tank and drum storage areas was bunded;
- Drainage from bunded areas was diverted for collection and safe disposal;
- The integrity and water tightness of all the bunding structures and their resistance to penetration by water or other materials stored therein was tested and demonstrated by the licensee to the satisfaction of the Agency and shall be reported to the Agency within eighteen months from the date of grant of this licence and every two years thereafter;
- The loading and unloading of fuel oils was carried out in designated areas protected against spillage and leachate run-off;
- While awaiting disposal, all materials were collected and stored in designated areas protected against spillage and leachate run-off;
- Except for roof water, all surface water discharges from workshop areas were fitted with oil interceptors;
- An inspection for leaks on all flanges and valves on over-ground pipes used to transport materials other than water was carried out weekly;
- The Applicant undertook a programme of testing and inspection of underground fuel pipelines to ensure that all underground fuel lines were tested at least every three years; and,
- The Applicant maintained (in storage) an adequate supply of containment booms and/or suitable absorbent material to contain and absorb any spillage.

8.6.2.1.4 Contamination of Surface Water by Leakages and Spills

Accidental spillage of petroleum hydrocarbons during refuelling of machinery and plant (static and mobile) construction plant with petroleum hydrocarbons is a significant pollution risk to surface waters and associated ecosystems and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

Discharges from wastewater systems (septic tanks) at office buildings, and at welfare facilities and workshops could potentially have caused surface water contamination. Activities and features associated with peat extraction include railway lines, machine passes, canteen structures, work sites, welfare facilities, mobile fuel tanks, fixed fuel tanks, peat loading facilities, and end-user sites. These potential impacts existed across the Application Site, but we understand from a review of available AER (Annual Environmental Reports submitted to the EPA under the IPC licence) reports that no significant pollution events/spills to groundwater have occurred since 2000 (surface water is dealt with separately in this rEIAR).

Pathway: Overland flow and site drainage network.

Receptor: Surface water quality in the receiving streams (Lullymore East, Lullybeg, Cloncant, Codd, Ballygarrett, Killinagh Upper streams) and down gradient rivers (Figile and Slate rivers).

Assessment of effects in the absence of control measures: In the absence of the IPC licence control measures the effect could potentially have been greater than the residual effect described in Section 8.6.3.1.4, but to the best of our knowledge there was no evidence of significant contamination at the Application Site, and if there was a spill it would have been localised and would likely have been absorbed by the environment at a local scale. The effect could potentially have been a significant, long-term, negative, indirect and unlikely effect on surface water quality. The greatest effects would have occurred on the receiving streams with the significance of effects decreasing progressively downstream.

Control Measures:

Pre-IPC Licence:

Prior to the regulation of activities at the Application Site by the EPA which commenced in 2000, BnM were implementing several control measures to reduce the risk of contamination by spills and leakages. These measures primarily relate to the storage of peat harvesting machinery, refuelling procedures and waste management. These measures are the same as those outlined in Section 8.6.2.1.3.

Active IPC Licence:

The Application Site has been regulated by the EPA under IPC Licence Registration No. P0503-01 since 2000. The control measures implemented to reduce to the risk of contamination by spills and leakages are the same as those outlined in Section 8.6.2.1.3.

8.6.2.1.5 *Effects Associated with Supporting Infrastructure*

From July 1988 to June 2020, activities at the Application Site were not solely limited to peat extraction and ancillary activities. During this time period several supporting infrastructures and facilities were constructed to aid the peat extraction and ancillary activities.

These works included the laying of the railway network across the Application Site as different areas of the site were brought in and out of production. Prior to 1988, 1 no. rail underpass (Offaly Co. Co. Ref. 86/184) was already present at the Application Site. During the Peat Extraction Phase, 3 no. underpasses were constructed, 1 no. located adjacent to the western boundary of the Application Site (Offally Co. Co. Ref 97/699), 1 no. located within the southwest of the Application site connecting Ballydermot North and South bogs to Blackriver Bog within the Application Site (Kildare Co. Co. Ref: 97/1140) and 1 no. located within the northwest of the Application Site connecting Codd 2 and Glashabaun North bogs (Offaly Co. Co. Ref: 97/520).Please note that the rail underpasses were consented but are assessed here for completion due to their association with the peat extraction and ancillary activities at the Application Site. The workshops and offices associated with the Ballydermot Works were built by 1949 and predate the Peat Extraction Phase While facilities were available at Ballydermot Works offices, these smaller outposts were situated across the Application Site to provide easier access to workers further away from the central buildings. Facilities are located to the north of Glashabaun North Bog and the northwest of Killina Bog.

The greatest risks associated with these supporting infrastructures was potential for the entrainment of suspended solids in downstream watercourses during the construction works. In the absence of control measures the release of untreated wastewater from the welfare facilities would also have had the potential to contaminate the local hydrological and hydrogeological environment.

However, these developments had a very small footprint in the context of the entire Application Site. Additionally, the construction of these infrastructures would have been completed over a relatively short time. Therefore, the potential for effects associated with these developments is much reduced when compared with the potential effects associated with the peat extraction and ancillary activities which were ongoing during this time period (Section 8.6.2.1.1 to Section 8.6.2.1.4).

Pathway: Infiltration through pore space in peat, subsoil and bedrock, and site drainage network.

Receptor: Local groundwater quality, and surface water quality in the receiving streams (Lullymore East, Lullybeg, Cloncant, Codd, Ballygarrett, Killinagh Upper streams) and down gradient rivers (Figile and Slate rivers).

Assessment of effects in the absence of control measures: Even in the absence of control measures the construction of supporting infrastructure would not have resulted in significant effects due to their small scale in comparison to the wider peat extraction activities. Nevertheless, in the absence of control measures relating, the effect would have been potentially slightly greater than the residual effect described in Section 8.6.3.1.5. The effect would have been a negative, indirect, slight, long-term effect on surface water quality.

Control Measures:

BnM received planning permission for the rail underpasses and these developments were constructed in accordance with the conditions set out in their respective permissions.

The welfare facilities in Ballydermot North Bog, 1 no. of which was installed between 1995 and 1996 and the remaining container was installed between 2001 and 2005, were constructed in accordance with best practice measures. Tried and tested, best practice measures with regards to hydrocarbons and refuelling were implemented during the construction of these facilities in line with IPC Licence requirements. These control measures are detailed in Section 8.6.2.1.3 above. Furthermore, there was no discharge of untreated wastewater associated with these welfare facilities or with the welfare facilities at the Ballydermot Works. Wastewater was discharged to an on-site septic tank with the effluent discharged to a percolation system through the peat prior to discharge to ground. During the Peat Extraction Phase, the septic tank was inspected and de-sludged annually by a licenced contractor to ensure that the treatment system worked efficiently.

8.6.2.1.6 *Effects on Groundwater Abstractions*

Historic impacts on the nearby Ballykilleen and Bracknagh GWSs and the Clonbulloge, Robertstown, Edenderry and Rathangan PWSs can be assessed on the basis of impacts relating to groundwater quality and water quantity (the volume of water available). The GSI's delineated source protection areas associated with these GWSs and PWSs do not overlap with the Application Site. The distances between the Application Site and the mapped source protection areas are detailed in Section 8.4.15.1 above. The inclusion of all of the GWSs and PWSs in the remedial impact assessment is considered to be a very conservative considering the shallow nature (3-6m deep) of the peat extraction and ancillary activities, particularly the historic bog drainage works.

Groundwater flowpaths from the Application Site are likely to be short and will discharge into the local surface water features. Furthermore, given the low permeability of the peat, soils and subsoils at the Application Site, groundwater recharge will be significantly restricted. According to GSI and EPA mapping, there are several watercourses mapped between the Application Site and these GWSs and PWSs. These streams act as hydrological barriers between the Application Site and these GWSs/PWSs.

There are also deep boundary drains which run along the perimeter of the bog which act as hydrological barriers.

Furthermore, based on the ZoIs of bog drainage infrastructures as discussed in Section 8.6.2.1.1, there was very limited potential for the drainage of the bog to impact these abstractions due to the intervening distance. The maximum zone of impact of the bog drainage infrastructure on groundwater levels is between 100 and 300m. All GWSs and PWSs are located in excess of 500m from the Application Site.

The GSI also map several additional private boreholes and wells in the vicinity of the Application Site. Other wells may also exist at local dwellings in the lands surrounding the Application Site and are not mapped by the GSI. These private water supplies are reliant on groundwater flows in the deeper bedrock aquifer underlying the glacial deposits.

Deep groundwater recharge from the Application Site to the underlying bedrock aquifers will have been minimal. The restriction of recharge relates to the generally impermeable layers which underlie much of Irelands' bogs leading to a 4% recharge coefficient for the bogs. Therefore, the majority of the groundwater drainage and seepage in the bog would have a lateral flow direction, discharging into the perimeter drains and entering the surface water drainage network in the lands surrounding the Application Site.

Pathway: Groundwater recharge and groundwater flow paths and site drainage network.

Receptor: Local groundwater quality and groundwater quantity, the Ballykilleen and Bracknagh GWSs and the Clonbulloge, Robertstown, Edenderry and Rathangan PWS and private groundwater well supplies.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would not have been a significant effect on local groundwater supplies due to the hydrogeological regime of the Application Site which is characterised by high rates of surface water runoff with very limited groundwater recharge. The effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.1.6 i.e. a negative, imperceptible, indirect, long-term, unlikely effect on groundwater quality and groundwater quantity.

Control Measures: No control measures would be necessary due to the shallow nature of the works and the nature of the local hydrogeological regime.

8.6.2.1.7 *Effect on Designated Sites*

As previously identified, there is a conceptual link between groundwater and surface water across the Application Site, whereby groundwater (entering shallow perimeter drains) and surface water within the bog primarily drains to surface water bodies situated around the Application Site. Pathways (flow routes) with nearby and regionally located (downstream) SAC/SPAs (Natura 2000 sites) were identified by digital tracing/tracking hydrological flow paths between the Application Site and their downstream discharge points on a local and a regional scale.

The only designated sites located within the ZoI of bog drainage infrastructures (refer to the Peatland Hydrology Study included as Appendix 8-4) are the Long Derries, Edenderry SAC and pNHA and the Grand Canal pNHA.

<u>Long Derries, Edenderry SAC/pNHA</u>

The SAC is designated for orchid-rich dry calcareous grassland. This habitat occurs on glaciofluvial sands and gravels adjacent to the peatland, rather than on the peatland itself. The SAC site synopsis

(NPWS, 20213) specifically refers to the presence of "*good quality dry, calcareous grassland*" and an "*interesting gravel pit flora*", indicating that the conservation interests of the SAC are associated with mineral substrates (i.e. sand and gravels) rather than peat. Historic sand and gravel pits are also located within the SAC, further confirming the presence of glaciofluvial deposits. The qualifying interest occurs on elevated mineral soils, located approximately 1–3 m above the adjacent bog surface.

It is noted that BnM extracted gravel material from the Long Derries esker to provide material for the construction of the railway across the Application Site. However, the railway infrastructure was established throughout the Application Site by 1988 and therefore the former gravel pits were present prior to the Peat Extraction Phase. No subsequent works or extraction was completed during the Peat Extraction Phase within the Long Derries, Edenderry SAC.

Drainage and peat extraction at the Application Site were already established prior to the designation as a candidate SAC (cSAC) in 1997 (9 years into the Peat Extraction Phase). The continued presence of the qualifying Orchid rich dry calcareous grassland habitat is consistent with limited ecological dependence on the hydrology of the peatland. Furthermore, the site-specific conservation objectives of the SAC (NPWS, 2021) do not identify hydrology or water levels as attributes requiring maintenance or restoration.

Therefore, given the differing substrates, topographic differences, limited works within the overlap area and absence of evidence for hydrological connectivity between the cutover bogs and the esker, it is considered unlikely that drainage of the Application Site has materially altered the ecological conditions supporting the qualifying calcareous grassland or adversely affected the integrity of the SAC.

Grand Canal pNHA

The Grand Canal pNHA is located to the north of Ticknevin Bog and was designated as a pNHA in 1992. The local baseline environment for the pNHA in its designation year, therefore, included the Application Site in its drained state. No significant drainage works were completed at the Application Site since this designation therefore there was no potential for significant effects or changes from the designation year.

River Barrow and River Nore SAC

Other designated sites downstream and hydrologically connected with the Application Site include the River Barrow and River Nore SAC. The surface water connections from the Application Site to local watercourses could have transferred poor water quality to these sensitive downstream receptors. However, the potential for effects was limited given the length of the hydrological flowpaths between the Application Site and these designated sites (~17km to the River Barrow and River Nore SAC). The River Barrow and River Nore SAC was formally recognized as an SAC in 2014 whilst it was a candidate SAC since 1999. The local baseline environment for the SAC in its designation year, therefore, included the Application Site in its drained state.

Pathway: Surface water drainage network.

Receptors: Long Derries, Edenderry SAC and pNHA, Grand Canal pNHA and the River Barrow and River Nore SAC.

Assessment of effects in the absence of control measures:

In the absence of control measures relating to surface water management the effect on the Long Derries, Edenderry SAC would have been similar to the residual effect described in Section 8.6.3.1.7. The effect would have been an imperceptible, long-term, negative, indirect likely effect. As stated above, the SAC designation is not dependent directly on stream water quality but rather a relatively high groundwater table and calcareous soils. No drainage works were completed at the Application Site since the SAC designation year, or since it became a cSAC in 1997) which could have impacted local groundwater levels.

Similarly, in the absence of control measures relating to surface water management the effect on the Grand Canal pNHA would have been similar to the residual effect described in Section 8.6.3.1.7. No drainage works were completed at the Application Site since the SAC designation which could have impacted local groundwater levels.

Even in the absence of control measures there would not have been a significant effect on the River Barrow and River Nore SAC due to its distant location from the Application Site and the large volumes of water within the River Boyne. The effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.1.7 i.e. an imperceptible, long-term, negative, indirect likely effect on the hydrology (flows and water quality) of the River Barrow and River Nore SAC.

Control Measures:

As outlined above the Application Site has been regulated by the EPA under IPC Licence Registration No. P0503-01 since 2000. In addition, the drainage system has been designed to limit runoff from the site via low-gradient field drains, mains drains, and silt ponds. Control measures relating to the protection of water quality are outlined in Section 8.6.2.1.1 to 8.6.2.1.4 above.

Although surface pathways exist between the Application Site and downstream designated sites, the scale of flows from the Application Site is small relative to the scale of flows in the downstream designated sites, particularly in the River Barrow. As outlined in Section 8.4.3, flow volumes along the hydrological flow paths were separated into groups. Surface water flows between 0.01 – 0.1m^3/s were classified within bog scale flows while sub-catchment to catchment scales flows were classified as being within 10 – 100+ m^3/s.

There are also other activities in all catchments upstream and downstream of the Application Site that have and will contribute to changes in flows and changes in water quality in the receiving water environment (i.e. agriculture, forestry etc).

8.6.2.1.8 Effect on the WFD Status of Surface and Groundwater Bodies

The Application Site has been subject to drainage and peat extraction and ancillary activities since 1935, *i.e.* for more than 65 years before the WFD existed.

As described above, the primary hydrological and hydrogeological changes associated with peat extraction and ancillary activities, occurred during the initial drainage of the bog in advance of peat extraction. Constructed drainage ditches drain the upper surface of the bog by lowering the local peat water table. At this time, ancillary features were also constructed including railway lines, machine passes, canteens, work sites, production centres, mobile fuel tanks, fixed fuel tanks and peat loading facilities. After the Application Site was drained, vegetation was removed from the bog surface, leaving only bare peat fields between the drains. During the Peat Extraction Phase, only minimal landuse change occurs which predominantly relate to minor annual topographic changes (i.e., lower ground levels) caused by ongoing peat extraction. The vast majority of the Application Site has been drained before 1988.

However, in terms of WFD Compliance Assessment, there is no requirement to assess the peat extraction activities at the Application Site which pre-date 2003 and the required transposition of the WFD Directive into Irish Law.

As the 1st WFD cycle was completed in 2010-2015, no WFD status existed for much of the Peat Extraction Phase. However, EPA Q-rating values are available from 2000 to 2020 for watercourses downstream of the Application Site.

The Q-data shows a relatively stable trend in Q-values during this period with the majority of the local watercourses fluctuating between Q3 ("Poor" Q-status) and Q4 ("Good" Q-status), being either moderately polluted or unpolluted. There is no clear negative trend in water quality at the monitoring stations downstream of the Application Site. It is noted 1 no. watercourse achieved High Q-status during this period (the Figile river near Clonbullogue) in 2000. Meanwhile, a Bad Q-status was obtained at 2 no. stations on the Figile River, in the vicinity of the Application Site, at Derrygarran Bridge (1 no. monitoring round) and at a bridge south of Ticknevin Bridge (on 7 no. occasions). It is noted that water quality at both of these locations improved through the latter part of the Peat Extraction Phase to Moderate and Poor Q-status respectively. Importantly, Ticknevin Bridge is located upstream of the Application Site, the bad ratings at this location reflect issues in the upstream catchment rather than any specific peat extraction related activities within the Application Site. Water quality improved in the Figile River in the vicinity of the Application Site.

It is considered that with the implementation of the control measures in accordance with IPC Licence Requirements the status of the SWBs throughout this Peat Extraction Phase of the Project were comparable to those recorded in the 1st WFD cycle (2010-2015) or the 2nd Cycle (2013-2018) where SWBs have not been assigned a status in the 1st cycle.

Pathway: Groundwater recharge and surface water runoff.

Receptor: Downstream surface waterbodies (Abbeylough_010, Figile_030, Figile_040, Figile_050, Slate_050 and Boyne_010 SWBs) and the underlying GWBs (Cushina, Bagenalstown Upper, Kildare and Trim GWBs).

Assessment of effects in the absence of control measures: In the absence of the control measures the effect on SWBs would have been greater than the residual effect described in Section 8.6.3.1.8. The effect would have been a significant, short-term, negative and indirect effect on downstream surface waterbody status.

In terms of GWBs, the Cushina (165km^2), Bagnelstown Upper (574km^2), Kildare (194km^2) and Trim (703km^2) GWBs have no potential to be impacted due to the local hydrogeological regime and the scale of the Application Site in comparison to the scale of these GWBs.

Control Measures:

Since 2003, the peat extraction and ancillary activities at the Application Site were completed under the conditions set out in IPC Licence No. P0503-01. This IPC Licence came into effect in 2000 and upgraded and enhanced several pre-existing environmental monitoring and control measures which had been implemented at the Application Site since July 1988. These pre-IPC measures largely included the incorporation of silt ponds into the bog drainage system to minimise the concentrations of suspended solids entering local watercourses. Further amendments were made to the IPC conditions in 2003 following the transposition of the WFD into Irish Law. Therefore, throughout the Peat Extraction Phase of the Project, peat extraction and ancillary activities have been operating under strict conditions designed to protect downstream water quality and quantity.

Control measures relating to the protection of water quality are outlined in Section 8.6.2.1.1 to 8.6.2.1.4 above.

8.6.2.1.9 Effect on Downstream Surface Water Abstractions

As previously identified, the Barrow PWS associated with the Barrow_130 DWPA is located downstream of the Application Site. The shortest hydrological flowpath between the Application Site and this DWPA is ~35km in length.

Alteration of the hydrological regime at the Application Site may have altered flows from the bog which ultimately discharge to the Barow_130 SWB. Note that even at the time when the bog was drained the potential for effects would have been limited given the length of the hydrological flowpaths and the large volumes of water within the River Barrow.

The vast majority of the Application Site was drained prior to July 1988. The local baseline environment therefore included the Application Site in its drained state.

Pathway: Surface water drainage network. Drainage from the Application Site discharges to outfall points and streams, which discharge to the Figile and Slate rivers which connect downstream to the Barrow_130 DWPA.

Receptors: Barrow_130 DWPA.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would not have been a significant effect on any surface water abstraction associated with this DWPA due to its distant location from the Application Site and the large volumes of water within the River Barrow. The effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.1.9 i.e. an imperceptible, long-term, negative, indirect likely effect on the hydrology (flows and water quality) of the Barrow_130 DWPA.

Control Measures:

As outlined above the Application Site has been regulated by the EPA under IPC Licence Registration No. P0503-01 since 2000. In addition, the drainage system has been designed to limit runoff from the site via low-gradient field drains, mains drains, and silt ponds. Control measures relating to the protection of water quality are outlined in Section 8.6.2.1.1 to 8.6.2.1.4 above.

Although surface pathways exist between the Application Site and the Barrow_130 DWPA, the scale of flows from the Application Site is small relative to the scale of flows in the River Barrow. As outlined in Section 8.4.3, flow volumes along the hydrological flow paths were separated into groups. Surface water flows between 0.01 – 0.1m^3/s were classified within bog scale flows while sub-catchment to catchment scales flows were classified as being within 10 – 100+ m^3/s. The surface water connections between the Application Site and the DWPA are ~30km in length and transition from bog scale flows near the bog to sub-catchment and catchment scale of flows (i.e., the Figile and Slate rivers, which in turn discharges to the River Barrow, have a much higher volumetric flow).

There are also other activities in all catchments upstream and downstream of the Application Site that have and will contribute to changes in flows and changes in water quality in the receiving water environment (i.e. agriculture, forestry etc).

8.6.2.2 Current Phase (June 2020 – Present Day)

The Current Phase of the Project encompasses the period of time between the cessation of peat extraction at the Application Site in June 2020 to the present day.

8.6.2.2.1 *Effects of Bog Drainage on Bog Hydrogeology*

No significant effects on bog hydrogeology will have occurred from the cessation of peat extraction in the June of 2020 to the present day across the vast majority of the Application site. By June 2020, all drainage infrastructure (field drains, main drains, silt ponds etc.) would have been in place across the majority of the Application Site for between 47 – 85 years (the earliest drainage commenced in 1935 in Killina, Lullymore and Lullybeg bogs while the last bogs to be drained were Ticknevin and Codd 2, which had been drained by 1973). Within the bogs, there were some smaller areas which had been drained since 1988 including area known as Clonbrown in the southwest of Ballydermot North (drained in 2017 and 2018), Clonbrown in the northwest of Ballydermot South (drained in 1996), Clonroosk in the southwest of Ballydermot South (drained in 2013) and Cushaling in the north of Codd 1 Bog (drained by 1995).

The hydrogeological regime would have been well established with field drains lowering the perched groundwater table in the adjacent former peat production fields.

No additional drainage or deepening of drains would have occurred during the Current Phase. The only works completed across 14 no. bogs comprising the Application Site consisted of minor maintenance and minor repairs to the drainage network and silt ponds where required.

Rehabilitation works, including drain blocking, have been completed at Lodge Bog . These works will have had a positive effect on local bog hydrogeology. 8.6.5

Pathways: Groundwater volume and water level drawdown.

Receptors: Peat Bog Hydrogeology.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would have been no significant effects on bog hydrogeology during the Current Phase. The residual effect would have been the same as that described in Section 8.6.3.2.1 *i.e.* a neutral, imperceptible, short-term, indirect, unlikely effect on bog hydrogeology.

Control Measures:

During this period BnM continued to operate the Application Site in accordance with IPC licensing requirements. No further control measures, beyond that implemented to date, are deemed necessary as the conditions, emission limits etc. set out in the IPC licence are designed in accordance with the relevant legislation to ensure ongoing protection of ground and surface waters.

8.6.2.2.2 *Effects of Bog Drainage on Downstream Surface Water Hydrology*

With the cessation of peat extraction, there was less potential for disturbance of peat and elevated concentrations of suspended sediments entering surface watercourses. Similarly, the activity of machinery and plant has been reduced, therefore lowering the potential occurrence of accidental spillages of hydrocarbons.

During this period the site drainage still operated under the same drainage systems as during the Peat Extraction Phase *i.e.* field drains, main drains, silt ponds and discharge outlets etc. Therefore, discharge volumes from the Application Site to nearby surface watercourses will be comparable to surface water discharges during the Peat Extraction phase.

Similar to the Peat Extraction Phase, the greatest potential for effects occurred in the receiving streams. Further downstream, the Figile, Slate and Barrow rivers are less susceptible to potential effects due to the increasing flow volumes. Nevertheless, the Current Phase of the Project did not rely on the dilution or assimilative capacity of any downstream watercourse. The control measures implemented in this phase, associated with the IPC licence, ensured that there would be no negative effect on any watercourse downstream of the Application Site.

Pathway: Site drainage and surface water discharge routes.

Receptor: Surface water quality and quantity in the receiving streams (Lullymore East, Lullybeg, Cloncant, Codd, Ballygarrett, Killinagh Upper streams) and down gradient rivers (Figile and Slate rivers).

Assessment of effects in the absence of control measures: Even in the absence of control measures there would have been no significant effects on downstream surface water quality or quantity during the Current Phase. The residual effect would have been the same as that described in Section 8.6.3.2.2 *i.e.* a neutral, imperceptible, short-term, indirect, unlikely effect on downstream surface water hydrology.

Control Measures:

During this period the Application Site continued to operate under IPC licensing requirements with respect to surface water discharge quality and quantity.

8.6.2.2.3 *Contamination of Groundwater by Leakages and Spills*

Despite the cessation of peat extraction at the Application Site, there was still some limited activity at the Application Site involving machinery and plant with which there is always a risk of accidental spillage of hydrocarbons. Similarly, the office buildings at the Ballydermot Works remained occupied and discharges from wastewater systems (septic tanks) etc. have the potential to cause surface water and groundwater contamination. These risks are the same as those outlined in Section 8.6.2.1.3 but to a lesser extent due to the lower volumes of plant, machinery and workers operating at the site during the Current Phase.

Pathway: Infiltration through pore space in peat, subsoil and bedrock.

Receptor: Local Groundwater Quality.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would have been no significant effects on local groundwater quality due to the hydrogeological characteristics of the Application Site. The residual effect would have been the same as that described in Section 8.6.3.2.3 *i.e.* a negative, imperceptible, short-term, indirect unlikely effect on groundwater quality.

Control Measures:

Measures that mitigated against contamination of groundwaters are outlined in Section 8.6.2.1.3 and are currently being adhered to at the Application Site.

8.6.2.2.4 *Contamination of Surface Water by Leakages and Spills*

Despite the cessation of peat extraction at the Application Site, there has been some limited activity at the Application Site during the Current Phase (removal of stockpiles and environmental monitoring) involving machinery and plant with which there is always a risk of accidental spillage of hydrocarbons. Similarly, the office buildings at the Ballydermot Works remain occupied and discharges from wastewater systems (septic tanks) etc. have the potential to cause surface water and groundwater contamination. These risks are the same as those outlined in Section 8.6.2.1.4 but to a lesser extent due to the lower volumes of plant, machinery and workers operating at the Application Site during this phase.

Pathway: Overland flow and site drainage network.

Receptor: Surface water quality and quantity in the receiving streams (Lullymore East, Lullybeg, Cloncant, Codd, Ballygarrett, Killinagh Upper streams) and down gradient rivers (Figile and Slate rivers).

Assessment of effects in the absence of control measures: Even in the absence of control measures there would have been no significant effects on downstream watercourses due to the restricted nature of the works completed in this phase. However, in the absence of control measures relating to hydrocarbons, the effect would have been greater than that described in Section 8.6.3.2.4. The effect would have been a negative, significant, short-term, indirect, unlikely effect on surface water quality.

Control Measures:

Measures that mitigated against contamination of groundwaters are outlined in Section 8.6.2.1.3 and are currently being adhered to at the Application Site.

8.6.2.2.5 *Effects on Groundwater Abstractions*

No effects on local groundwater abstractions will have occurred from the cessation of peat extraction in June 2020 to the present day. Drainage and hydrogeology of the Application Site are unchanged during this period.

Pathway: Groundwater recharge and groundwater flow paths and site drainage network.

Receptor: Local groundwater quality and groundwater quantity, the Ballykilleen and Bracknagh GWSs and the Clonbulloge, Robertstown, Edenderry and Rathangan PWS and private groundwater well supplies.

Assessment of effects in the absence of control measures: Even in the scenario where no control measures were implemented there would not have been a significant effect on local groundwater supplies due to the hydrogeological regime of the Application Site which is characterised by high rates of surface water runoff with very limited groundwater recharge. The effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.2.5 *i.e.* no effect on groundwater supplies.

Control Measures:

Any works during this time period have been completed under licence from the EPA and BnM's Environmental Management System.

8.6.2.2.6 *Effect on Designated Sites*

Despite the cessation of peat extraction at the Application Site, there was still some relatively limited activity at the Application Site involving machinery and plant (removal of stockpiles ceased in 2021), the maintenance of the existing drainage network and environmental monitoring.

The Application Site remains hydrologically linked with the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC. The risks to the receiving waters (in terms of water quantity and water quality) are the same as those outlined in Section 8.6.2.1.7 but to a much lesser extent due to the lower intensity of works being completed at the Application Site. Less activity on-site has decreased the likelihood of pollution incidents or exceedances of discharge limits occurring. The risk is much reduced in comparison to the Peat-Extraction Phase of the Project.

Similar to the Peat Extraction Phase, the greatest potential for effects occurred in the receiving streams in close proximity to the Application Site. Further downstream, the SWBs associated with the River Barrow and River Nore SAC are less susceptible to potential effects due to the large flow volumes. Nevertheless, the Current Phase of the Project did not rely on the dilution or assimilative capacity of any downstream watercourse. The control measures implemented in this phase, associated with the IPC licence, ensured that there would be no negative effect on any watercourse downstream of the Application Site.

Pathway: Surface water drainage network. Drainage from the Application Site discharges to outfall points and streams and rivers.

Receptor: Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would not have been a significant effect on downstream designated sites due to the limited activity at the Application Site during this Phase. Furthermore, no drainage works were completed in the vicinity of the Long Derries, Edenderry SAC/pNHA which could have impacted the local groundwater table. The River Barrow and River Nore SAC is distant from the Application Site and there are significant volumes of water within the associated watercourses. The effect in the absence of control measures would have been a negative, imperceptible, short-term, indirect, unlikely effect on water quantity and water quality in the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC.

Control Measures: Any works during this time period have been completed under licence from the EPA and BnM's Environmental Management System.

The only works completed comprised minor maintenance and minor repairs to the drainage network and silt ponds where required.

8.6.2.2.7 *Effects on WFD Status of Surface and Groundwater Bodies*

With the cessation of peat extraction, there was less potential for disturbance of peat and elevated concentrations of suspended sediments entering surface watercourses. Similarly, the activity of machinery and plant has been reduced, therefore lowering the potential occurrence of accidental spillages of hydrocarbons.

During this period the site drainage still operated under the same drainage systems as during the operational phase of peat extraction *i.e.* field drains, main drains, silt ponds and discharge outlets etc. Therefore, discharge volumes from the Application Site to nearby surface watercourses will be comparable to surface water discharges during the operational phase.

Therefore, there was little potential for the Current Phase of the Project to effect the WFD status of the receiving waterbodies.

Pathway: Groundwater recharge and surface water runoff.

Receptor: Downstream surface waterbodies (Abbeylough_010, Figile_030, Figile_040, Figile_050, Slate_050 and Boyne_010 SWBs) and the underlying GWBs (Cushina, Bagenalstown Upper, Kildare and Trim GWBs).

Assessment of effects in the absence of control measures: Due to the reduced activity at the Application Site, we consider that the effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.2.7 *i.e.* a negative, imperceptible, short-term, indirect, unlikely effect on WFD status of downstream SWBs. There would have been no effect on the underlying GWBs.

Control Measures:

During this period the Application Site continued to operate under IPC licensing requirements with respect to surface water discharge quality and quantity.

8.6.2.2.8 Effect on Downstream Surface Water Abstractions

The Application Site remains hydrologically linked with the Barrow_130 DWPA. The risks to the receiving waters (in terms of water quantity and water quality) are the same as those outlined in Section 8.6.2.1.9 but to a much lesser extent due to the lower intensity of works being completed at the Application Site. Less activity on-site has decreased the likelihood of pollution incidents or exceedances of discharge limits occurring. The risk is much reduced in comparison to the Peat-Extraction Phase of the Project.

Similar to the Peat Extraction Phase, the greatest potential for effects occurred in the receiving streams. Further downstream, the River Barrow is less susceptible to potential effects due to the large flow volumes. Nevertheless, the Current Phase of the Project did not rely on the dilution or assimilative capacity of any downstream watercourse. The control measures implemented in this phase, associated with the IPC licence, ensured that there would be no negative effect on any watercourse downstream of the Application Site.

Pathway: Surface water drainage network. Drainage from the Application Site discharges to outfall points and streams, which discharge to the Figile and Slate rivers which in turn discharge into the River Barrow.

Receptor: Barrow_130 DWPA.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would not have been a significant effect on downstream surface water abstractions due to the limited activity at the Application Site during this Phase. Furthermore, the Barrow_130 DWPA is distant from the Application Site and there are significant volumes of water within the River Barrow. The effect in the absence of control measures would have been a negative, imperceptible, short-term, indirect, unlikely effect on water quantity and water quality in the River Barrow_130 DWPA.

Control Measures: Any works during this time period have been completed under licence from the EPA and BnM's Environmental Management System.

The only works completed comprised minor maintenance and minor repairs to the drainage network and silt ponds where required.

8.6.2.3 Remedial Phase

8.6.2.3.1 *Effect on Bog Hydrogeological Regime*

The overall aim of the decommissioning and rehabilitation plans is to put the Application Site on a trajectory towards becoming a naturally functioning peatland.

The current drainage system was designed to lower the local water table in the bog to facilitate peat extraction. This lowered peat water table does not support typical bog communities. Therefore, in order to achieve the aims of the rehabilitation plans, it will be necessary to alter the drainage regime which currently exists on-site.

Those areas selected for rewetting will experience the greatest change in bog hydrogeology. Rewetting can be achieved through measures such as drain blocking which will encourage natural re-vegetation of the cutaway areas with typical bog communities. More intensive drain blocking will be completed in areas of bare peat whereas less intensive measures will be utilised in areas where habitats are already present. Drain blocking will help establish a more suitable hydrological/hydrogeological regime where the peat water table will be much closer to the surface than it is at present. Post restoration monitoring in other sites has shown that groundwater levels in rewetted bogs can recover relatively quickly i.e. within 2-5 years.

The magnitude of this positive effect will vary across the Application Site, dependent on the local intensity of the drain blocking programme where different areas of the site will be deemed more suitable for rewetting.

Pathways: Water volume and peat water level rise.

Receptors: Local peat bog hydrology/hydrogeology.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, direct, moderate, permanent likely effect on the bog hydrogeological regime.

Mitigation Measures:

No specific mitigation measures are required in relation to the proposed alteration of the existing bog hydrogeology as the proposed measures will have a positive effect on the bog hydrogeology.

Any works undertaken as part of the rehabilitation plan will be completed under licence from the EPA with BnM reporting to the EPA until the IPC Licence is surrendered. All works completed during the Remedial Phase will be done in accordance with 'best practice' procedures and the mitigation measures in relation to the protection of surface and groundwater quality are detailed in Section 8.6.3.3.2 to Section 8.6.3.3.4 below.

8.6.2.3.2 *Effect on Downstream Surface Water Quality*

Whereas draining the Application Site to facilitate peat extraction had an adverse impact on downstream surface watercourses, improvements in flow and water quality can be achieved through bog rehabilitation and rewetting.

One of the successful criteria for rehabilitation, is revegetation of the Application Site. Vegetation will stabilise substrates in the current bare peat fields, thereby reducing the potential for elevated concentrations of suspended solids in site runoff. Additionally, vegetation can quickly stabilise material in blocked drains, further reducing the potential for the entrainment of suspended solids. Whereas the previously bare peat fields acted as a source of sediment and required silt control measures, a rehabilitated bog containing wetland habitats will increase the sites solids retention time. Silt ponds will continue to operate during the early stages of the rehabilitation process and will only be decommissioned when the Application Site is deemed to be on a trajectory of environmental stability and/or rehabilitation has been completed.

The water quality improvements associated with rehabilitated peatlands are not limited to reduced suspended solid concentrations. International studies have shown a long-term reduction in pollutant concentrations, including nitrate and ammonia, following rewetting in comparison to drained peatlands (Pschenyckyj. C. et al. 2021). While several studies have shown that the magnitude of these positive effects depends on site-specific factors such as the degree of degradation and local peat characteristics, all studies have shown an overall long-term decrease in pollutant concentrations (Negassa et al., 2020).

It is worth noting that some studies have shown a short-term increase in phosphorous and suspended solid concentrations following restoration (Harpenslager et al. 2015 and Koskinen et al, 2017). This short-term increase in pollutants is linked to initial drain-blocking activities before the hydrogeological regime of the Application Site becomes stabilised (Pschenyckyj. C. et al. 2021).

The rehabilitations plan will also improve water attenuation at the Application Site, with the blocked drains slowing the rate at which water moves through the Application Site and the rate at which water enters downgradient rivers.

Following rehabilitation, water will still discharge from the designated emission points. However, as discussed in the above paragraphs, this discharge will be of improved quality and of lower volumes.

Pathway: Site drainage and surface water discharge routes.

Receptor: Surface water quality and quantity in the receiving streams (Lullymore East, Lullybeg, Cloncant, Codd, Ballygarrett, Killinagh Upper streams) and down gradient rivers (Figile and Slate rivers).

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, indirect, slight, long-term, likely effect on downstream surface water quality/quantity.

Mitigation Measures:

Any works undertaken as part of the rehabilitation plan will be completed under licence from the EPA with BnM reporting to the EPA until the IPC Licence is surrendered.

The existing drainage systems and silt control measures, which have proven effect, will continue to operate during the early stages of the rehabilitation plan when there is the potential for the entrainment of suspended solids in surface waters during drain blocking. During this time no remedial works will be completed during periods of prolonged rainfall. Silt ponds will continue to be in use and will be regularly inspected and maintained as per IPC licence requirements. All onsite activities will be completed in accordance with 'best practice' procedures.

Following implementation of the rehabilitation measures a programme of aftercare and maintenance, designed in accorded to meet the Conditions of the IPC Licence, will be completed at the Application Site. This will comprise of initial quarterly monitoring, with the number of site visits reducing after 2 years to bi-annually and then after 5 years to annual visits. A water quality monitoring program will be established to monitor the impact of rehabilitation on water quality discharge from the bog. The monitoring results will be reported on each year to the EPA with the parameters to be included as follows: monthly monitoring for pH, Suspended Solids, Total Solids, Total Phosphorus, Total Ammonia, Colour, and COD and DOC.

8.6.2.3.3 Effect of Potential Leakages and Spillages on Groundwater Quality

During the Remedial Phase, there will be some activity at the Application Site involving machinery and plant with which there is always a risk of accidental spillage of hydrocarbons. This activity will be greatest during the initial stages of rehabilitation when works associated with rewetting and revegetation such as drain blocking will be completed. Once this work has been completed there will only be very limited activity at the Application Site which will mainly comprise of non-intrusive monitoring and minimal repairs to peat blockages.

Pathway: Site drainage networks and groundwater flowpaths.

Receptor: Local groundwater quality.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a negative, indirect, slight, short-term, unlikely effect on local groundwater quality.

Mitigation Measures:

The following environmental control measures will be implemented during the remedial measures phase in order to mitigate against leaks and spills:

- All machinery will be regularly checked and maintained prior to arrival at the site;
- Fuelling and lubrication of equipment will only be completed in designated areas and away from surface water features;
- Vehicles will never be left unattended during refuelling;
- All refuelling will occur in mobile fuel bowsers;
- Only dedicated, trained and competent personnel will complete refuelling operations;
- Fuel bowsers will be bunded to 100% capacity to prevent any spills;
- Storage tanks for bowsers and generators will be double-skinned;
- Waste oils and fluids will be collected in leak proof containers and removed from the site for disposal;
- Spill kits will be kept on site; and,
- All activities will be completed in accordance with current 'best practice' procedures.

8.6.2.3.4 Effect of Potential Leakages and Spillages on Surface Water Quality

See as Section 8.6.2.3.3 above.

Pathway: Overland flow and site drainage network.

Receptor: Surface water quality and quantity in the receiving streams (Lullymore East, Lullybeg, Cloncant, Codd, Ballygarrett, Killinagh Upper streams) and down gradient rivers (Figile and Slate rivers).

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a negative, indirect, significant, short-term, unlikely effect on downstream surface water quality.

Mitigation Measures:

The mitigation measures outlined in Section 8.6.2.3.3 will be implemented and adhered to through the Remedial Phase of the Project and until the IPC Licence for the Application Site is surrendered. These measures significantly decrease the risk of surface water contamination by leaks and spills of hydrocarbons. No further mitigation measures are deemed necessary.

8.6.2.3.5 Effect on Groundwater Abstractions

Local groundwater resources are characterised in Section 8.4.15, with no groundwater supplies mapped within the Application Site.

The works associated with the proposed rehabilitation plans are all near-surface activities. Therefore, the potential to impact local groundwater supplies (quality and quantity) is negligible.

Pathway: Groundwater recharge and groundwater flow paths and site drainage network.

Receptor: Groundwater quality and groundwater quantity in local groundwater well supplies.

Pre-Mitigation Potential Effect: The pre-mitigation potential for effects is considered to be a negative, indirect, imperceptible, short-term, very unlikely effect on local groundwater wells.

Mitigation Measures:

With the exception of the protection of groundwater quality from the accidental spillages of hydrocarbons as discussed in Section 8.6.2.3.3, no additional mitigation measures would be necessary due to the shallow nature of the works and the nature of the local hydrogeological regime.

8.6.2.3.6 Effect on Downstream Designated Sites

Peatlands and downstream terrestrial aquatic ecosystems are directly linked and while the degradation of the Application Site may have caused a deterioration in habitats and reduced levels of biodiversity in the downstream catchment, rewetting of bog is linked with improved surface water quality. Therefore, the proposed rehabilitation plans and rewetting of the Application Site will likely improve the quality of aquatic ecosystems such as the downstream designated sites of the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC. However, the significance of any positive effects on the River Barrow and River Nore SAC will be limited given their distant location from the Application Site and the large volumes of water within SWBs.

Pathway: Surface water drainage network. Drainage from the site discharges to the rivers and associated tributaries.

Receptor: Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, indirect, imperceptible, long-term effect on downstream designated sites.

Mitigation Measures:

Any works during this time period have been completed under licence from the EPA and BnM's Environmental Management System. These mitigation measures outlined in Sections 8.6.3.3.2 to Section 8.6.3.3.4. The mitigation measures outlined above will be implemented and adhered to until the IPC Licence for the Application Site is surrendered.

8.6.2.3.7 Effect on Surface and Groundwater Body WFD Status

The EU Water Framework Directive (2000/60/EC) requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the Directive is not compromised. Therefore, the Remedial Phase of the Project must not compromise the objectives of the WFD.

The status of the GWBs and SWBs in the vicinity and downstream of the Application Site are described in Section 8.4.12 and 8.4.13 respectively.

Potential effects on groundwater and surface water quality and quantity as a result of the Remedial Phase, in the absence of mitigation measures has the potential to result in a short-term deterioration in the WFD status of surface water bodies in the immediate vicinity of the Application Site. This short-term impact will be associated with the short-term actions phase of the rehabilitation plans during which drain blocking will be completed and there will be increased risk of hydrocarbon spills and entrainment of suspended solids in surface watercourses. However, even in an unmitigated scenario, the long-term effects of the rehabilitation plans will have a positive impact on the WFD status of surface waterbodies in the vicinity of the Application Site due to the improved quality of surface water discharge from the site and the improved water attenuation within the bog.

The proposed activities on the Application Site during the Remedial Phase will be limited to near surface activities and due to the local hydrogeological regime of the site being characterised by low groundwater recharge rates, the potential for the Project to impact on the status of the underlying GWBs is negligible.

A full WFD Compliance Assessment is included as Appendix 8-3. Our understanding of the WFD objectives is that water bodies, regardless of whether they have 'Poor' "Moderate" or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed in order to ensure there is no deterioration in the status of a waterbody.

Pathway(s): Surface water drainage and downstream discharge to SWBs. Groundwater recharge to the underlying GWBs.

Receptor: The following surface waterbodies have been deemed to have the potential to be affected by the Remedial Phase due to their proximal location downstream of the surface water emissions points associated with the Application Site (refer to Section 8.4.4.4): Abbeylough_010, Figile_030, Figile_040, Figile_050, Slate_050 and Boyne_010 SWBs. Please refer to the WFD Compliance Assessment attached as Appendix 8-3 for a detailed description of the screening process.

In terms of GWBs, the Cushina, Bagnelstown Upper, Kildare and Trim GWBs have no potential to be impacted due to the local hydrogeological regime and the scale of the Application Site in comparison to the scale of these GWBs.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, indirect, slight, long-term effect on the receiving SWBs. The pre-mitigation potential effect is considered to be a neutral effect on the underlying GWBs.

Impact Assessment/Mitigation Measures: Due to the hydrogeological regime at the Application Site, the surface waterbodies directly downstream of the bog discharge locations are deemed to be the most sensitive receptors.

Strict mitigation measures in relation to the protection of surface and groundwaters are outlined above in Section 8.6.2.3.1 to 8.6.2.3.4. The implementation of these mitigation measures during the Remedial Phase will ensure the qualitative and quantitative status of the receiving surface and groundwaters will not be altered.

Consequently, there will be no change in GWB or SWB status in the underlying GWBs or downstream SWBs. There will be no change in quantitative (volume) or qualitative (chemical) status, and the downstream SWBs are protected from any potential deterioration from chemical pollution.

As such, the Remedial Phase is compliant with the requirements of the Water Framework Directive (2000/60/EC).

8.6.2.3.8 *Effect on Downstream Surface Water Abstractions*

The proposed rehabilitation plans and rewetting of the Application Site will likely improve the water quality downstream of the Application Site. However, the significance of any positive effects on Barrow_130 DWPA will be limited given its distant location from the Application Site and the large volumes of water within the River Barrow.

Pathway: Surface water drainage network. Drainage from the site discharges to the Figile and Slate rivers which in turn discharge to the River Barrow.

Receptor: Barrow_130 DWPA.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, indirect, imperceptible, long-term effect on downstream designated sites.

Mitigation Measures:

Any works during this time period have been completed under licence from the EPA and BnM's Environmental Management System. These mitigation measures outlined in Sections 8.6.3.3.2 to Section 8.6.3.3.4. The mitigation measures outlined above will be implemented and adhered to until the IPC Licence for the Application Site is surrendered.

8.6.3 Residual Effects

8.6.3.1 Peat Extraction Phase (July 1988 – June 2020)

8.6.3.1.1 *Effects of Bog Drainage on Bog Hydrogeology*

The residual effect of Peat Extraction Phase of the Project is a permanent, moderate, negative, direct, long-term likely effect on the bog hydrogeology across the majority of the Application Site. It is intended to implement a Cutaway Bog Decommissioning and Rehabilitation Plans for each of the bogs comprising the Application Site and this will likely involve drain blocking and other measures to raise the subsurface water levels. The assessment of the implementation of the Draft Cutaway Bog Decommissioning and Rehabilitation Plans is provided in Section 8.6.4.3.

The residual effects on bog hydrogeology in Clonbrown, Clonroosk and Cushaling which were drained during the Peat Extraction Phase was a permanent, significant, direct, long-term effect.

8.6.3.1.2 *Effects of Bog Drainage on Downstream Surface Water Hydrology/ Quality*

All activities pre-dating 2000 were unlicensed and no records exist regarding the quality of discharges to nearby surface watercourses. However, by 1988 peat extraction and ancillary activities were already well established at the Application Site and while EPA Q-values throughout this phase of the Project fluctuate, there is no clear negative trend in terms of surface water quality between 1988 and 2020. Some improved sediment control measures were installed at the Application Site in the late 1990s and early 2000s and water quality discharge licence limits have been in place since 2000 in accordance with IPC licensing. The available monitoring data indicate that improvements in downstream water quality have not been significant, and this is because there are other activities in the catchment that effect water quality and also that the baseline water quality has not changed significantly during the Peat Extraction

Phase. Data from EPA stations located upstream of the Application Site indicate that water quality was more polluted upstream of the site, and improved in the vicinity of the site.

The effect on surface water quantity in downstream surface watercourse are not likely to be significant. The drainage systems were designed to reduce runoff to greenfield runoff rates. In addition, runoff from intact raised peat bogs can be quite high when saturated during the winter months.

The residual effect is a moderate, long-term, negative and indirect likely effect on downstream surface water quality and a moderate, long-term, negative and indirect effect on downstream surface water quantity (i.e. river flows).

The cessation of activities and the implementation of the rehabilitation plan will limit the potential for significant effects into the future and this is assessed below.

8.6.3.1.3 *Contamination of Groundwater by Leakages and Spills*

From a review of the AER reports, we understand that no significant fuel spills or wastewater discharges have occurred since 2000. In addition, extensive control measures have been implemented since 2000 as part of the IPC licence which mitigates against the possibility of any groundwater contamination.

While there are no records to rely on, there does not appear to be any significant issues with hydrocarbons or wastewater discharges to groundwater resulting from the peat extraction works prior to IPC regulation (we note that no major issues are referenced in the IPC licence application or in subsequent annual environmental reports).

Therefore, the residual effect on local groundwater quality is imperceptible, long-term, negative, indirect and unlikely.

8.6.3.1.4 *Contamination of Surface Water by Leakages and Spills*

BnM did not record (in annual AER submissions to the EPA) the occurrence of any major significant fuel spills and/or wastewater discharges. In addition, extensive control measures have been implemented since 2000 as part of the IPC licence which mitigate against the possibility of any surface water contamination.

While there are no pre-IPC licence records to rely on, there does not appear to be any significant issues with hydrocarbons or wastewater discharges to surface water resulting from the peat extraction and ancillary activities prior to IPC regulation.

The residual effect is a slight, long-term, negative, indirect, unlikely impact on local surface water quality and downstream aquatic ecosystems.

8.6.3.1.5 *Effects Associated with Supporting Infrastructure*

The potential for effects associated with the supporting infrastructure is limited due to their small scale of within the wider the Application Site. Furthermore, all activities at the Application Site were completed using control measures designed to ensure the protection of downstream surface water quality and underlying groundwater quality. Since 2000 all activities at the Application Site have been completed in accordance with IPC Licence conditions. Furthermore, with respect to the welfare facility, there has been no discharge of untreated wastewater at the Application Site. Based on the above, we consider that the residual effect to be negative, indirect, imperceptible, long-term effect on groundwater and surface water quality.

8.6.3.1.6 *Effects on Groundwater Abstractions*

The potential for the peat extraction and ancillary activities to impact the hydrogeology of the Ballykilleen and Bracknagh GWSs and the Clonbulloge, Robertstown, Edenderry and Rathangan PWS was limited as the Application Site is not located within the delineated source protection area associated with any of these supplies. The natural hydrological and hydrogeological regime of the peat bog, with little groundwater recharge and high runoff rates, also limited the potential effects that peat extraction may have had on local groundwater abstractions including private groundwater supplies. The Application Site is not located within the mapped source protection areas associated with any GWS or PWS. The residual effect is considered to be – Neutral, imperceptible, indirect, long-term, unlikely effect on groundwater quality and groundwater quantity.

8.6.3.1.7 Effect on Designated Sites

The potential for the peat extraction and ancillary activities to impact the hydrology of the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC has been reduced as the bog drainage regime was already in place at the time of the designations. Proven and effective control measures have also been implemented to limit the runoff from the Application Site to original greenfield runoff rates. The Application Site has also been operating under IPC licence conditions since May 2000. The residual effect is imperceptible, long-term, negative, indirect likely effect on the hydrology (flows and water quality) of the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC.

8.6.3.1.8 Effect on the WFD Status of Surface and Groundwater Bodies

As the 1st WFD cycle was completed in 2010-2015, no WFD status existed for much of the Peat Extraction Phase. However, EPA Q-rating values are available from 2000 to 2020 for all watercourses downstream of the Application Site.

The Q-data shows a relatively stable trend in Q-values during this period with the majority of the local watercourses fluctuating between Q3 (“Poor” Q-status) and Q4 (“Good” Q-status), being either moderately polluted or unpolluted. There is no clear negative trend in water quality at the monitoring stations downstream of the Application Site. It is noted 1 no. watercourse achieved High Q-status during this period (the Figile river near Clonbullogue) in 2000. Meanwhile, a Bad Q-status was obtained at 2 no. stations on the Figile River, in the vicinity of the Application Site, at Derrygarran Bridge (1 no. monitoring round) and at a bridge south of Ticknevin Bridge (on 7 no. occasions). It is noted that water quality at both of these locations improved through the latter part of the Peat Extraction Phase to Moderate and Poor Q-status respectively. Importantly, Ticknevin Bridge is located upstream of the Application Site, the bad ratings at this locations reflect issues in the upstream catchment rather than any specific peat extraction related activities within the Application Site. Water quality improved in the Figile River in the vicinity of the Application Site.

We consider that with the implementation of the control measures in accordance with IPC Licence Requirements the status of the SWBs during this phase were comparable to those recorded in the 1st WFD cycle (2010-2015).

No receiving SWBs (Figile_030, Figile_040, Figile_050 and Slate_050 SWBs) have ever been assigned ‘Bad’ status. Note that the Figile_010 and Slate_040 SWBs upstream of the Application Site achieved ‘Poor’ status in all WFD cycles while the Figile_030 and Slate_050 SWBs in the vicinity of the Application Site achieved ‘Moderate’ status. This indicates that there are water quality issues upstream of the Application Site. Peat extraction and drainage are listed as significant pressures on several of the receiving SWBs. However, these pressure on the watercourses has not increased since 2003 as the bogs were drained well before the transposition of the WFD into law. Peat extraction and drainage is also listed as a significant pressure on the Figile_010 and Slate_040 SWBs located upstream of the Application Site.

In addition, the underlying Cushina, Bagnelstown, Kildare and Trim GWBs achieved "Good" status in all WFD cycles. IPC licence control measures have ensured the protection of groundwater quality.

Therefore, we consider that there has been a not significant, short-term, negative and indirect effect on downstream SWB status and no residual effect on GWB status. A full WFD Compliance Assessment is included as Appendix 8-3.

8.6.3.1.9 *Effect on Downstream Surface Water Abstractions*

The potential for the peat extraction and ancillary activities to impact the Barrow_130 DWPA is limited given the length of the hydrological flowpath (30km) and the large volumes of water within the River Barrow. Proven and effective control measures have also been implemented to limit the runoff from the Application Site to original greenfield runoff rates. The Application Site has also been operating under IPC licence conditions since 2000. The residual effect is imperceptible, long-term, negative, indirect likely effect on the hydrology (flows and water quality) of the Barrow_130 DWPA.

8.6.3.2 Current Phase (June 2020 – Present Day)

8.6.3.2.1 *Effects of Bog Drainage on Bog Hydrogeology*

The bog hydrogeology remained largely unchanged during this period due to a lack of activity in regard to drainage infrastructure. Therefore, the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on bog hydrogeology.

8.6.3.2.2 ***8.6.6.2.3****Effects of Bog Drainage on Downstream Surface Water Hydrology/ Quality*

No significant effects on downstream surface water hydrology will have occurred from the cessation of peat extraction in June 2020 to the present day. There has been a slight decrease in Q-values in downstream surface watercourses in recent EPA monitoring rounds. This would likely be related to other pressures in the catchment as the cessation of peat extraction would not negatively affect water quality. However, a perceptible positive trend in Q-values, associated with the cessation of peat extraction, would not have been expected given the relatively short time period since peat extraction ceased (approximately 6 years). Therefore, the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on downstream surface water hydrology.

8.6.3.2.3 *Contamination of Groundwater by Leakages and Spills*

From a review of the available AER reports, we understand that no significant fuel spills or wastewater discharges have occurred during this period. Therefore, the residual effect is a negative, imperceptible, short-term, indirect unlikely effect on groundwater quality.

8.6.3.2.4 *Contamination of Surface Water by Leakages and Spills*

From a review of the available AER reports, we understand that no significant fuel spills or wastewater discharges have occurred during this period. Therefore, the residual effect is a negative, imperceptible, short-term, indirect, unlikely effect on surface water quality.

8.6.3.2.5 *Effects on Groundwater Abstractions*

For the reasons outlined above in Section 8.6.2.2.5 and due to the lower levels of activity onsite during the Current Phase of the Project, that there has not been any residual effect on groundwater abstractions.

8.6.3.2.6 *Effect on Designated Sites*

No significant change in the hydrology of the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC will have occurred following the cessation of peat extraction. Due to the reasons outlined above, we consider the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on water quantity and water quality flowing from the Application Site towards the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC.

8.6.3.2.7 *Effect on WFD Status of Surface and Groundwater Bodies*

No change in the qualitative or quantitative status of the receiving waterbodies will have occurred following the cessation of peat extraction. Due to the reasons outlined above, we consider the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on WFD status of downstream SWBs and underlying GWBs.

8.6.3.2.8 *Effect on Downstream Surface Water Abstractions*

No significant change in the hydrology of the River Barrow will have occurred following the cessation of peat extraction. Due to the reasons outlined above, we consider the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on water quantity and water quality flowing from the Application Site towards the Barrow_130 DWPA.

8.6.3.3 Remedial Phase

8.6.3.3.1 *Effects of Bog Drainage on Bog Hydrogeology*

Following the implementation of the proposed rehabilitation plans, the Application Site will likely be wetter, will retain more water, will recolonise with vegetation slowly, and will eventually become a naturally functioning peatland. As such, we consider the residual effects of the rehabilitation plan to be moderate, positive, direct, long-term effect on local peat bog hydrology/hydrogeology.

8.6.3.3.2 *Effects of Bog Drainage on Downstream Surface Water Hydrology/ Quality*

Following the implementation of the proposed rehabilitation plans, the Application Site will be wetter, will retain more water, will recolonise with vegetation slowly, and will eventually become a naturally functioning peatland with much-reduced silt and nutrient output. As such, we consider the residual effects of the rehabilitation plan to be a moderate, positive, indirect, long-term effect on downstream surface water hydrology and water quality.

8.6.3.3.3 *Effect of Potential Leaks and Spillages on Groundwater Quality*

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all industrial sites. Proven and effective measures to mitigate the risk of spills and leaks will be implemented during the Remedial Phase of the Project. It is considered that the residual effect to be negative, imperceptible, direct, short-term, unlikely effect on groundwater quality.

8.6.3.3.4 *Effect of Potential Leaks And Spillages on Surface Water Quality*

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all industrial sites. Proven and effective measures to mitigate the risk of spills and leaks will be implemented throughout the Remedial Phase of the Project. Therefore, the residual effect is imperceptible, negative, direct, short-term, unlikely effect on surface water quality.

8.6.3.3.5 *Effect on Groundwater Abstractions*

There will be no effect on groundwater resources and existing abstractions.

8.6.3.3.6 *Effect on Designated Sites*

Due to the reasons outlined above, and with the implementation of the rehabilitation plans the Application Site will likely be wetter, will retain more water, will recolonise with vegetation slowly, and will eventually become a naturally functioning peatlands and or wetlands with much-reduced silt and nutrient output. It is considered that consider the likely residual effect to be moderate, positive, indirect, long-term effects on the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC.

8.6.3.3.7 *Effect on the WFD Status of Surface and Groundwater Bodies*

Due to the local hydrogeological regime at the Application Site (very limited groundwater recharge), coupled with the implementation of the proposed mitigation measures for the protection of surface water quality, and the additional hydrological benefits associated with bog rehabilitation (improved surface water quality and improved water attenuation), we consider that there will be a slight, positive, long-term, indirect, likely effect on the WFD status of downstream SWBs. There will be no residual effect on the WFD status of the underlying GWBs.

8.6.3.3.8 *Effect on Downstream Surface Water Abstractions*

Due to the reasons outlined above, and with the implementation of the rehabilitation plans the Application Site will likely be wetter, will retain more water, will recolonise with vegetation slowly, and will eventually become a naturally functioning peatlands and or wetlands with much-reduced silt and nutrient output. It is considered that consider the likely residual effect to be an imperceptible, positive, indirect, long-term effects on the Barrow_130 DWPA.

8.6.4 Significance of Effects

8.6.4.1 Peat Extraction Phase (July 1988 – June 2020)

8.6.4.1.1 *Effects of Bog Drainage on Bog Hydrogeology*

With the implementation of the control measures, we consider that there has been a moderate effect on local bog hydrogeology across the majority of the Application Site as a result of the Peat Extraction Phase of the Project between July 1988 and June 2020. There were significant effects in very localised areas.

8.6.4.1.2 *Effects of Bog Drainage on Downstream Surface Water Hydrology/ Quality*

For the reasons outlined above, and with the implementation of the control measures, it is considered that there has been a moderate effect on downstream surface water quality as a result of the Peat Extraction Phase of the Project between July 1988 and June 2020. There were no significant effects.

8.6.4.1.3 Contamination of Groundwater by Leakages and Spills

For the reasons outlined above and with the implementation of the control measures we consider that there has not been a significant effect on groundwater quality as a result of leaks and spills during the Peat Extraction Phase of the Project.

8.6.4.1.4 Contamination of Surface Water by Leakages and Spills

For the reasons outlined above and with the implementation of the control measures, it is considered that there has not been a significant effect on downstream surface water quality as a result of leaks and spills during the Peat Extraction Phase of the Project.

8.6.4.1.5 Effects Associated with Supporting Infrastructure

For the reasons outlined above and with the implementation of the control measures we consider that there has not been a significant effect on groundwater or surface water quality as a result of the construction or operation of the supporting infrastructure during the Peat Extraction Phase of the Project.

8.6.4.1.6 Effects on Groundwater Abstractions

For the reasons outlined above, we consider that there has not been a significant effect on local groundwater abstractions during the Peat Extraction Phase of the Project.

8.6.4.1.7 Effect on Designated Sites

For the reasons outlined above and with the implementation of the outlined control measures we consider that there has not been a significant effect on the hydrology of the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC during the Peat Extraction Phase of the Project.

8.6.4.1.8 Effect on the WFD Status of Surface and Groundwater Bodies

With the implementation of the IPC licence controls no significant effects on the status of downstream SWBs or the underlying GWBs have occurred during the Peat Extraction Phase of the Project.

8.6.4.1.9 Effect on Downstream Surface Water Abstractions

For the reasons outlined above and with the implementation of the outlined control measures we consider that there has not been a significant effect on the hydrology of the River Barrow or the River Barrow_130 DWPA during the Peat Extraction Phase of the Project.

8.6.4.2 Current Phase (June 2020 – Present Day)

8.6.4.2.1 Effects of Bog Drainage on Bog Hydrogeology

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on the local bog hydrogeology during the Current Phase of the Project.

8.6.4.2.2 Effects of Bog Drainage on Downstream Surface Water Hydrology/ Quality

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on the downstream surface water hydrology during the Current Phase of the Project.

8.6.4.2.3 Contamination of Groundwater by Leakages and Spills

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on local groundwater quality during the Current Phase of the Project.

8.6.4.2.4 Contamination of Surface Water by Leakages and Spills

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on downgradient surface waterbodies during the Current Phase of the Project.

8.6.4.2.5 Effects on Groundwater Abstractions

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on groundwater resources and abstractions during the Current Phase of the Project.

8.6.4.2.6 Effect on Designated Sites

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on downgradient designated sites including the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC during the Current Phase of the Project.

8.6.4.2.7 Effect on WFD Status of Surface and Groundwater Bodies

With the implementation of the IPC Licence conditions we consider that there has not been a significant effect on WFD status during the Current Phase of the Project.

8.6.4.2.8 Effect on Downstream Surface Water Abstractions

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on downgradient Barrow_130 DWPA during the Current Phase of the Project.

8.6.4.3 Remedial Phase

8.6.4.3.1 *Effects of Bog Drainage on Bog Hydrogeology*

For the reasons outlined above we consider that the proposed rehabilitation plans will have a significant effect on local bog hydrogeology within the Application Site.

8.6.4.3.2 *Effects on Downstream Surface Water Hydrology/Quality*

For the reasons outlined above we consider that the proposed rehabilitation plans will have a significant effect on downstream water quality and quantity.

8.6.4.3.3 *Contamination of Groundwater by Leakages and Spills*

For the reasons outlined above and with the implementation of the mitigation measures, we consider that there will not be a significant effect on groundwater quality.

8.6.4.3.4 *Contamination of Surface Water by Leakages and Spills*

For the reasons outlined above and with the implementation of the mitigation measures, we consider that there will not be a significant effect on surface water quality.

8.6.4.3.5 *Effects on Groundwater Abstractions*

For the reasons outlined above we consider that there will not be a significant effect on groundwater resources and abstractions.

8.6.4.3.6 *Effect on Designated Sites*

For the reasons outlined above and with the implementation of the mitigation measures, we consider that there will not be a significant effect on the Long Derries, Edenderry SAC/pNHA, the Grand Canal pNHA and the River Barrow and River Nore SAC.

8.6.4.3.7 *Effect on the WFD Status of Surface and Groundwater Bodies*

With the implementation of the mitigation measures outlined above there will be no significant effects resulting from the Remedial Phase of the Project. The Remedial Phase will not result in the deterioration in the WFD status of any surface or groundwater body nor will it jeopardise the attainment of good status in the future.

8.6.4.3.8 *Effect on Downstream Surface Water Abstractions*

For the reasons outlined above and with the implementation of the mitigation measures, we consider that there will not be a significant effect on the Barrow_130 DWPA.

8.6.5 Summary

Please see the below table for a summary of all identified impacts relating to water.

Table 8-20: Assessment Classification Summary

Topic	Pre-Mitigation Effect (EPA, 2022 Classification)	Mitigation Section Reference	Residual Effect (EPA, 2022 Classification)	EIA Significance Threshold

Peat Extraction Phase				
Effects on Bog Hydrogeology	Permanent, Moderate, Negative, Direct, Long-Term	Section 8.6.2.1.1	Permanent, Moderate, Negative, Direct, Long-Term effect across the majority of the Application Site Permanent, Significant, Negative, Direct, Long-Term effect on small areas of Application Site (in Clonbrown, Clonroosk and Cushaling	significant
Effects on Surface Water Quality due to Bog Drainage	Significant, Long-Term, Negative, Indirect	Section 8.6.2.1.2	Moderate, Long-Term, Negative, Indirect	not significant
Leaks and Spills and Effects on Groundwater	Slight, Long-Term, Negative, Indirect	Section 8.6.2.1.3	Imperceptible, Long-Term, Negative, Indirect	not significant
Leaks and Spills and Effects on Surface Water	Significant, Long-Term, Negative, Indirect	Section 8.6.2.1.4	Slight, Long-Term, Negative, Indirect	not significant
Supporting Infrastructure	Negative, Indirect, Slight, Long-Term	Section 8.6.2.1.5	Negative, Indirect, Imperceptible, Long-Term	not significant
Groundwater Abstractions	Negative, Imperceptible, Indirect, Long-Term	Section 8.6.2.1.6	Neutral, Imperceptible, Indirect, Long-Term	not significant
Designated Sites	Imperceptible, Long-Term, Negative, Indirect	Section 8.6.2.1.7	Imperceptible, Long-Term, Negative, Indirect	not significant
WFD Status	Significant, Short-Term, Negative, Indirect	Section 8.6.2.1.8	Not Significant, Short-Term, Negative and Indirect	not significant
Surface Water Abstractions	Imperceptible, Long-Term, Negative, Indirect	Section 8.6.2.1.9	Imperceptible, Long-Term, Negative, Indirect	not significant
Current Phase				
Effects on Bog Hydrogeology	Neutral, Imperceptible, Short-Term, Indirect	Section 8.6.2.2.1	Neutral, Imperceptible, Short-Term, Indirect	not significant

Effects on Surface Water Quality due to Bog Drainage	Neutral, Imperceptible, Short-Term, Indirect	Section 8.6.2.2.2	Neutral, Imperceptible, Short-Term, Indirect	not significant
Leaks and Spills and Effects on Groundwater	Negative, Imperceptible, Short-Term, Indirect	Section 8.6.2.2.3	Negative, Imperceptible, Short-Term, Indirect	not significant
Leaks and Spills and Effects on Surface Water	Negative, Significant, Short-Term, Indirect	Section 8.6.2.2.4	Negative, Imperceptible, Short-Term, Indirect	not significant
Groundwater Abstractions	None	Section 8.6.2.2.5	None	not significant
Designated Sites	Negative, Imperceptible, Short-Term, Indirect	Section 8.6.2.2.6	Neutral, Imperceptible, Short-Term, Indirect	not significant
WFD Status	Negative, Imperceptible, Short-Term, Indirect	Section 8.6.2.2.7	Neutral, Imperceptible, Short-Term, Indirect,	not significant
Surface Water Abstractions	Negative, Imperceptible, Short-Term, Indirect	Section 8.6.2.2.8	Neutral, Imperceptible, Short-Term, Indirect	not significant
Remedial Phase				
Effects on Bog Hydrogeology	Positive, Direct, Moderate, Permanent	Section 8.6.2.3.1	Moderate, Positive, Direct, Long-Term	not significant
Effects on Surface Water Quality due to Bog Drainage	Positive, Indirect, Slight, Long-Term	Section 8.6.2.3.2	Moderate, Positive, Indirect, Long-Term	not significant
Leaks and Spills and Effects on Surface Water	Negative, Indirect, Slight, Short-Term	Section 8.6.2.3.3	Negative, Imperceptible, Direct, Short-Term	not significant
Leaks and Spills and Effects on Groundwater	Negative, Indirect, Significant, Short-Term	Section 8.6.2.3.4	Imperceptible, Negative, Direct, Short-Term	not significant
Groundwater Abstractions	Negative, Indirect, Imperceptible, Short-Term	Section 8.6.2.3.5	None	not significant
Designated Sites	Positive, Indirect, Imperceptible, Long-Term	Section 8.6.2.3.6	Moderate, Positive, Indirect, Long-Term	not significant
WFD Status	Positive, Indirect, Slight, Long-Term	Section 8.6.2.3.7	Slight, Positive, Long-Term, Indirect	not significant

Surface Water Abstractions	Positive, Indirect, Imperceptible, Long-Term	Section 8.6.2.3.8	Imperceptible, Positive, Indirect, Long-Term	not significant

8.6.6 Cumulative/In Combination Effects

8.6.6.1 Peat Extraction Phase (July 1988 – June 2020)

Indirect cumulative effects can occur via surface water and groundwater flow paths, but these are restricted by connectivity and proximity.

The Application Site drains to the Figile and Slate rivers. Artificial drainage, comprising of filed drains, main drains, silt ponds and outfalls, had been inserted at the Application Site by July 1988. The Application Site discharges surface water to tributaries of these watercourses. There is no outfall from the bogs to the River Boyne or its tributaries to the north.

Potential cumulative effects associated with landuse, hydrological and/or hydrogeological changes at the Application Site due to the peat extraction and ancillary activities would have had the potential to result in some cumulative effects associated with other activities occurring within the catchments of the Figile and Slate rivers over this time period (1988 – 2020).

The assessment of cumulative effects during the Peat Extraction Phase of the Project is divided as follows:

- Cumulative effects assessment of third party peat turf cutting and milled peat production (i.e. turbary activities);
- Cumulative effects of agriculture in the surrounding lands; and,
- Cumulative effects of forestry.

The cumulative effects of the Peat Extraction Phase (July 1988 – June 2020) and the peat extraction and site preparation works which preceded 1988 would have had a profound negative effect on the bog hydrogeological regime whereby vegetation was cleared, drainage inserted, and peat extracted from much of the Application Site. The cumulative effect on downstream surface water quality and flow volumes is not considered to be significant given the control measures being implemented by BnM.

8.6.6.1.1 *Cumulative Effects of Third-Party Peat Cutting*

Following the Turf Development Act of 1981, BnM oversaw a private turf development scheme which provided grants to private bog developers. Third party extraction was undertaken on turbary plots at the periphery of the Application Site and as such exact locations and volumes are not available.

The Peat Extraction Phase of the Project would potentially have interacted with these minor turbary activities and could have contributed to a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia. Bog drainage would also have been required for these turbary activities and cumulative impacts on the local bog hydrology may have occurred.

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality in downgradient waterbodies and bog hydrogeology.

Control Measures:

Control measures relating to the protection of water quality are outlined in Sections 8.6.2.1.1 to 8.6.2.1.4 above.

Impact Assessment:

No control measures beyond those required to comply with the IPC licence conditions were implemented. Control measures were also implemented by BnM in an ad hoc manner between July 1988 and 2000 by implementation of the pre-existing surface water management system (Refer to Section 8.6.2.1.2).

The areas of third party peat cutting were small in comparison to the peat extraction and ancillary activities completed by BnM. The third party peat cutting was also completed at bog margins.

By July 1988 the vast majority of the Application Site was already artificially drained. Consequently, the continued drainage of the Application Site during the Peat Extraction Phase of the Project would have been limited in its potential to alter the hydrological regime in downstream watercourses. However, during the Peat Extraction Phase, there was an ongoing risk of elevated concentrations of suspended solids making their way into downstream surface watercourses from the erosion of peat sediment via the bog drainage network. This potential pathway would pose a significant risk to local surface water quality in the Figile and Slate rivers and their associated tributaries. Other water quality parameters of concern are ammonia and Chemical Oxygen Demand (COD).

As outlined, EPA Q-values throughout the Peat Extraction Phase of the Project fluctuate, there is no clear negative trend in terms of surface water quality between July 1988 and June 2020. Some improved sediment control measures were installed at the Application Site in the late 1990s and early 2000s and water quality discharge licence limits have been in place since 2000 in accordance with IPC licensing. The available monitoring data indicate that improvements in downstream water quality have not been significant, and this is because there are other activities in the catchments that effect water quality and also that the baseline water quality was reasonably good and has not changed significantly during the Peat Extraction Phase of the Project.

Residual Effects: Any third party or private peat cutting completed at the Application Site during the Peat Extraction Phase of the Project (July 1988 – June 2020) would have been infinitely small, in terms of the peat extraction areas and the volumes of peat being removed from the Application Site, in comparison to the BnM operations. There are no indications from surface water quality monitoring data that third party peat extraction in combination with BnM peat extraction activities had a significant impact on downstream surface water quality. Therefore, any cumulative effects on local bog hydrogeology and downstream local surface water quality would have been consistent with emerging trends within the downstream catchments when compared to those which would have resulted solely from the large scale industrial BnM peat extraction operations. The residual effect is a moderate, long-term, negative, indirect likely effect on downgradient waterbodies (i.e. the Figile and Slate rivers and associated tributaries).

Significance of Effects: For the reasons outlined above we consider that there has not been a significant cumulative effect during the Peat Extraction Phase of the Project.

8.6.6.1.2 *Cumulative Effects with Agriculture*

The Application Site drains to the Figile and Slate rivers. Agriculture is the largest land use in the surrounding lands and in the wider catchments/sub-catchments. Corine land cover maps (1990 – 2018) show that the majority of lands surrounding the Application Site have been used for agricultural purposes during the Peat Extraction Phase of the Project (July 1988 – June 2020).

Agriculture is the largest pressure on water quality in Ireland. Agricultural practices such as the movement of soil and the addition of fertilizers and pesticides can lead to nutrient losses and the entrainment of suspended solids in local surface watercourses. This can have a negative impact on local and downstream surface water quality.

The Peat Extraction Phase of the Project would potentially have interacted with these agricultural activities and could have contributed to a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies.

Control Measures:

No control measures beyond those required to comply with the IPC licence conditions are deemed necessary. These control measures have been implemented by BnM since 2000 and build upon pre-existing surface water management system which was already in operation at the Application Site (July 1988 – 2000).

Impact Assessment:

The area of the Application Site (54.61km^2) is small in comparison to the total catchment area of the Figile, Slate and Barrow rivers downstream of the Application Site. The total catchment area of the Slate River upstream of its confluence with the Figile River is 215km^2. The total catchment area of the Figile River upstream of its confluence with the River Barrow is 622km^2. The total catchment area of the River Barrow downstream of the Figile River at Monasterevin is 1,064km^2. The total area of the Application Site draining to the river Barrow, represents only a small percentage (5%) of the catchment area. Therefore, there was limited potential for cumulative effects on the River Barrow. There would have been greater potential for cumulative effects on the Figile and Slate rivers.

By July 1988 the vast majority of the Application Site had already been artificially drained. Consequently, the continued drainage of the Application Sites during the Peat Extraction Phase of the Project would have been limited in its potential to alter the hydrological regime in downstream watercourses. However, during the Peat Extraction Phase, there was an ongoing risk of elevated concentrations of suspended solids and ammonia making their way into downstream surface watercourses via the bog drainage network. This potential pathway would pose a significant risk to downstream local surface water quality.

However, while the EPA Q-values throughout the Peat Extraction Phase of the Project fluctuate, there is no clear negative trend in terms of surface water quality between July 1988 and June 2020. Furthermore, EPA Q-stations located upstream of the Application Site fluctuate in a similar manner indicating that there are other activities in the catchment, including agriculture, which had a greater effect on downstream surface water quality.

Some improved sediment control measures were installed at the Application Site in the late 1990s and early 2000s and water quality discharge licence limits have been in place since 2000 in accordance with IPC licensing. Any cumulative effects will have been reduced in subsequent years with environmental monitoring showing that since 2000, the emission limit for ammonia (3mg/l) has only been exceeded on 3 no. occasions from the 226 no. grab samples taken from outfalls from the Application Site. Meanwhile the emission limit for suspended solids (35mg/l) has only been exceeded on 6 no. occasions. As discussed in Section 8.4.6.2.2 above, 98.67% and 97.34% of the total samples analysed for ammonia and suspended solids have been compliant with the relevant IPC limits. Therefore, if significant cumulative effects were occurring, we would expect to see an improvement in downstream water quality following the implementation of the IPC licence control measures.

However, the available monitoring data indicate that improvements in downstream water quality have not been significant. This indicates that the wider land use in the catchment, which is dominated by agriculture, has a greater effect on surface water quality than the peat extraction and ancillary activities within the Application Site and any associated cumulative effects.

Residual Effect: The baseline July 1988 environment comprised of a drained peatland located within a largely agricultural catchment. There are no indications from surface water quality monitoring data that peat extraction and ancillary activities within the Application Site in combination with agricultural activities in the wider catchment had a significant impact on downstream surface water quality. The EPA Q-values suggest that any cumulative effects were small in comparison to the effects resulting solely from agricultural practices in the wider catchment. Therefore, any cumulative effects on local downstream local surface water quality would have been consistent with emerging trends within the downstream catchments when compared to those which would have resulted solely from the large scale, commercial BnM peat harvesting operations. The residual effect is a moderate, long-term, negative, indirect, likely cumulative effect on downgradient waterbodies.

Significance of Effects: For the reasons outlined above we consider that there has not been a significant cumulative effect during the Peat Extraction Phase of the Project.

8.6.6.1.3 *Cumulative Effects with Forestry*

There are some small areas of coniferous forestry in the lands surrounding the Application Site. These areas of forestry do not form part of the Substitute Consent application.

The most common water quality problems arising from forestry relate to the release of sediment and nutrients to the aquatic environment and impacts from acidification. Forestry may also give rise to modified stream flow regimes caused by associated land drainage.

Due to the close proximity of these areas of coniferous forestry to the Application Site and given that they drain to the same river waterbodies as the Application Site, the potential cumulative effects on downstream water quality and quantity need to be assessed.

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality and quantity in downgradient waterbodies.

Control Measures:

No control measures beyond those required to comply with the IPC licence conditions are deemed necessary. These control measures have been implemented by BnM since 2000 and build upon pre-existing surface water management system which was already in operation at the Application Site (July 1988 – June 2000).

Impact Assessment:

The areas of coniferous forestry were small in comparison to areas of peat extraction and ancillary activities completed by BnM.

By July 1988 the vast majority of the Application Site had already been artificially drained. Consequently, the continued drainage of the Application Site during the Peat Extraction Phase of the Project would have been limited in its potential to alter the hydrological regime in downstream watercourses. However, during the Peat Extraction Phase, there was an ongoing risk of elevated concentrations of suspended solids making their way into downstream surface watercourses from the erosion of peat sediment via the bog drainage network. This potential pathway would pose a significant risk to local surface water quality. Other water quality parameters of concern are ammonia and Chemical Oxygen Demand (COD).

As outlined previously, EPA Q-values throughout the Peat Extraction Phase of the Project fluctuate, there is no clear negative trend in terms of surface water quality between July 1988 and June 2020. In addition, there is no distinguishable improvement in surface water quality following the implementation of the improved sediment control measures in the late 1990s and early 2000s and the IPC licence control measures in 2000. The monitoring data indicates there are other activities in the catchments which effect water quality and also that the baseline water quality was reasonably good and has not changed significantly during the Peat Extraction Phase of the Project.

Residual Effects: By July 1988 peat extraction and ancillary activities were already well established across the majority of the Application Site. Therefore, the baseline environment contained peat extraction across much of the Application Site. Any cumulative effects with the commercial forestry activities will have been reduced in subsequent years as BnM implemented improved sediment control measures throughout the 1990s and IPC licencing controls in 2000.

EPA Q-values in downstream watercourses fluctuate throughout this phase of the Project, there is no clear negative trend in terms of surface water quality between July 1988 and June 2020.

Therefore, the cumulative effect of the Peat Extraction Phase of the Project and the forestry activities in the surrounding lands is moderate, long-term, negative, indirect, likely effect on downgradient waterbodies (i.e. Figile and Slate rivers, and their associated tributaries).

Significance of Effects: For the reasons outlined above we consider that there has not been a significant cumulative effect during the Peat Extraction Phase of the Project.

8.6.6.2 Current Phase (June 2020 – Present Day)

8.6.6.2.1 *Cumulative Effects with Agriculture*

The Application Site is situated within a largely agricultural catchment and any activities within the Application Site have the potential to interact with the agricultural practices in the surrounding lands and could contribute to a deterioration of downstream surface water quality.

The potential effects are similar to those associated with the Peat Extraction Phase of the Project but of a significantly reduced magnitude due to the reduced scale of any works. During this phase of the Project activities onsite include the removal of stockpiles (last stockpiles were removed from the Application Site by 2021), maintenance of the existing drainage system and environmental monitoring.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies.

Control Measures:

All operations completed during the Current Phase of the Project were done in accordance with IPC licence requirements and no additional control measures are deemed necessary.

Residual Effects: There are no indications from EPA Q-values or environmental monitoring data that there has been a significant impact on downstream surface water quality. No cumulative effects have occurred.

Significance of Effects: For the reasons outlined above and with the implementation of IPC licence control measures, we consider that there has not been a significant cumulative effect during the Current Phase of the Project.

8.6.6.2.2 *Cumulative Effects with Forestry*

There are some small areas of coniferous forestry in the lands surrounding the Application Site, and given that they drain to the same river waterbodies as the Application Site, the potential cumulative impacts on downstream water quality and quantity need to be assessed.

The potential effects are similar to those associated with the Peat Extraction Phase of the Project but of a significantly reduced magnitude due to the cessation of peat extraction and the reduced scale of ancillary activities. During this phase of the Project activities onsite are limited to the removal of stockpiles (last stockpiles were removed from the Application Site by 2021), maintenance of the existing drainage system and environmental monitoring.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies.

Control Measures:

All operations completed during the Current Phase of the Project were done in accordance with IPC licence requirements and no additional control measures are deemed necessary.

Residual Effects: There are no indications from EPA Q-values or environmental monitoring data that there has been a significant effect on downstream surface water quality. No cumulative effects have occurred.

Significance of Effects: For the reasons outlined above and with the implementation of IPC licence control measures, we consider that there has not been a significant cumulative effect during the Current Phase of the Project.

8.6.6.2.3 *Cumulative Effects with Enhanced Rehabilitation Measures (PCAS)*

The Peatland Action Scheme (PCAS) is a programme of enhanced peatland rehabilitation measures, which is in addition to the IPC licence decommissioning and rehabilitation requirement. PCAS being applied at specific locations across the BnM landbank that are identified as suitable for the prescribed enhancement measures.

PCAS works are ongoing at Lodge Bog within the Application Site. The works include enhanced rehabilitation measures to rewet Lodge Bog and include intensive drain blocking, outfall modification and fertiliser application. These works will have had a positive effect on the local bog hydrogeology within Lodge Bog. The PCAS measures themselves may have resulted in a short-term negative effect on surface water quality during the works (elevated concentrations of suspended sediment). In the long-term, the PCAS measures in Lodge Bog will provide greater surface water attenuation and surface water quality benefits in and downstream of the restoration areas. These PCAS measures and the standard remedial measures, which will be implemented across the Application Site, will have a positive cumulative effect on bog hydrogeology and surface water quality.

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Slate River and its associated tributaries) and bog hydrogeology.

Mitigation Measures: All operations completed during the Current Phase of the Project were done in accordance with IPC licence requirements and no additional control measures are deemed necessary. All PCAS works completed at Lodge Bog were also done in accordance with IPC licence requirements.

Residual Effects: There are no indications from EPA Q-values or environmental monitoring data that there has been a significant effect on downstream surface water quality. No cumulative effects have occurred.

Significance of Effects: For the reasons outlined above and with the implementation of IPC licence control measures, we consider that there has not been a significant cumulative effect during the Current Phase of the Project. Remedial Phase.

8.6.6.3 Remedial Phase

8.6.6.3.1 *Cumulative Effects with Proposed Ballydermot Wind Farm*

BnM intend to utilise the Application Site for both peatland rehabilitation and wind energy infrastructure in order to facilitate environmental stabilisation of the bog and to optimise climate action benefits.

It is proposed to construct a wind energy development at the Application Site consisting of 47 no. turbines, 20 no. turbines with an overall blade to tip height of 200m and 27 no. turbines with an overall tip height of 220m at the Application Site. The overall footprint of the infrastructure associated with the wind farm is <3% of the total area of the Application Site. The Draft Cutaway Bog Decommissioning and Rehabilitation Plans for the Application Site will be updated as required to incorporate the proposed wind farm infrastructure, with the key objectives of the rehabilitation plan *i.e.* rewetting and revegetation, occurring between and surrounding the proposed wind farm infrastructure. A separate EIAR and accompanying NIS are being undertaken for the proposed Ballydermot Wind Farm development. At the time of writing, the planning application for this development has not yet been submitted to An Coimisiún Pleanála. There will be a slight cumulative effect with on hydrological and hydrogeological environment for the proposed Ballydermot Wind Farm, but the effect is limited by the small footprint of the infrastructure associated with the wind farm relative to the overall Application Site area.

The EIAR for the proposed Ballydermot Wind Farm development will detail the potential hydrological and hydrogeological issues relating to the construction, operation and decommissioning phases of the proposed wind farm and proposes a suite of detailed, tried and tested, best practice mitigation measures designed to ensure that the proposed wind farm development does not in any way have a negative impact on downstream surface water quality and quantity.

The main risk to downstream surface water quality and the underlying groundwater quality will occur during the construction phase of the proposed wind farm development when there is greatest activity on site and large volumes of material being excavated, increasing the potential for elevated concentrations of suspended solids in runoff and heightening the risk of hydrocarbon spillages and leaks. However, extensive mitigation measures will be utilised to protect surface water quality during all phases of the proposed wind farm development. These mitigation measures will utilise and enhance the existing bog drainage network to ensure the proposed wind farm development will be in accordance with IPC licence conditions.

During the operational phase of the proposed wind farm development, the majority of the remedial rehabilitation measures, such as drain blocking, will have been completed and there will be little activity on site with the exception of monitoring and maintenance. The increased surface water runoff associated with the wind farm development infrastructure will be offset by the increased surface water attenuation at the site following the implementation of the remedial measures.

Water quality of discharges from restored peatlands generally improves as a result of bog rehabilitation measures and site restoration. The proposed rehabilitation measures at the Application Site include drain blocking which will improve water attenuation by slowing the movement of water through the Application Site and the release of water downstream. Re-vegetation of the Application Site will stabilise substrates and reduce the risk of elevated concentrations of suspended sediment in downstream watercourses.

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality in downgradient waterbodies and bog hydrogeology.

Mitigation Measures: No mitigation measures beyond those required to comply with the IPC licence conditions and those outlined in Sections 8.6.2.3.1 to Section 8.6.2.3.4 are deemed necessary.

Likely Cumulative Residual Effects: Infrastructure associated with the proposed wind farm development comprises a small proportion of landcover within the Application Site. Effective mitigation measures have been proposed for the remedial phase of the Project and with the implementation of similar measures for all phases of the potential wind farm development the cumulative residual effect is a moderate, long-term, likely, positive effect.

Significance of Effects: For the reasons outlined above we consider that there will not be a significant cumulative effect.

8.6.6.3.2 *Cumulative Effects with Enhanced Rehabilitation Measures (PCAS)*

As stated above in Section 8.6.6.2.3 PCAS works are ongoing at Lodge Bog. The PCAS measures will provide greater surface water attenuation and surface water quality benefits in and downstream of the restoration areas.

Other bogs comprising the Application site are also under consideration for inclusion within the PCAS including Ballydermot, Barnaran, Blackriver, Codd, Derrybrennan, Glashabaun, Killinagh, Lullybeg, Lullymore and Ticknevin bogs. This cumulative assessment assumes that PCAs works will be completed at these bogs. In the event that future PCAS plans are not implemented or prepared, the bogs will be rehabilitated in line with the Cutaway Bog Decommissioning and Rehabilitation Plans included in Appendix 4-3.

These PCAS measures and the standard remedial measures, which will be implemented across the Application Site, will have a positive cumulative effect on bog hydrogeology and surface water quality.

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality in downgradient waterbodies and bog hydrogeology.

Mitigation Measures: No mitigation measures beyond those required to comply with the IPC licence conditions and those outlined in Sections 8.6.2.3.1 to Section 8.6.2.3.4 are deemed necessary.

Likely Cumulative Residual Effects: The PCAS works will have a long-term positive effect on the local bog hydrogeological environment and the local hydrological environment (in terms of surface water quality and attenuation). The cumulative residual effect is a long-term, likely, moderate, positive effect.

Significance of Effects: For the reasons outlined above we consider that there will not be a significant cumulative effect.

8.6.6.3.3 *Cumulative Effects with Agriculture*

As stated previously, the Application Site is situated within a largely agricultural catchment and any activities within the Application Site have the potential to interact with the agricultural practices in the surrounding lands and could contribute to a deterioration of downstream surface water quality.

Water quality of discharges from restored peatlands generally improves as a result of bog rehabilitation measures and site restoration.

The proposed rehabilitation measures at the Application Site will improve water attenuation and reduce the risk of elevated concentrations of suspended sediment in downstream watercourses. Therefore, the potential cumulative effects will be less than those described for the Peat Extraction Phase above.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies.

Mitigation Measures: No mitigation measures beyond those required to comply with the IPC licence conditions and those outlined in Sections 8.6.2.3.1 to Section 8.6.2.3.4 are deemed necessary.

Likely Cumulative Residual Effects: The Remedial Phase will have a positive effect on downstream surface water quality. The cumulative effect with agriculture will be a long-term, slight, neutral, effect.

Significance of Effects: For the reasons outlined above and with the implementation of IPC licence control measures, we consider that there will not be a significant cumulative effect.

8.6.6.3.4 *Cumulative Effects with Forestry*

As stated previously, there are some small areas of coniferous forestry in the lands surrounding the Application Site and given that they drain to the same river waterbodies as the Application Site, the potential cumulative impacts on downstream water quality and quantity need to be assessed.

The potential effects are similar to those associated with the Peat Extraction Phase of the Project but of a significantly reduced magnitude as the Remedial Phase will result in improvements in surface water attenuation and water quality (reduced concentrations of suspended solids) at the Application Site.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Figile and Slate rivers, and their associated tributaries).

Mitigation Measures: No mitigation measures beyond those required to comply with the IPC licence conditions and those outlined in Sections 8.6.2.3.1 to Section 8.6.2.3.4 are deemed necessary.

Likely Cumulative Residual Effects: The Remedial Phase will have a positive effect on downstream surface water quality. The cumulative effect with forestry will be a long-term, slight, neutral, effect.

Significance of Effects: For the reasons outlined above and with the implementation of IPC licence control measures, we consider that there will not be a significant cumulative effect during the Remedial Phase of the Project.

8.6.6.3.5 *Cumulative Effects with Water Supply Project*

Planning permission for the Water Supply Project Eastern and Midlands Region has been submitted to ACP (Case no: 323980). The project includes an abstraction from Parteen Basin on the Lower River Shannon, and various elements of water supply infrastructure, which will extend from Parteen Basin, through the midlands, to Peamount in Co. Dublin. The Water Supply Project aim to increase water supply resilience in the East and Midlands region.

The pipeline associated with the Ervia Water Supply is proposed to pass through Codd 2, Glashabaun North, Glashabaun South and Derrybrennan bogs and will include a proposed abstraction from the Figile River (during the testing and commissioning phase). An overlap of the construction periods associated with the Water Supply Project and the Remedial Phase could result in cumulative effects on the local water environment. Without appropriate management, concurrent construction works could result in cumulative pressures on the local water environment, including increased sediment generation and disturbance.

However, based on the estimated timeline for the construction of the Water Supply Project, it is expected that the short-term rehabilitation actions at the Application Site will be completed. Therefore, there is no potential for the construction phase of the Water Supply Project to overlap with the works associated with the short-term rehabilitation actions. The remaining long-term rehabilitation works will be minimal, comprising monitoring, aftercare and maintenance and there would be no potential for significant cumulative effects due to the nature of these works.

Furthermore, the EIAR submitted for the Water Supply Project concludes that following the implementation of the mitigation and control measures, there would be no significant effect and that the project would not compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater WFD designated water body and/or jeopardise the attainment of good surface water (or good ecological potential) or groundwater status. The EIAR includes details restrictions on abstraction rates from the Figile River (during the testing and commissioning phase) for a range of flow volumes to ensure that there are no significant negative effects.

Similarly, the mitigation measures prescribed in this rEIAR for the Remedial Phase, will ensure that there are no significant effects on the water environment and the WFD Compliance Assessment (Appendix 8-4) demonstrates compliance with WFD.

Considering the mitigation measures prescribed for both projects, and the timing of the works in relation to the short-term rehabilitation actions, significant cumulative effects will not occur.

8.6.7 Human Health

Due to the nature of the peat extraction process, combined with the mitigation measures and environmental monitoring implemented at the site, no water related impacts on human health have likely resulted from the Peat Extraction Phase nor the Current Phase of the Project.

Furthermore, the Remedial Phase will pose no risk to human health and will likely result in the improvement in local surface water quality.

8.6.8 Monitoring

Environmental monitoring will continue as per the existing IPC conditions until the current IPC licence is surrendered.

This monitoring will encompass surface water sampling to ensure that the discharge from the Application Site remains below the existing IPC emission limit values, thereby protecting downstream surface water quality.

It is also likely that some monitoring will be proposed in order to evaluate the success of the rehabilitation plan. This shall include groundwater monitoring in the form of piezometers which will allow for the measurement of the peat groundwater table and assess the impact of the proposed rehabilitation measures, such as drain blocking, which are designed to raise the local peat groundwater table.

8.6.9 Major Accidents and Disasters (MADs)

The main risk of MADs at peatland sites is related to peat stability. However, due to the low-lying and flat nature of the Application Site, slope stability has posed no risk at the Application Site during any phases of the Project.

Flooding can also result in downstream MADs. However, there has been no risk of flooding downstream of the Application Site as a result of the historic and/or proposed activities at the site due to the low lying nature of the Application Site and the attenuation provided by the on-site drainage system, in particular the presence of the settlement ponds. There are no other foreseeable MADs.

8.6.10 Conclusions

The Application Site comprises the Ballydermot Bog Group, a group of 14 no. BnM bogs which form part of the Allen Bog Group. The Application Site comprises an area of 5,448 hectares (ha). The Application Site is located 2.2km southeast of Edenderry, 3.3km west of Allenwood, 2.4km north of Rathangan and 1.7km east of Clonbullogue Village. The current topography of the Application Site is relatively flat with an elevation range of between approximately 68 and 84mOD (metres above Ordnance Datum).

Regionally, the vast majority of the Application Site is located in the River Barrow surface water catchment within Hydrometric Area 14 of the South Eastern River Basin District. A small area in the north of the Ticknevin Bog located in the River Boyne surface water catchment within Hydrometric Area 07 of the Eastern River Basin District.

Currently, the surface of the Application Site is drained by a network of field drains that are typically spaced every 15 to 20m. Larger arterial drains connect the smaller field drains and gently slope towards perimeter silt ponds and surface water outfalls. Surface water outflows from site discharge to small streams which in turn discharge into the Figile and Slate Rivers. There is no surface water outfall to the River Boyne or its tributaries to the north. Several pumping stations are located within the Application Site to assist drainage due to the lowered ground elevations.

The baseline for the assessment of peat extraction and ancillary activities at the Application Site is July 1988, and the Peat Extraction Phase covers the period between July 1988 and June 2020. BnM commenced drainage works at Application Site in 1935. By July 1988 peat extraction activities were well established at the Application Site. The emerging baseline trend was a drained area of cutover bog with peat extraction having been ongoing for many years.

As a result, the potential impacts from peat extraction and ancillary activities were consistent with the baseline environment, and arising potential impacts on water quality from sediment, hydrocarbons, wastewater are all assessed as having moderate potential impacts. Available water quality data of upstream and downstream watercourses, and discharge water quality monitoring from the bog, do not indicate any significant impacts on water quality occurred during the Peat Extraction Phase.

Since 2000, BnM have been operating the Application Site under IPC Licence requirements. The IPC Licence (P0503-01) sets out several conditions and emission limits designed to ensure the protection of surface and groundwaters.

Peat extraction ceased at the Application Site in June 2020 and our assessment concludes that potential impacts on surface water flows and surface water quality, and groundwater quality are neutral during this period. No changes to the hydrological and/or hydrogeological environments will have occurred from Current Phase of the Project *i.e.* since the cessation of peat extraction to the present day.

The Remedial Phase has also been assessed. The implementation of the Cutaway Bog Decommissioning and Rehabilitation Plans will generally involve the rewetting and revegetation of the drained bog. The plan will have a long term positive effect on the local peat hydrogeology within the Application Site where groundwater table in the peat bog is stabilised and closer to the bog surface. The plan will also have positive long term effects on downstream water quality and regulation of surface water flows.

Our assessment confirms that no significant cumulative effects on the hydrological or hydrogeological environments have resulted from the various phases of the Project. Similarly, no cumulative effects on the hydrological or hydrogeological environments will result from the implementation of the Cutaway Bog Decommissioning and Rehabilitation Plans, nor the proposed wind farm development at the Application Site.