7. HYDROLOGY AND HYDROGEOLOGY

7.1 Introduction

7.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to provide a description and assessment of the direct and indirect effects of the Subject Development on the hydrological (surface water) and hydrogeological (groundwater) environment.

The Subject Development, detailed fully in Chapter 3 of this rEIAR, comprises of 25 no. deviations from the windfarm permitted under ABP-300460-17 (amended by ABP-303729-19). The Subject Development relates to wind farm roads and hardstand areas, peat storage and containment measures, borrow pits, environmental and water quality mitigation measures, and ancillary works. The Subject Development is located in the townlands of Meenbog and Croaghnoagh, near the twin towns of Ballybofey and Stranolar, Co. Donegal.

As described in Section 1.4.1 of this rEIAR, this Chapter uses the following terminology: the 'Site', the 'Permitted Development', the 'Subject Development', the 'Meenbog Windfarm' and the 'November 2020 Peatslide'.

This chapter presents:

- A description of the baseline sensitivity and importance of the receiving hydrological and hydrogeological environment based on the baseline site conditions prior to the onset of construction of the Meenbog Windfarm;
- The mitigation and monitoring measures which were implemented during the construction of the Meenbog Windfarm for the protection of the hydrological and hydrogeological environment;
- An assessment of the residual effects of the Subject Development on the hydrological and hydrogeological environment; and,
- An assessment of the cumulative effects from the Subject Development and other projects in the surrounding area.

7.1.2 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 include upland hydrology and windfarm drainage design. We routinely complete impact assessment reports for hydrological and hydrogeological aspects for a variety of project types.

This chapter of the EIAR was prepared by Michael Gill, Conor McGettigan and John Twomey.

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 hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the 100 wind farm-related projects including original application for Meenbog Windfarm.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with 3 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 has prepared the hydrology and hydrogeology chapter of environmental impact assessment reports for several wind farm development on peatlands. Conor also routinely prepares hydrological and hydrogeological assessment reports, WFD compliance assessment reports and flood risk assessments for a variety of development types including wind farms.

John Twomey (BSc) is a recent graduate of Earth and Ocean Science from UG and is in the process of training to become an Environmental Scientist. He has recently assisted in the completion of hydrogeological and hydrological impact assessments on quarries, windfarms and industrial developments.

7.1.3 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 of the rEIAR. Details of these scoping responses pertaining to hydrology and hydrogeology are listed below in **Table 7.1**. Further details are outlined in Section 2.5.2 of this rEIAR.

Table 7.1 Scoping Responses Relevant to Hydrology and Hydrogeology

Consultee	Description	Addressed in Section
Geological Survey Ireland	*"The Groundwater Data Viewer indicates an aquifer classed as a 'Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones' underlies the proposed wind farm development. The Groundwater Vulnerability map indicates the range of groundwater vulnerabilities within the area covered is variable. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' in your assessments, as any groundwater-surface water interactions that might occur would be greatest in these areas."*	Section 7.3.9
Health Service Executive	*"All drinking water sources, both surface and ground water, must be identified. Public and Group Water Scheme sources and supplies should be identified in addition to any private wells supplying potable water to houses in the vicinity of the proposed development. Measures to ensure that all sources and supplies are protected should be described. The Environmental Health Service recommends that a walk-over survey of the site is undertaken in addition to a desktop analysis of Geological Survey of Ireland data in order to identify the location of private wells used for drinking water purposes. Any potential significant impacts to drinking water sources should be assessed. Details of bedrock, overburden, vulnerability, groundwater flows, aquifers and catchment areas should be considered when assessing potential impacts and any proposed mitigation measures."*	Section 7.3.15 identifies all water resources. All effects on local water sources are assessed in Section 7.5.2.7 (Public Water Supplies) and Section 7.5.2.4 (Groundwater levels and private wells).
Uisce Eireann	*"Where the development proposal has the potential to impact an Uisce Éireann Drinking Water Source(s), the applicant shall provide details of measures to be taken to ensure that there will be no negative impact to Uisce Éireann's Drinking Water Source(s) during the construction and operational phases of the development. Hydrological / hydrogeological pathways*	All effects on local water sources are assessed in Section 7.5.2.7 (Public Water Supplies)

	between the applicant's site and receiving waters should be identified as part of the report."	
	"Where the development proposes the backfilling of materials, the applicant is required to include a waste sampling strategy to ensure the material is inert."	No fill material was imported to the site. All backfilling was completed with local peat and overburden which was excavated from the work areas during the construction process.
	"Mitigations should be proposed for any potential negative impacts on any water source(s) which may be in proximity and included in the environmental management plan and incident response"	All mitigation measures which were implemented for the protection of surface waters are detailed in Section 7.5.2.
	"Any and all potential impacts on the nearby reservoir as public water supply water source(s) are assessed, including any impact on hydrogeology and any groundwater/ surface water interactions"	All effects on the Lough Mourne surface water abstraction are detailed in Section 7.5.2.7.
	"Any potential impacts on the assimilative capacity of receiving waters in relation to Uisce Éireann discharge outfalls including changes in dispersion / circulation characterises. Hydrological / hydrogeological pathways between the applicant's site and receiving waters should be identified within the report"	All effects on the Lough Mourne surface water abstraction are detailed in Section 7.5.2.7.
	"Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (and resultant potential impact on the capacity of the source) or the potential of the development to influence / present a risk to the quality of the water abstracted by Uisce Éireann for public supply should be identified within the report."	All effects on the Lough Mourne surface water abstraction are detailed in Section 7.5.2.7.
Waterways Ireland	*" This is not within any Zone of Influence of our waterways so we will not be commenting".*	N/A

7.1.4 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:

- S.I. No. 349/1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84/1994, S.I. No. 101/1996, S.I. No. 351/1998, S.I. No. 93/1999, S.I. No. 450/2000 and S.I. No. 538/2001, S.I. No. 134/2013 and the Minerals Development Act 2017), the Planning and Development Act, and S.I. No. 600/2001 Planning and Development Regulations and subsequent Amendments. These instruments implement EU Directive 85/337/EEC and subsequent

amendments, on the assessment of the effects of certain public and private projects on the environment;
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including 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);
- Planning and Development Act, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- S.I. No 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law;
- S.I. No. 94/1997: European Communities (Natural Habitats) Regulations, resulting from EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293/1988: Quality of Salmon Water Regulations;
- 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). . Since 2000 water management in the EU has been directed by the 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**"). The WFD was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003);
- S.I. No: 122/2010: European Communities (Assessment and Management of Flood Risks) Regulations, resulting from EU Directive 2007/60/EC;
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended; and,
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.

7.1.5 Relevant Guidance

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

- Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- DoE/NIEA (2015): Wind farms and groundwater impacts - A guide to EIA and Planning considerations";
- OPW (2009) The Planning system and Flood Risk Management;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (2006);
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind farm Construction (Scottish Natural Heritage, 2010);
- 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.

- Land Types for Afforestation (Forest Service, 2016b);
- Forest Protection Guidelines (Forest Service, 2002);
- Forest Operations and Water Protection Guidelines (Coillte, 2013);
- Forestry and Water Quality Guidelines (Forest Service, 2000b); and,
- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 (DAFM, 2018).

7.2 Assessment Methodology

7.2.1 Desk Study

A desk study of the Site and the study area (refer to Section 7.2.5 below for a definition of the study area) was completed in January and February 2024 to collect all relevant hydrological, hydrogeological and meteorological data. The desk study was completed to supplement site specific data which has been gathered for the Site and detailed in Section 7.2.2.

The desk study involved consultation with the following sources:

- 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 & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 3 (Geology of South Donegal). Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports; and,
- OPW Flood Mapping (www.floodmaps.ie).

7.2.2 Baseline Monitoring and Site Investigations

A comprehensive and robust hydrological dataset has been collected at the Site across multiple phases of site investigations.

HES completed a detailed review of the permitted planning application, associated files and site investigations as part of the baseline land, soils and geological assessment of this rEIAR. The intrusive site investigations (detailed in full in Chapter 6: Land, Soils and Geology) for the Permitted Development planning application included mapping the distribution and depth of blanket peat along with assessing the mineral subsoil/bedrock interface beneath the peat at key locations. The surveying of several pre-existing on-site borrow pits confirmed the findings of the investigations and allowed for the development of an accurate site-specific hydrogeological conceptual model.

The previous site investigations, completed as part of the EIAR assessment for the Permitted Development, relating to the hydrological and hydrogeological environment are as follows:

- HES, AGEC and MKO have completed site inspections and walkover surveys at the Site on several dates in October 2014 and July 2017.
- The walkover surveys included hydrological mapping whereby water flow directions and drainage patterns were recorded.
- Measurement of surface water flows from streams draining the Site.
- A total of 3 no. surface water quality samples were undertaken to assess the baseline water quality of the primary surface waters originating from the Site.
- Field hydrochemistry measurements were taken to determine the origin and nature of the flows within the Site;
- Completion of a preliminary Flood Risk Assessment (FRA) for the Permitted Development;
- Completion of over 500 no. peat probes by HES, AGEC Ltd and MKO to determine the thickness and geomorphology of the blanket peat;

- 30 no. gouge cores and 1 no. window sample were completed to investigate peat and mineral subsoil lithology along with depth to bedrock;
- A Peat Stability Assessment was undertaken by AGEC Ltd (October, 2017); and,
- MKO completed baseline biological monitoring at 5 no. locations in September 2014.

Additional hydrological monitoring was completed during the construction of the Meenbog Windfarm by MKO & HES in line with the requirements set out in the EIAR and the Construction Environmental Management Plan (CEMP). This monitoring comprised of the following:

- Installation of sondes to provide continuous turbidity monitoring. 3 no. sondes were installed on 9th September 2019 and 3 no. additional sondes were installed following the peat slide that occurred in November 2020;
- A suitably qualified Ecological Clerk of Works (ECoW) undertook daily visual check of waterbodies during the construction phase. These checks included the maintenance of sondes, visual inspection of surface water sampling points and visual inspection of all visual check locations (12 no. locations);
- Monthly grab sampling at 4 no. sampling locations from August 2019 to February 2023;
- MKO completed biological monitoring at 19 no. locations in November 2020;
- Triturus Environmental Ltd. completed biological monitoring at 10 no. locations in October 2021; and
- MKO completed biological monitoring at 10 no. locations in October 2023.

Additional site investigations have been completed during the construction of the Meenbog Windfarm, These site investigations included:

- Fehily Timoney and Company (FTC) completed additional extensive site investigations and geotechnical analysis, with an assessment of the site stability submitted to Donegal Co. Co. (Appendix 6-2).
- In February 2021, Ionic Consulting produced a site-wide stability assessment (included as Appendix D to Appendix 6-2). This assessment was based on a significant amount of site-specific ground investigation data, including over 1,750 peat probes and shear vane results.
- Furthermore, AFRY completed an assessment of the stability of the works completed to date on the Site in October 2023. A Technical Note arising from this site inspection is included in Appendix 6-3.

MKO have also completed several multi-disciplinary walkover surveys at each of the deviation sites between 2021 and 2023.

The data obtained from all of these site investigations have been used in the characterisation, description and assessment of the hydrological and hydrogeological environment.

7.2.3 Impact Assessment Methodology

The EPA's Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2022) states that there are 7 no. steps in the preparation of the EIAR. The initial steps relate to screening, scoping, the consideration of alternatives and the description of the project. Step 5 relates to the description of the baseline environment which is presented in Section 7.3 for the hydrological and hydrogeological environment. Step 6 relates to the assessment of impacts and is presented in Section 7.5.

EPA, 2022 requires that the baseline environment is described in terms of the context, character, significance and sensitivity of the existing environment. In addition to the above methodology, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Levels of importance which are defined in **Table 7.2** for hydrology and **Table 7.3** for hydrogeology are used to assess the potential effects that the Subject Development may have had on them.

Table 7.2: 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.
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.

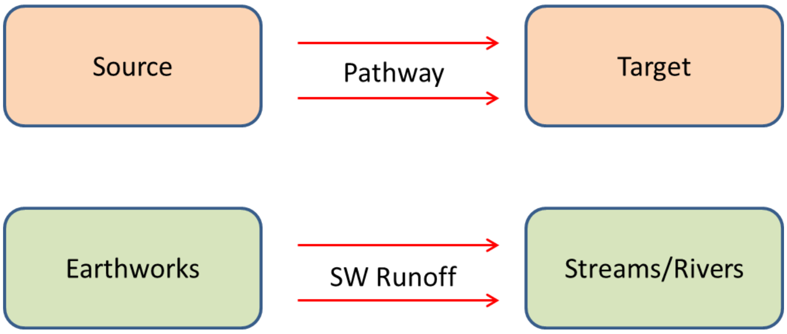
Table 7.3: Estimation of Importance of Hydrogeology Criteria (NRA, 2008)

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.

Importance	Criteria	Typical Example
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	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.

7.2.4 Overview of Impact Assessment Process

The conventional source-pathway-target model (see below, top) was applied to assess potential impacts on downstream environmental receptors (see below, bottom as an example) as a result of the Subject Development.



As outlined previously, where potential effects are identified, the classification of impacts in the assessment follows the descriptors set out in the Glossary of effects (EPA, 2022) as outlined in Chapter 1 of this rEIAR.

The descriptors used in this environmental impact assessment are those set out in the EPA, 2022 Glossary of effects as shown in 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.

7.2.5 Study Area

The study area for the hydrological and hydrogeological assessment of effects is defined by the regional surface water catchments and groundwater bodies within which the Subject Development is located. The hydrological study area is defined in Section 7.3.3, whilst the hydrogeological study area is defined in Section7.3.8.

7.2.6 Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of the Hydrology and Hydrogeology Chapter of the rEIAR.

7.3 Receiving Environment

7.3.1 Site Description and Topography

The Site is located in Co. Donegal, situated ~8km to the southwest of the towns of Ballybofey and Stranorlar, and ~12km northeast of Donegal Town. The eastern and southern boundaries of the Site are defined by the Northern Ireland border. The closest town in Northern Ireland is Castlederg which is located ~19km to the southeast. The Site has a total area of ~903ha (~9km^2) in area.

The Site comprises of a mix of conifer forestry, blanket bog and the partially constructed Meenbog Windfarm. The elevation of the Site ranges between ~145 and 312 mOD (metres above Ordnance Datum). The majority of the Site slopes in a north-westerly direction towards the Bunadaowen River which flows through the Site. The southern section of the Site slopes to the southeast towards the Northern Ireland border.

Construction of the Meenbog Windfarm commenced in November 2019, with approximately 90% of the civil engineering works, including wind farm access roads, 110kV electrical substation, turbine hardstands, turbine foundations, and ancillary works substantially completed over the following 12-month period up to November 2020 when a peat slide occurred. The partially constructed Meenbog Windfarm, which includes the Subject Development, covers only a very small percentage (~1.1%) of the overall Site area.

7.3.2 Water Balance

Long term rainfall and evaporation data were sourced from Met Éireann (www.met.ie). The 30-year annual average rainfall (1981-2010) recorded at Ballybofey (Lough Mourne), located ~2km northwest of the Site are presented in **Table 7.4**. The average annual rainfall at Ballybofey (Lough Mourne) is 1,931m/year.

However, the rainfall data from Lough Mourne is likely to underestimate the actual average annual rainfall at the Site due to elevation differences. Lough Mourne rainfall station stands at an elevation of 101mOD whilst the topography at the Site ranges from ~145 to 312mOD.

Met Éireann also provide a grid of average annual rainfall for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the average annual rainfall at the Site ranges from 2,004 to 2,185mm/year. The average annual rainfall is 2,095mm/yr (this is considered to be the most accurate estimate of average annual rainfall from the available sources).

Table 7.4 Average long-term Rainfall Data (mm)

Station		X-Coord		Y-Coord		Ht (MAOD)		Opened		Closed		
Lough Mourne		110700		23500		101		1963		N/A		
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
214	152	170	113	101	107	122	154	162	211	204	221	1,931

In addition, HES installed a rain gauge at the Site on 24th November 2020. The daily rainfall volumes from 24th November 2020 to 17th December 2023 have subsequently been recorded and the data is presented in **Figure 7-1** below. The greatest daily rainfall was recorded on 20th February 2022 with 75.6mm of rainfall. During the monitoring period the month with the greatest rainfall was February 2022 with a total volume of 399mm of precipitation recorded at the Site.

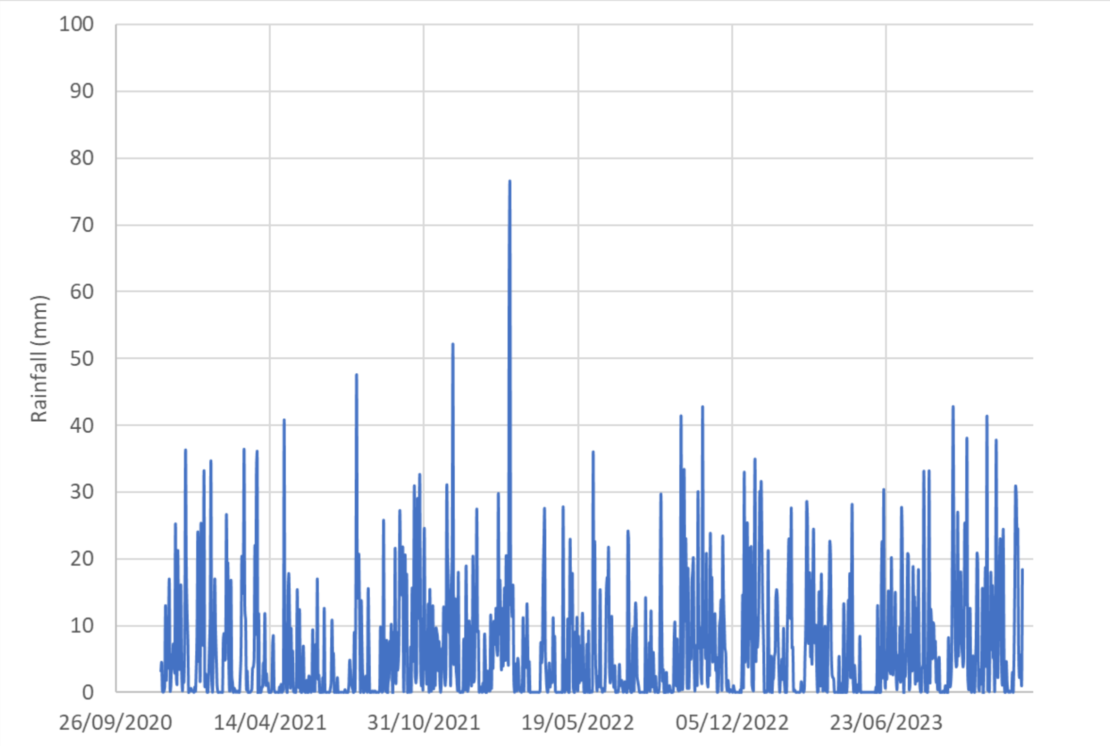


Figure 7-1: Daily Rainfall Data at Site (Dec 2020 – Dec 2023)

The closest synoptic[1] station where the average potential evapotranspiration (PE) is recorded is at Belmullet, located ~36km west of the Site. The long-term average PE for this station is 527.1mm/year. This value is used as a best estimate of the PE at the Site. Actual Evaporation (AE) is estimated as 500.7mm/year (which is 0.95 × PE).

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

Effective rainfall (ER) = AAR – AE

= 2,095mm/year – 501mm/year

ER = 1,594mm/year

Groundwater recharge coefficient estimates are available from the GSI (www.gsi.ie). Within the Site groundwater recharge coefficients are mapped as ranging from 4 to 10% due to the coverage of blanket peat, the sloping nature of the local topography and the low to moderate permeability of the underlying bedrock aquifer.

An estimate of ~112mm/year average annual groundwater recharge is given for the Site. This calculation is based on a recharge coefficient of 7%. This means that the hydrology of the Site is characterised by high surface water runoff rates and relatively low groundwater recharge rates. This is supported by on-site observations made during the site walkover surveys whereby a high density of headwater streams and drains were recorded within the Site.

Therefore, conservative annual recharge and runoff rates for the Site are estimated to be ~112mm/yr and 1,482mm/yr respectively.

Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM's). Projections for the period 2041-2060 (mid-century) are available from Met Eireann. The data indicates a projected decrease in summer rainfall from 0 to 13% under the medium-low emission range scenario and an increase in the frequency of heavy precipitation

[1] Meteorological station at which observations are made for synoptic meteorology and at the standard synoptic hours of 00:00, 06:00, 12:00, and 18:00.

events of ~20%. In total the projected annual reduction in rainfall near the Site ~8% under the medium-low emission scenario and ~4% under the high emissions scenario. As stated above the local average long term rainfall data for the Site is estimated to be 1,594mm/yr. Under the medium-low emissions scenario this may reduce to ~1,466mm/yr, while under the high emissions scenario this figure may reduce to 1,530mm/yr.

In addition to average rainfall data, extreme value rainfall depths are available from Met Éireann. **Table 7.5** presents return period rainfall depths for the area of the Site. These data are 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, 50-year, 100-year).

Table 7.5 Return Period Rainfall Depths (mm) for the Site

	Return Period (Years)			
Storm Duration	1	5	30	100
5 mins	4.9	5.9	8.7	10.7
15 mins	8.1	9.7	14.3	17.6
30 mins	10.9	13.8	19.3	23.7
1 hour	14.8	18.7	26.1	32.1
6 hours	32.2	40.7	56.9	70.0
12 hours	43.6	55.1	77.0	94.7
24 hours	59.0	74.6	104.2	128.2
2 days	76.78	90.1	125.6	150.4

7.3.3 Regional and Local Hydrology

The vast majority of the Site is located in the Foyle River surface water catchment within Hydrometric Area 1. This river basin district is an international river basin district with ~3% of this district located in Northern Ireland. Meanwhile, a small area in the northwest of the Site is mapped in the Donegal Bay North regional surface water catchment, with Hydrometric Area 37 of the North Western River Basin District.

Within the Foyle River catchment, the Site is located in the Mourne Beg River sub-catchment (MourneBeg_SC_010). The Mourne Beg River, a tributary of the Mourne River, flows to the southeast from Lough Mourne, situated ~2km northeast of the existing wind farm site entrance. The Mourne Beg River flows to the east, ~150m north of the Site before it crosses into Northern Ireland. Further downstream, this watercourse discharges into the River Derg, ~15km to the east. The River Derg continues to the east. The Mourne River is formed at the meeting of the River Derg and the River Strule, ~27km east of the Site. The Mourne River then flows to the north, through the town of Strabane, before it confluences with the Fin River to form the River Foyle.

In terms of WFD river sub-basins, the Site is located in a total of 5 no. WFD river sub-basins within the Mourne Beg River sub-catchment.

- The northwest of this area of the Site is located in the Mourne Beg_010 river sub-basin. This area is drained by the Mary Breen's Burn Stream which flows to the northeast and discharges into the Mourne Beg River, ~1.8km to the northeast of the Site. A tributary of the Mary Breen's Burn Stream is mapped to originate ~25m west of Deviation 2.
- A small area in the northeast of the Site is also mapped in the Mourne Beg_010 river sub-basin. Here, the Mourne Beg River is located ~100m north of the Site.
- Much of the Site is located in the Bunadaowen_010 river sub-basin. This area is drained by the Bunadaowen River and several of its tributaries. There is a high density of mapped watercourses in this area.

- A small area in the northeast of the Site is mapped in the Mourne Beg River (Derrygoonan) sub-basin. In this area the Shruhangarve Stream flows to the northeast, ~130m northwest of Deviation 22, before it discharges into the Mourne Beg River.
- The southeast of the Site is located in the Glendergan River sub-basin. A tributary of the Glendergan River flows to the south ~50m from Deviation 9. The Glendergan River itself forms the southeastern boundary of the Site. This watercourse discharges into the River Derg ~3.7km to the southeast.

Within the Donegal Bay North surface water catchment, the Site is mapped in the Eske sub-catchment (Eske_SC_010). Within this area, a tributary of the Lowerymore River flows to the southwest ~200m west of Deviation 1. The Lowerymore River flows to the southwest, through Barnesmore Gap, before discharging into Lough Eske ~8.7km to the southwest.

A regional hydrology map showing the WFD catchments and sub-catchments is shown as **Figure 7-2**. A local hydrology map showing WFD river sub-basins is shown as **Figure 7-3**. Meanwhile, **Table 7.6** below details the locations of the components of the Subject Development with respect to the WFD regions.

Table 7.6: Components of the Subject Development with Respect to WFD Regions

Deviation ID	Main EPA Mapped Watercourses	WFD River Sub-Basin	WFD Sub-Catchment	WFD Regional Surface Water Catchment
1	Lowerymore River	Lowerymore_020	Eske_SC_010	Donegal Bay North
8, 9 & 10	Glendergan River	Glendergan River	LeaghanyRiver_SC_010	Foyle
2 & 21	Mary Breen's Burn Stream and the Mourne Beg River	Mourne Beg_010	MourneBeg_SC_010	
3, 4, 5, 6, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 24 & 25	Bunadaowen River	Bunadaowen_010		
22 & 23	Shruhangarve Stream	Mourne Beg River (Derrygoonan)		

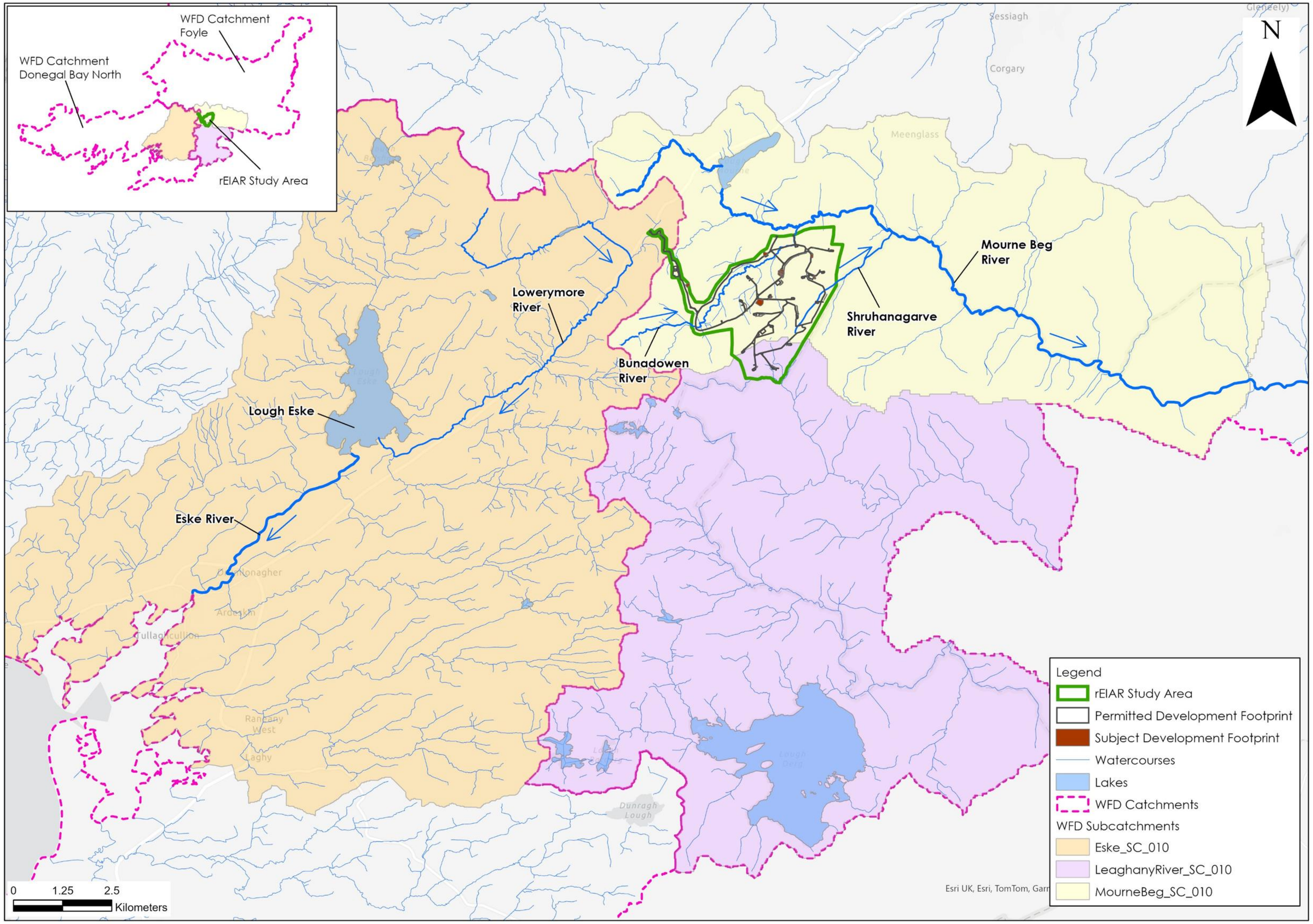


Figure 7-2: Regional Hydrology Map

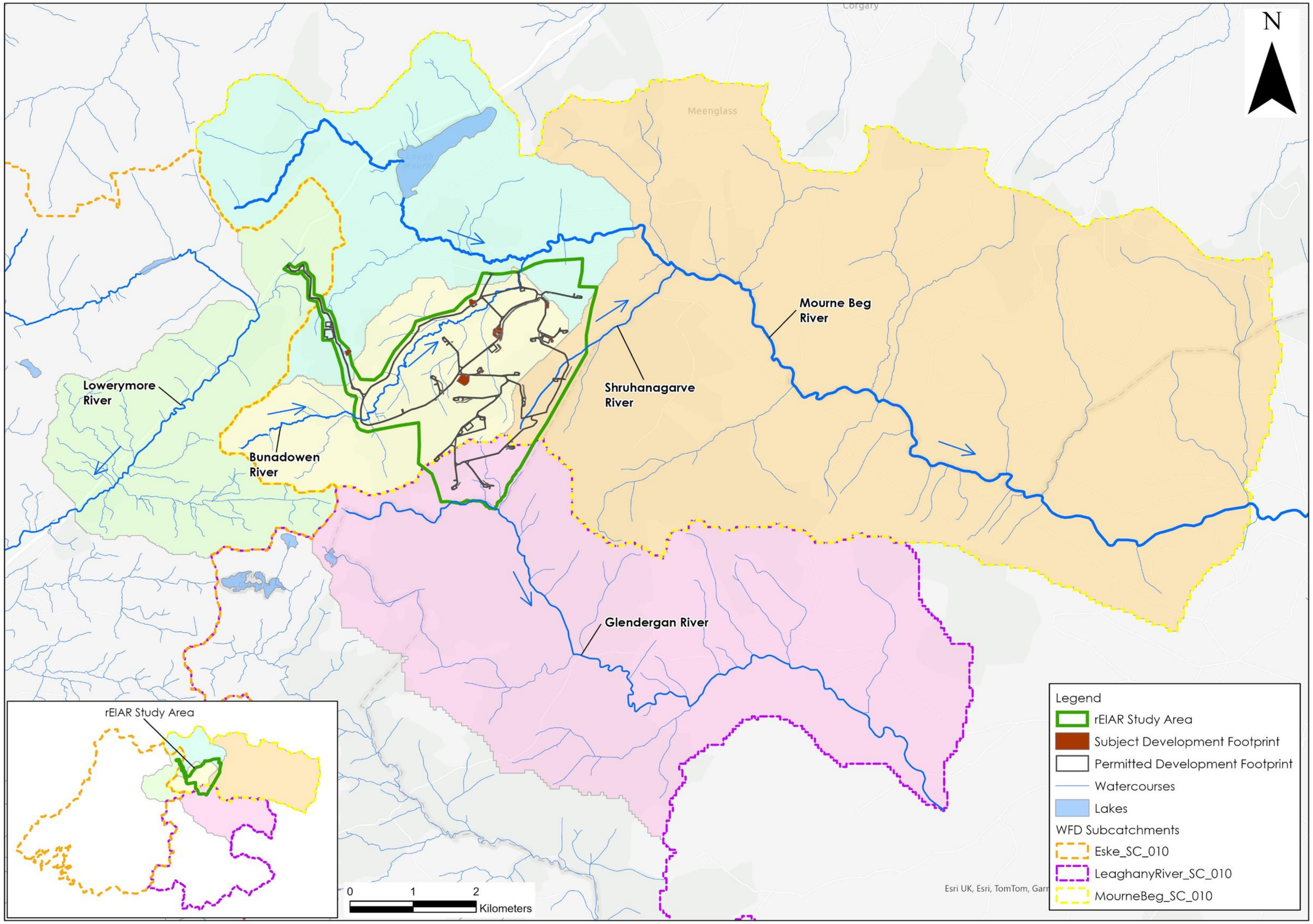


Figure 7-3: Local Hydrology Map

7.3.4 Surface Water Flows

An OPW gauging station is located on the Bunadaowen River within the Site. This station, Croaghnagawna Station (Station No: 01054), recorded water level and flow volumes. The Bunadaowen River at this location has an upstream catchment size of 4.9km2 and the 95%ile flow volume is recorded as being 0.021m^3/s. This means that that 95% of the time the flow in the Bunadaowen River at this location is at or above 0.021m^3/s. However, there are no gauging station of the Mourne Beg or Glendergan rivers in the vicinity of the Site for which flow data is available.

Therefore, the EPA's hydrotool, available on www.catchments.ie, was consulted in order to estimate baseline flow volumes in the local area. The Hydrotool dataset contains estimates of naturalised river flow duration percentiles. Several nodes were consulted in the vicinity and downstream of the Site. **Figure 7-4** below present the estimated flow duration curves for each of the consulted Hydrotool Nodes downstream of the Site. The location of the consulted nodes are shown on **Figure 7-7** below.

EPA Hydrotool Nodes are available on the Bunadaowen River and the Mourne Beg Rivers in the vicinity of the Site. No modelled flow volumes are available for the watercourses within Northern Ireland. Flow volumes are also available on the Lowerymore River downstream of the Site.

The 95%ile flow at Node 01_373 on the Bunadaowen River, upstream of its confluence with the Mourne Beg River, is estimated to be 0.045m^3/s (45l/s). This indicates that 95% of the time, the flow at this location is estimated to be at or above 0.045m^3/s. Due to the increased catchment size, the 95%ile flow at the nodes along the Mourne Beg River downstream of the Site are larger. For example at Node 01_1848, the furthest available downstream node, the 95%ile flow is estimated to be 0.258m^3/s (253l/s). Similarly, the flow volumes in the Lowerymore River increase progressively downstream. The increasing flow volumes downstream are associated with the increased upstream catchment of the respective waterbodies.

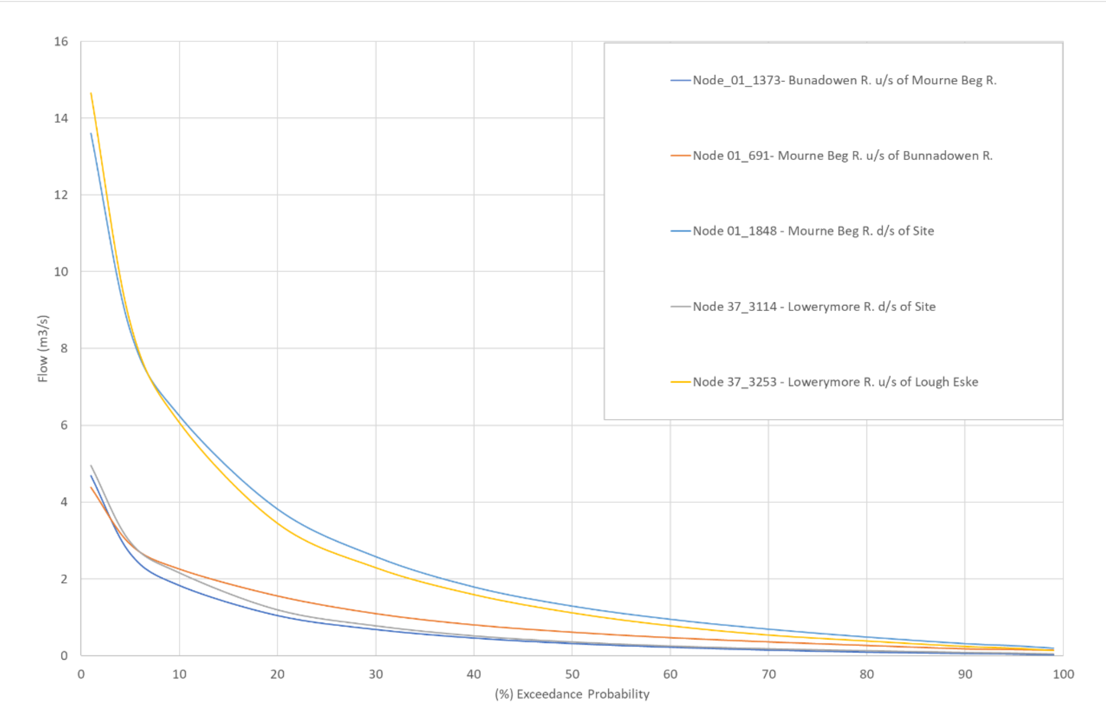


Figure 7-4: EPA Hydrotool Node Flow Duration Curves

Surface water flows were measured by HES at the Site on 20th September 2017. The recorded flow volumes are shown in

Table 7.7 below. The watercourses monitored are typical of the headwater streams that drain towards the Bunadaowen River.

Table 7.7: Surface Water Flow Monitoring (20th September 2017)

Location	Easting	Northing	Channel Width (m)	Water Depth (m)	Flow Volume (m^3/s)
FM1	208130	387062	1.1	0.35	0.033
FM2	206135	385190	0.5	0.09	0.013
FM3	205791	385190	1.1	0.15	0.080
FM4	206593	386681	0.4	0.09	0.011

7.3.5 Site Drainage

7.3.5.1 Baseline Environment

Prior to the construction of the wind farm development, the drainage within the Site comprised of numerous manmade drains that are in place predominately to drain the forestry plantations. This internal forestry drainage pattern is influenced by the local topography, peat cover, layout of the forest plantation and by the pre-existing forestry road network. The forestry plantations, which covered the majority of the Site are generally drained by a network of mound drains which typically run perpendicular to the topographic contours of the Site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantation.

Mound drains and ploughed ribbon drains are generally spaced approximately every 15-20m and 2m respectively. Interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. Interceptor drains are also located up-gradient of existing forestry access roads. Culverts are located on existing access roads at stream and drain crossings and at low points under access roads which drain runoff onto down-gradient forest plantations.

A schematic of a typical standard forestry drainage network and one which is representative of the Site drainage network is shown as **Figure 7-5.** The forestry drains are the primary drainage routes towards the natural streams, but the flows in the higher elevated drains are generally very low or absent most of the time.

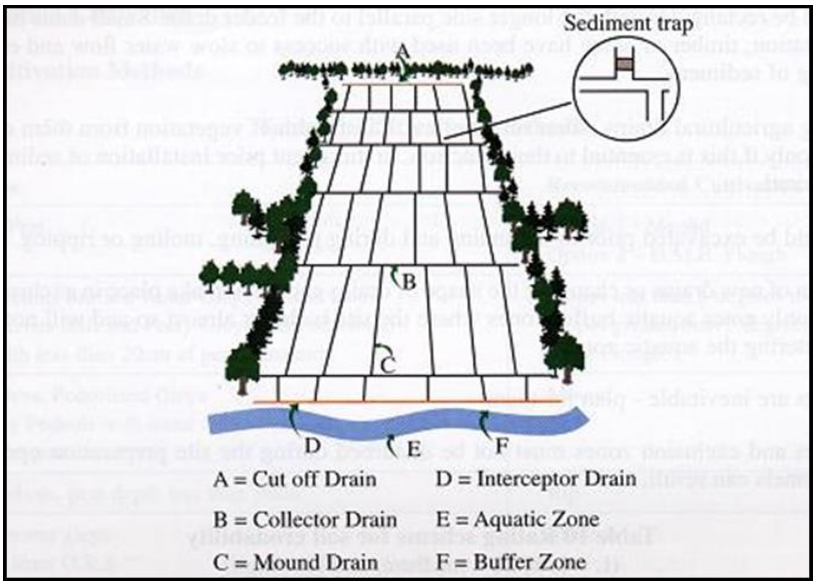


Figure 7-5: Schematic of Existing Forestry Drainage

7.3.5.2 Existing Environment

Prior to the onset of construction works for the Permitted Development, the drainage management systems would have been inserted in accordance with the EIAR and CEMP. These drainage systems were inserted around work areas and were integrated with the pre-existing forestry site drainage network described above.

The Meenbog Windfarm drainage system has been designed to mitigate effects on surface watercourses by runoff control and drainage management:

- Firstly, 'clean water is kept clean' by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations, construction areas and temporary storage areas.
- Secondly, drainage waters from works areas that might carry silt or sediment, and nutrients, are collected and routed towards settlement ponds (or stilling ponds) prior to controlled diffuse release over vegetated surfaces.
- There is no direct discharge from the work areas or from infrastructure footprint to surface waters.
- All runoff from works areas (i.e. dirty water) is attenuated and treated to a high quality prior to being released.
- A schematic of the existing site drainage management is shown as **Figure 7-6** below.

HES prepared detailed drainage plans for the as-built development. The drainage plan was designed to ensure the protection of downstream surface water quality. The detailed drainage plans are included in the planning drawings and also attached as Appendix 3-3 of this rEIAR.

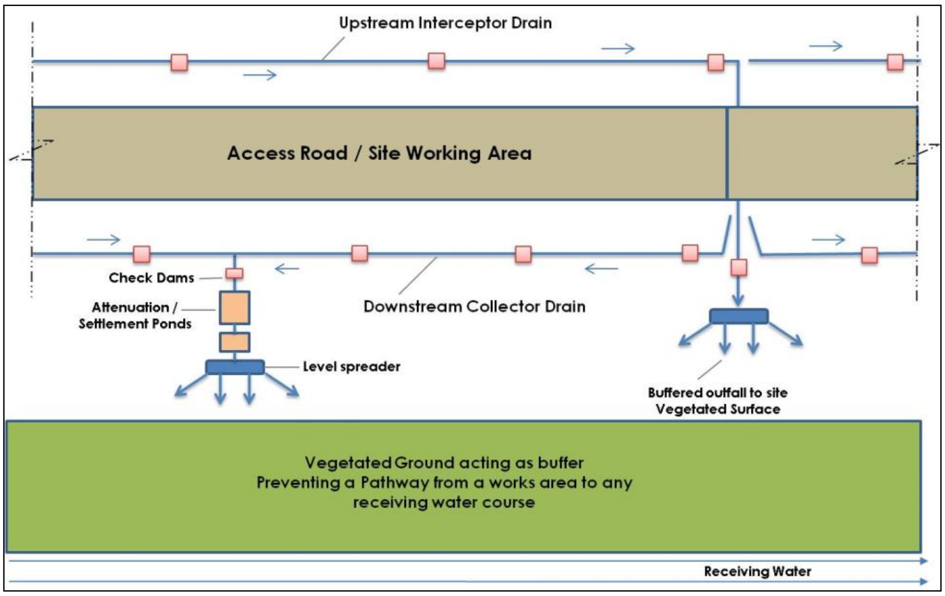


Figure 7-6: Schematic of Existing Site Drainage Management

7.3.6 Summary Flood Risk Assessment

A Flood Risk Assessment of the Site has been carried out by HES, the findings of which are presented in full in **Appendix 7-1** and are summarised below.

To identify those areas as being at risk of flooding, the OPW's Past Flood Events Maps, the National Indicative Fluvial Mapping, CFRAM River Flood Extents, historical mapping (i.e. 6" and 25" base maps) and the GSI Groundwater Flood Maps were consulted. These flood maps are available to view at Flood Maps - Floodinfo.ie.

The OPW Past Flood Events Maps have no records of recurring or historic flood instances within the Site. Similarly, identifiable text on local available historical 6" or 25" mapping does not identify any lands that are "liable to flood". There is one mapped flood event ~4.24km to the southwest of the Site (ID: 4194) that is of no consequence.

The GSI's Winter 2015/2016 Surface Water Flood Map shows surface water flood extents for this winter flood event. This flood event is recognised as being the largest flood event on record in many areas. The flood map for this event records 1 no. recorded surface water flood zones within the south of the Site. This flood area is not in the vicinity of any of the components of the Subject Development. This area has the possibility of flooding again if there is similar heavy rainfall to 2015/2016 winter.

No CFRAM mapping has been completed for the area of the Site. The closest mapped CFRAM fluvial flood zones are along the Finn River, ~5.5km to the northeast at Stranolar.

The National Indicative Fluvial Flood Map for the Present Day Scenario maps a flood zone within the west of the Site along the Bunadaowen River. The flood zones from this river are constrained to be immediate vicinity of the channel and do not encroach upon components of the Subject Development. These areas of the Site are located in Fluvial Flood Zones A and B while the remainder of the Site, including the Subject Development, are located within Fluvial Flood Zone C (low risk).

Furthermore, the Site is not mapped within any historic or modelled groundwater flood zones.

The main risk of flooding is via fluvial flooding from the Bunadaowen River. As stated previously, none of the components of the Subject Development are located within this flood zone.

Surface water ponding/pluvial flooding may occur in some flat areas of the Site due to the presence of low permeability peat at the surface. Mostly the risk of pluvial flooding is low.

In general the risk of flooding at the Site is low due to the elevated and sloping nature of the Site and the high density of mountain streams which flow downslope.

7.3.7 Surface Water Quality

7.3.7.1 EPA Water Quality Monitoring

Biological Q-rating[2] data for EPA monitoring points in the local catchments downstream of the Site are presented below. The 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 Q1 (Bad) to 4-5 (High).

A map of EPA monitoring locations, and the most recent status results, are shown on **Figure 7-7** below.

2 The Q-Rating scheme method is used whereby a Quality-index is assigned to a river or stream based on macroinvertebrate data.

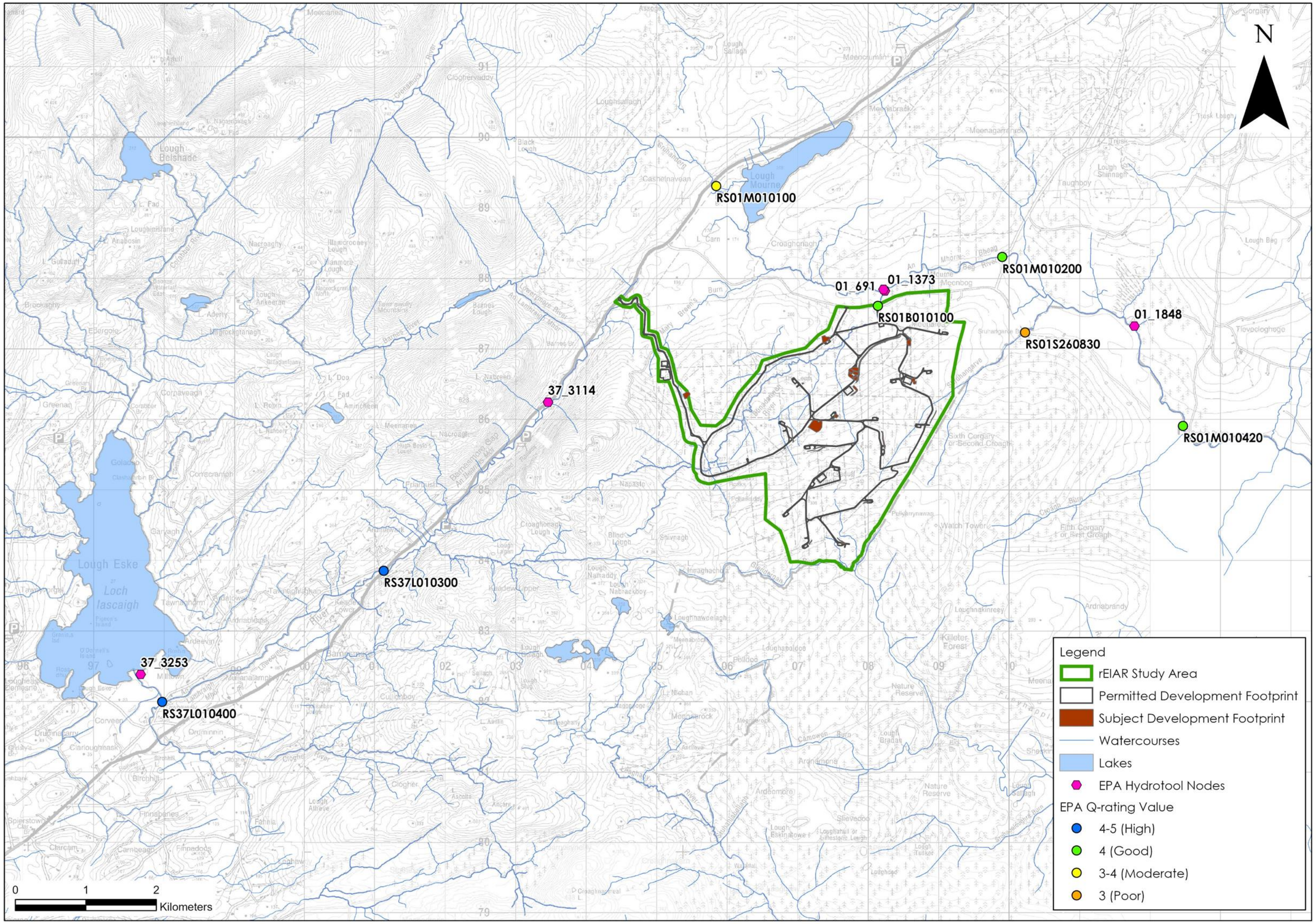


Figure 7-7: EPA Water Monitoring Locations (with Most-Recent Status) and EPA Hydrotool Nodes

7.3.7.1.1 Pre-Construction Monitoring

EPA Q-rating monitoring has been completed on several dates and at multiple locations prior to the onset of construction works at the Site. All available Q-rating values for watercourses in the vicinity and downstream of the Site were consulted from 2010 to 2019. These data are presented in **Table 7.8** and

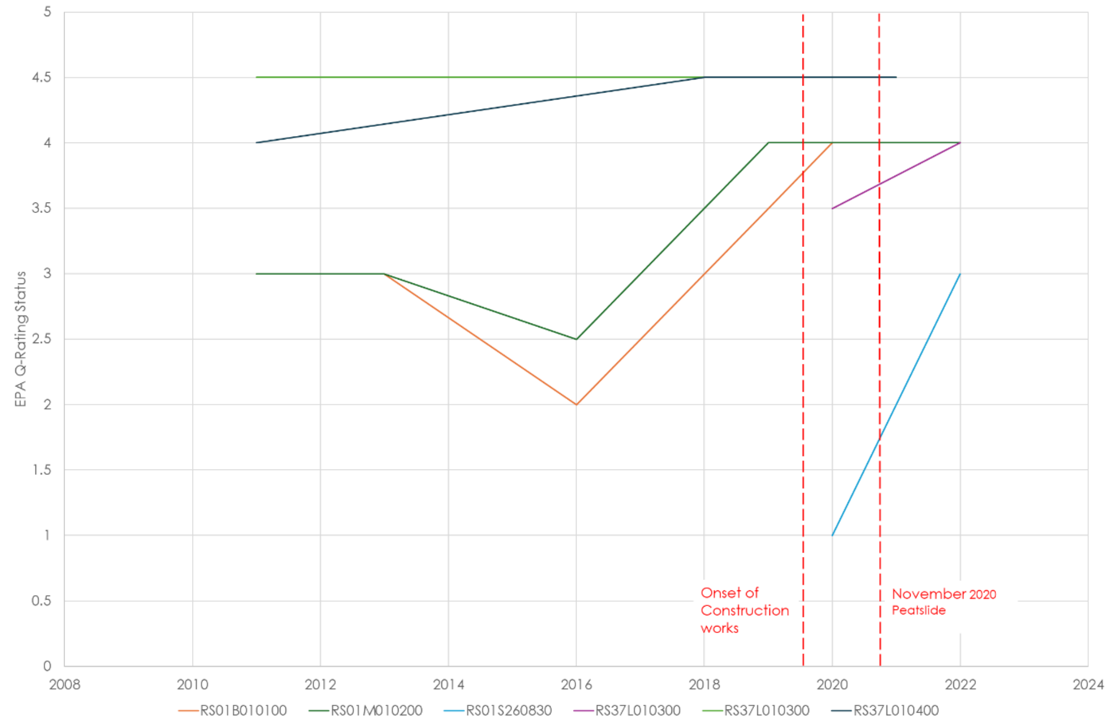


Figure 7-8.

In the vicinity of the Site within the Mourne Beg river sub-catchment, the Q-rating status of the Bunadaowen River ranged from 'Poor' to 'Moderate' Status. This watercourse was found to be of 'Poor' status (*i.e.* Q2) in 2016 and 2017 upstream of its confluence with the Mourne Beg River (Station ID: RS01B010100). Meanwhile, the status improved to 'Moderate' (*i.e.* Q3-4) in the 2019 monitoring round.

Downstream of Bunadaowen River, status of the Mourne Beg River also improved during this period. At a bridge southwest of Tonreagh (Station ID: RS01M010200), the Mourne Beg River achieved 'Poor' status in 2016 and 'Good' status in 2019.

No EPA monitoring was completed on the Shruhangarve or Glendergan Rivers in the vicinity of the Site during this period.

Within the Eske sub-catchment, the Lowerymore River was typically of 'High' status during this period. Both monitoring locations downstream of the Site achieved a Q4-5 rating ('High' status) in 2018 (Station ID: RS37L010300 and RS37L010400).

Table 7.8: EPA Q-Rating Values - Pre-Construction (2010 – 2019)

Watercourse	Station ID	Easting	Northing	Most Recent Year	EPA Q-Rating Status
Mourne Beg River Sub-Catchment					
Bunadaowen	RS01B010100	208140	387608	2019	Q3.5
Mourne Beg	RS01M010200	209903	388300	2019	Q4

Watercourse	Station ID	Easting	Northing	Most Recent Year	EPA Q-Rating Status
Eske Sub-Catchment					
Lowerymore	RS37L010300	201129	383850	2018	Q4-5
Lowerymore	RS37L010400	197985	381990	2018	Q4-5

7.3.7.1.2 Construction Phase Monitoring

The main construction activities were occurring at the Site from November 2019 to November 2020. EPA Q-rating monitoring has been completed at 4 no. locations downstream of the Site during 2020. These data are presented in **Table 7.9** and

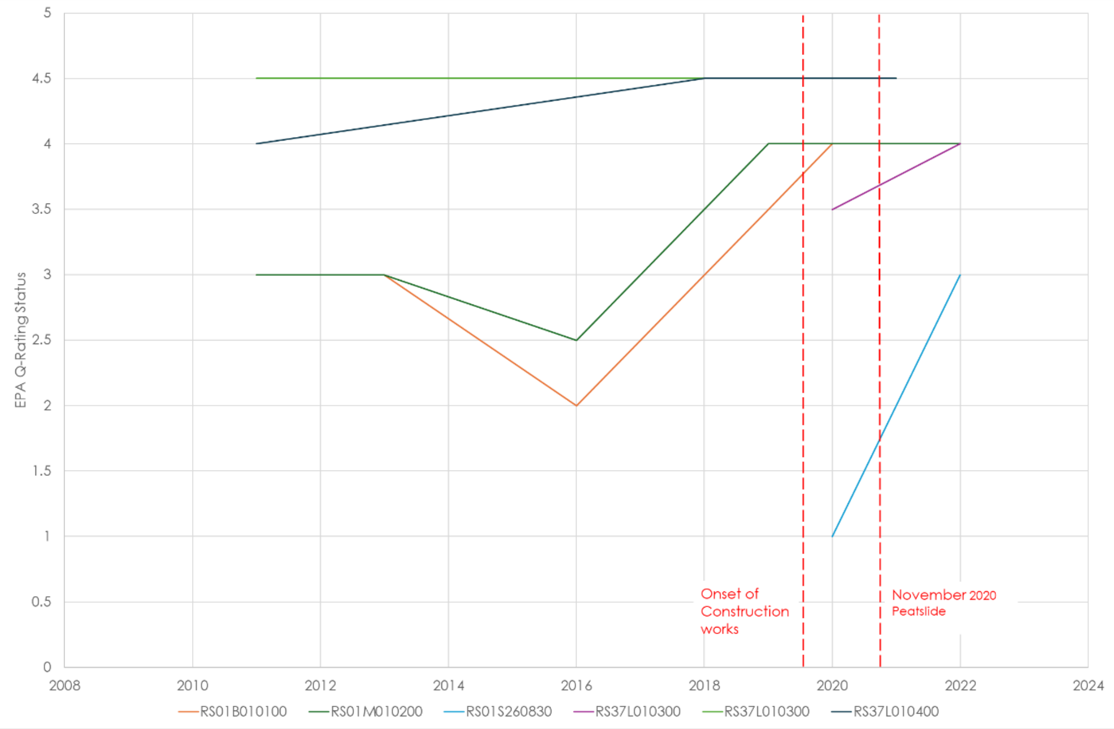


Figure 7-8.

During this EPA monitoring round, the Bunadaowen River achieved a Q-rating status of Q4 ('Good' status) upstream of its confluence with the Mourne Beg River. Further downstream, the Mourne Beg River was also found to be of 'Good' status.

However, the Shruhangarve River, downstream of the Site was found to be of 'Bad' status (*i.e.* Q1) at Shruhangarve Bridge (Station ID: RS01S260830). This status was attributed to the occurrence of a peat slide within the catchment of the Shruhangarve River in November 2020.

Downstream of this watercourse, the Mourne Beg River was found to be of 'Moderate' status (i.e. Q3-4) upstream of Croagh Bridge (Station ID: RS01M010420).

No EPA monitoring was completed on the Glendergan or Lowerymore rivers in the vicinity of the Site during this period.

Table 7.9: EPA Q-Rating Values – Construction Phase

Watercourse	Station ID	Easting	Northing	Year	EPA Q-Rating Status
Mourne Beg River Sub-Catchment					
Bunadaowen	RS01B010100	208140	387608	2020	Q4
Mourne Beg	RS01M010200	209903	388300	2020	Q4
Shruhangarve	RS01S260830	210229	387230	2020	Q1
Mourne Beg	RS01M010420	212470	385903	2020	Q3.5

Post-November 2020 Peatslide Monitoring

The main construction works on the Meenbog Windfarm were curtailed in November 2020 following the occurrence of a peatslide at the Site. However, we note that some minor works were completed as necessary within the Site from time to time during the period since the November 2020 Peatslide. The recent (2021-2022) biological Q-rating[3] data for EPA monitoring points in the local catchments downstream of the Site are shown in **Table 7.10** below.

Downstream of the Site within the Mourne Beg river sub-catchment, the Bunadaowen River achieved a Q-rating status of Q4 ('Good' status) upstream of its confluence with the Mourne Beg River (Station ID: RS01B010100). Downstream of this confluence the Mourne Beg River also achieved a Q4 rating in the latest EPA monitoring round (2022). Meanwhile, the Shruhangarve River achieved a Q3 rating ('Poor' status) at Shruhangarve Bridge (Station ID: RS01S260830) Note that this is an improvement on the 2020 monitoring round, with this watercourse recovering from the effects relating to the 2020 peat slide. Further downstream, the Mourn Beg River achieved a Q4 rating upstream of Croagh Bridge (Station ID: RS01M010420).

No EPA Q-rating points are available downstream of the Site on the Glendergan River in the Leaghany River sub-catchment.

Within the Eske sub-catchment, the Lowerymore River achieved a Q4-5 rating ('High' status) downstream of the Site at the bridge near Barnesmore Hill (Station ID: RS37L010300) in 2021. The Lowerymore River was also found to be of 'High' status upstream of Lough Eske (Station ID: RS37L010400).

Table 7.10:EPA Water Quality Monitoring Q-Rating Values

Watercourse	Station ID	Easting	Northing	Year	EPA Q-Rating Status
Mourne Beg River Sub-Catchment					
Bunadaowen	RS01B010100	208140	387608	2022	Q4
Mourne Beg	RS01M010200	209903	388300	2022	Q4
Shruhangarve	RS01S260830	210229	387230	2022	Q3
Mourne Beg	RS01M010420	212470	385903	2022	Q4
Eske Sub-Catchment					
Lowerymore	RS37L010300	201129	383850	2021	Q4-5
Lowerymore	RS37L010400	197985	381990	2021	Q4-5

3 The Q-Rating scheme method is used whereby a Quality-index is assigned to a river or stream based on macroinvertebrate data.

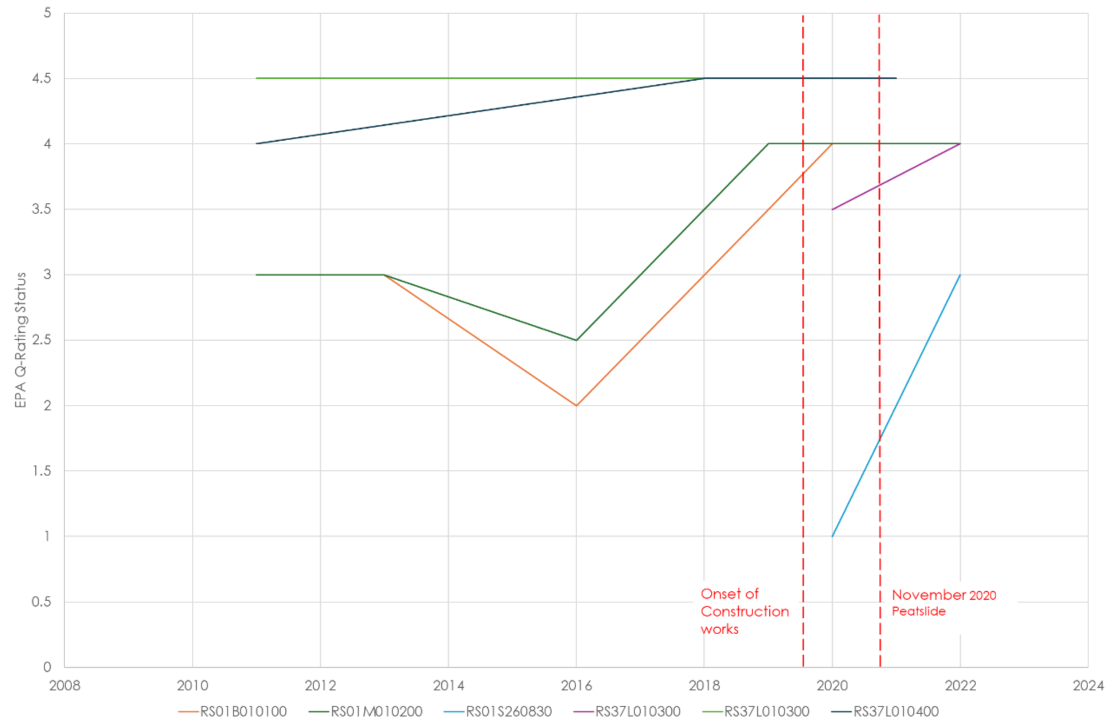


Figure 7-8: EPA Q-Ratings (2010-2022)

7.3.7.2 Northern Ireland Environmental Agency Monitoring

The Northern Ireland Environment Agency (NIEA), an agency with the Department of Agriculture Environment and Rural Affairs is responsible for water quality monitoring in Northern Ireland. The Northern Ireland Water Framework Directive Statistics Report 2021 is the latest available water quality report. Water bodies are assessed against a number of elements as required by the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. For surface waters, ecological status is assessed against five classes: bad; poor; moderate; good; and high. Chemical status surface water bodies are assessed against two classes: good and failing to achieve good. The status of a water body is determined by the lowest test element and follows the one-out, all-out rule. The ecological status of a river waterbody is consequently assigned as a combination of lowest test element from the chemical testing and biological testing.

The Glendergan River was classified in 2015 and 2018 as 'Moderate' and in 2021 as 'Poor' ecological status. In 2021, due to the inclusion of 'forever' chemicals and Cybermethrin in the assessment process, none of the assessed water bodies met good or high 'Overall Surface Water Status', which in turn decreased ecological status classification of most catchments in Northern Ireland. The decrease in ecological status in the Glendergan River is a result of change in assessment methodology, rather than being attributed to activities at the Site. This is also highlighted in the NIEA's Northern Ireland Water Framework Directive Statistics Report 2021.

When river water quality was assessed without 'forever' chemicals in Glendergan river, it was assigned status 'Good' in 2021, an improvement from the 2015 and 2018 classification, when it was classed as 'Moderate'.

7.3.7.3 Additional Biological Water Quality Assessments

In addition to the EPA biological monitoring described above, a total of 3 no. rounds of biological water quality assessments were completed in the vicinity of the Site as part of the water quality programme for the Meenbog Windfarm. A map of the additional monitoring locations is shown on **Figure 7-9** below.

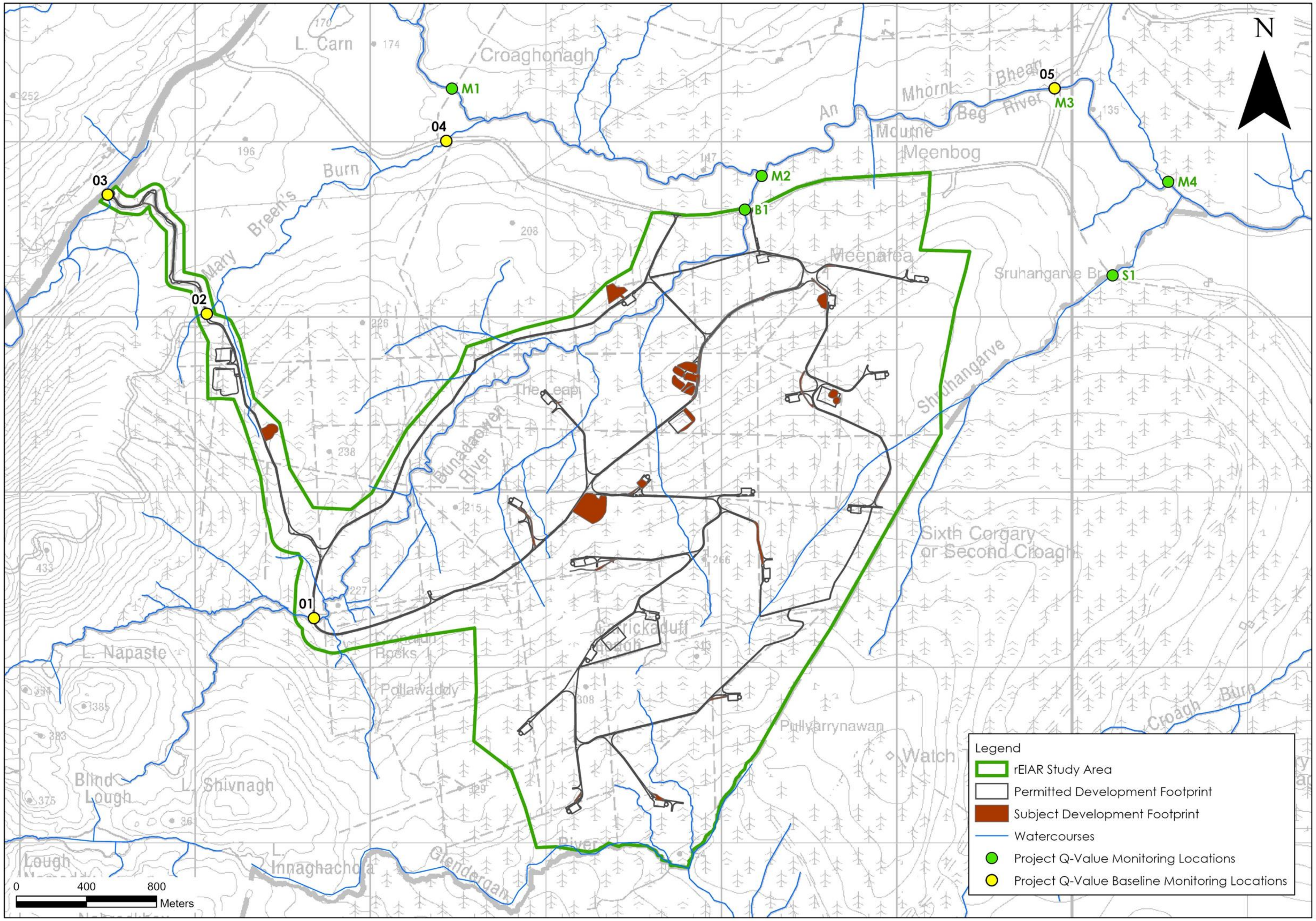


Figure 7-9: Additional Biological Monitoring Locations

7.3.7.3.1 Pre-Construction Monitoring

MKO completed baseline surveys at 5 no. locations within and downstream of the Site in September 2014 to assess aquatic macroinvertebrates for Q-Value determination of the baseline environment.

The results are presented in **Table 7.11** below. All 5 no. sampling locations were assigned a Q-rating of 3-4 (i.e. 'Moderate' status). No baseline monitoring was undertaken on or downstream of the Shruhangarve River.

Table 7.11: MKO Q-Rating Assessment (2014)

Watercourse	Sampling Location ID	Year	EPA Q-Rating Status
Mourne Beg River Sub-Catchment			
Bunadaowen	Sample Point 1	2014	Q3-4
Mary Breen's Burn Stream	Sample Point 2	2014	Q3-4
Mary Breen's Burn Stream	Sample Point 4	2014	Q3-4
Mourne Beg	Sample Point 5	2014	Q3-4
Eske Sub-Catchment			
Lowerymore	Sample Point 3	2014	Q3-4

7.3.7.3.2 Construction Phase Monitoring

No additional rounds of biological monitoring were completed from the onset of construction works in November 2019 to the November 2020 Peatslide.

Post-November 2020 Peatslide Monitoring

A total of 3 no. rounds of biological water quality assessments were completed in 2020 (MKO), 2021 (Triutus Environmental Ltd) and 2023 (MKO).

During these monitoring rounds a total of 39 no. kick samples were taken.

6 no. sampling locations were common across the 3 no. monitoring cycles and the results of the kick sampling at these locations are presented in **Figure 7-10** below. During these monitoring rounds, the Q-ratings of the Mourne, Bunadaowen and Shruhangarve River in the vicinity and downstream of the Site ranged from 3.5 ('Moderate' status) to 4.5 ('High' status). The monitoring shows no deterioration in the Q-rating status of these watercourses. 4 no. monitoring locations (M1, M4, M5 and S1) show an improvement in Q-ratings during this period while no change was recorded at 4 no. monitoring locations (M2, M3 and B1).

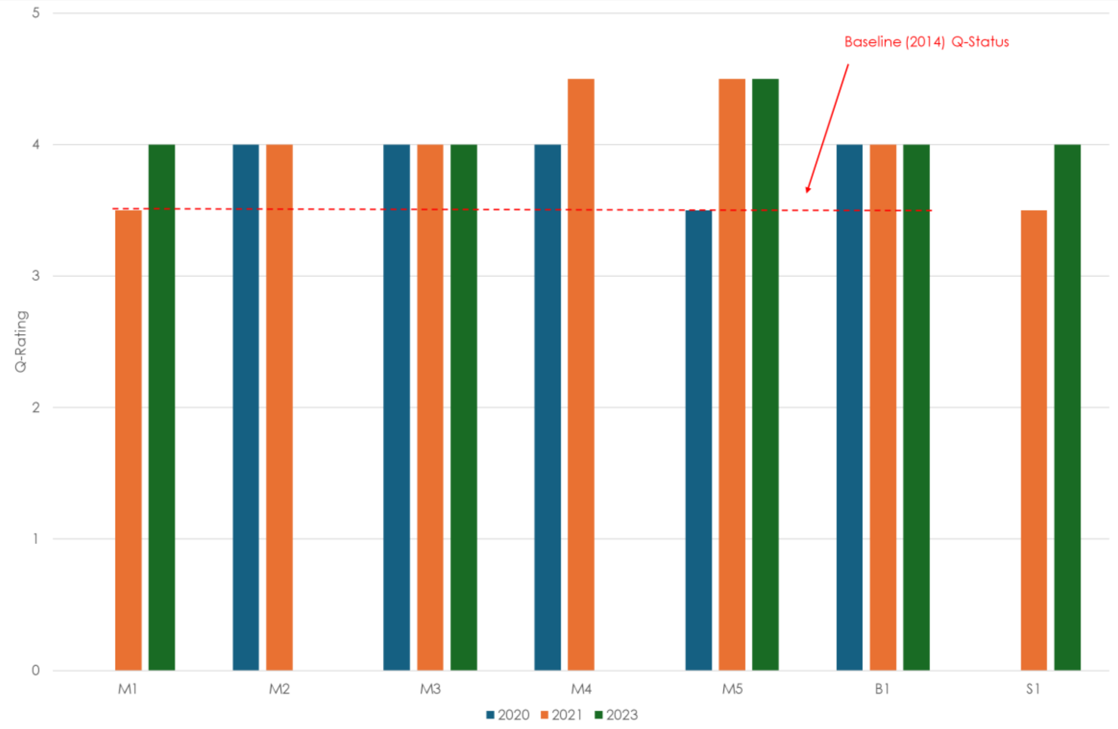


Figure 7-10: Additional Q-Rating Monitoring Results

7.3.7.4 Surface Water Quality Monitoring

7.3.7.4.1 *Baseline*

As part of the EIAR for the Permitted Development HES completed surface water monitoring at 4 no. locations on the Bunadaowen River in September 2017.

Field hydrochemistry measurements of electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at these 4 no. monitoring locations and the results are summarised as follows:

- Electrical conductivity (EC) values for drains and natural surface waters at the site area ranged between 39 and 45µS/cm. This indicates that surface water flow was derived predominantly from rainfall input / runoff during this sampling event.
- The pH values were slightly acidic, ranging from 5.6 to 5.7. Slightly acidic pH values of surface waters would be typical of peatland environments due to the decomposition of peat.
- In addition, the Precambrian bedrock (and related till subsoils where present) which underlie the study area would have slightly acidic groundwater characteristics which would have some effect on surface water chemistry especially during dry periods, when baseflow is likely to be more prevalent.

Surface water samples were taken from the Bunadaowen River on 20th September 2017 for laboratory analysis and the results are summarised as follows:

- Total suspended solids were <10mg/L in all samples;
- Ammonia N was below the laboratory detection limit of 0.03mg/L in all samples;
- BOD was less than 1mg/L in all samples;
- Nitrite was below the laboratory detection limit of 0.03mg/L in samples;
- Nitrate was also below the laboratory detection limit of 0.2mg/L in all samples and phosphorus ranged between 0.027 and 0.045mg/L which would be considered low. The low levels of nutrients reported in the samples would be typical of surface water quality from a peatland environment; and,
- Chloride which ranged between 6.6 and 8.1mg/L is typical of surface waters in a non-coastal setting.

7.3.7.4.2 Further Monitoring During the Construction Phase

During the construction of the Meenbog Windfarm, MKO was engaged to undertake a water quality monitoring programme in line with the requirement set out in the EIAR for the Permitted Development. This included continuous turbidity monitoring, daily visual checks of waterways and monthly hydrochemistry monitoring.

Visual Checks

Since construction commenced in late 2019, over 230 visual check sheets were filled out until March 2021. The visual checks were completed at 12 no. locations on watercourses in the vicinity and downstream of the Site. The locations of these inspection points are shown on **Figure 7-11**.

Daily visual checks noted any localised increases in turbidity in onsite water courses, general site conditions, and recorded mitigation measures necessary as outlined in the CEMP or discussed with the relevant personnel such as the project hydrologist, geologist, or site manager. Copies of the available visual check sheets are included as **Appendix 7-2**.

Surface Water Chemistry Monitoring

Monthly grab samples were taken from August 2019 to February 2023 and sent to an accredited laboratory for analysis. A total of 4 no. sampling locations were sampled during this monitoring period. The locations of the sampling are shown on **Figure 7-11**. Sampling was paused in February 2023 as all key water quality parameters had been stable for almost 2 years. The original laboratory certs are attached as **Appendix 7-3**.

The results of the sampling are summarised in **Table 7.12** and are shown alongside the relevant Environmental Quality Standard (EQS). The results from the 147 no. samples are summarised as follows:

- 100% compliance was recorded with regards to the concentrations of chloride, nitrate, total phosphorus and BOD;
- Suspended solid concentrations were below 25mg/l EQS in all samples with the exception of SW2 on the 30th November 2020;
- Elevated levels of Nitrate, Nitrite, Ammonia and Ammonium were recorded at SW4 on the 24th of April 2020. All other water sampling results were stable on this date. Levels returned to baseline levels in subsequent sampling rounds;
- Elevated levels of Orthophosphate were recorded across all sampling stations in the monthly samples dating from March, April, and June 2020. Levels subsequently returned to baseline;
- Elevated levels of Orthophosphate were recorded at SW1 in December 2020. Levels returned to baseline levels by the following sampling event; and,
- Elevated levels of Orthophosphate were recorded at SW4 in November 2021. Levels returned to baseline levels by the following sampling event.

With respect to S.I. 272/2009, Ammonia concentrations were found to be of High status in 97.3% of the samples. BOD concentrations were below the High status threshold of ≤2.2mg/l in all samples. Meanwhile, 89% of the samples were found to be of High status with respect to Orthophosphate.

Continuous Turbidity Monitoring

3 no. sondes (MSe1. MSe3 and MSe4) were installed as a water quality early warning system on the Lowerymore, Bunadaowen and Shruhangarve watercourses on 9th September 2019, prior to the onset of construction. MSe 5, 6, and 7 were installed in various locations along the Mourne Beg River to monitor turbidity upstream of active works and downstream of the Shruhangarve Stream which had been effected by the peat slide. Please note than MSe3, located on the Shruhangarve Stream was lost during the peat slide on 12th November 2020 and was reinstated on 18th December 2020. The locations of the sondes are shown in **Figure 7-11**.

Turbidity is a measure of the cloudiness of a fluid and may be used as an indicator of potential suspended solids. The purpose of the sondes was to act as an early warning system of potential sediment input into receiving waters and allowed further investigations and remedial action to be undertaken if required. The sondes were not used as a measure of water quality, which was instead assessed through chemical and biological monitoring.

The continuous turbidity monitoring results are presented in **Figure 7-12** below. The data has been recorded at 15 minute intervals and is summarised in **Figure 7-12** as average daily turbidity concentrations. Turbidity can be used as a proxy for total suspended solids (1 NTU = ~3 mg/L TSS), with the TSS EQS of 25mg/L included in the figure as ~75NTU.

The data can be summarised as follows:

- The vast majority of the daily turbidity averages are well below the equivalent TSS EQS.
    - A total of 1.1% of the average daily turbidity data exceeded 75NTU at MSe1.
    - A total of 2.7% of the average daily turbidity data exceed 75NTU at MSe 3 on the Shruhangarve Stream.
    - A total of 3.6% of the average daily turbidity data exceeded 75NTU at MSe4.
    - A total of 0.2% of the average daily turbidity data exceed 75NTU at MSe5.
    - A total of 0.1% of the average daily turbidity data exceeded 75NTU at MSe6.
    - A total of 0.2% of the average daily turbidity data exceeded 75NTU at MSe7.
- Prior to the curtailment of the main construction activities in November 2020, the average daily turbidity data exceeded 75NTU on several occasions. On 28th May 2020, the average turbidity concentration at MSe3 on the Shruhangarve was recorded as 153NTU. An exceedance was also recorded at MSe4 on the Bunadaowen Stream on 12th August 2020 (92.8NTU). The daily average turbidity concentrations returned to background concentrations on the succeeding days.
- Several exceedances were also recorded at MSe3 in late September 2020. Several elevated average daily turbidity concentration were recorded between 25th and 1st October. The average daily turbidity concentrations exceed 400NTU on each of these dates. The concentrations returned to background levels for much of October, with some brief peaks recorded on 10th, 11th, 13th and 14th October.
- The peat failure occurred on the 12th November 2023 and the NTU concentrations in the Sruhangarve Stream were at background concentrations in the preceding days. Some elevated turbidity concentrations were recorded following reinstallation of MSe3 on 21st, 22nd and 26th December 2020. However, the turbidity concentrations quickly returned to background levels. There have been brief spikes in the daily average turbidity concentrations at MSe3 on 16th January 2021, 21st July 2021 and 8th December 2021. Short-term spikes in turbidity are common in peatland environments, particularly following periods of heavy rainfall. A review of the rainfall data has shown that many of these spikes were preceded by a period of intense precipitation.
- Several exceedances have also been recorded at other monitoring station since the suspension of construction activities, during the winter of 2021/2022 and in the spring and early summer of 2022. Many of these occurred on the Lowerymore River (MSe1), with some elevated concentrations also recorded at MSe7 in August 2022.
- All daily average turbidity concentrations have been well below 75NTU since August 2022.

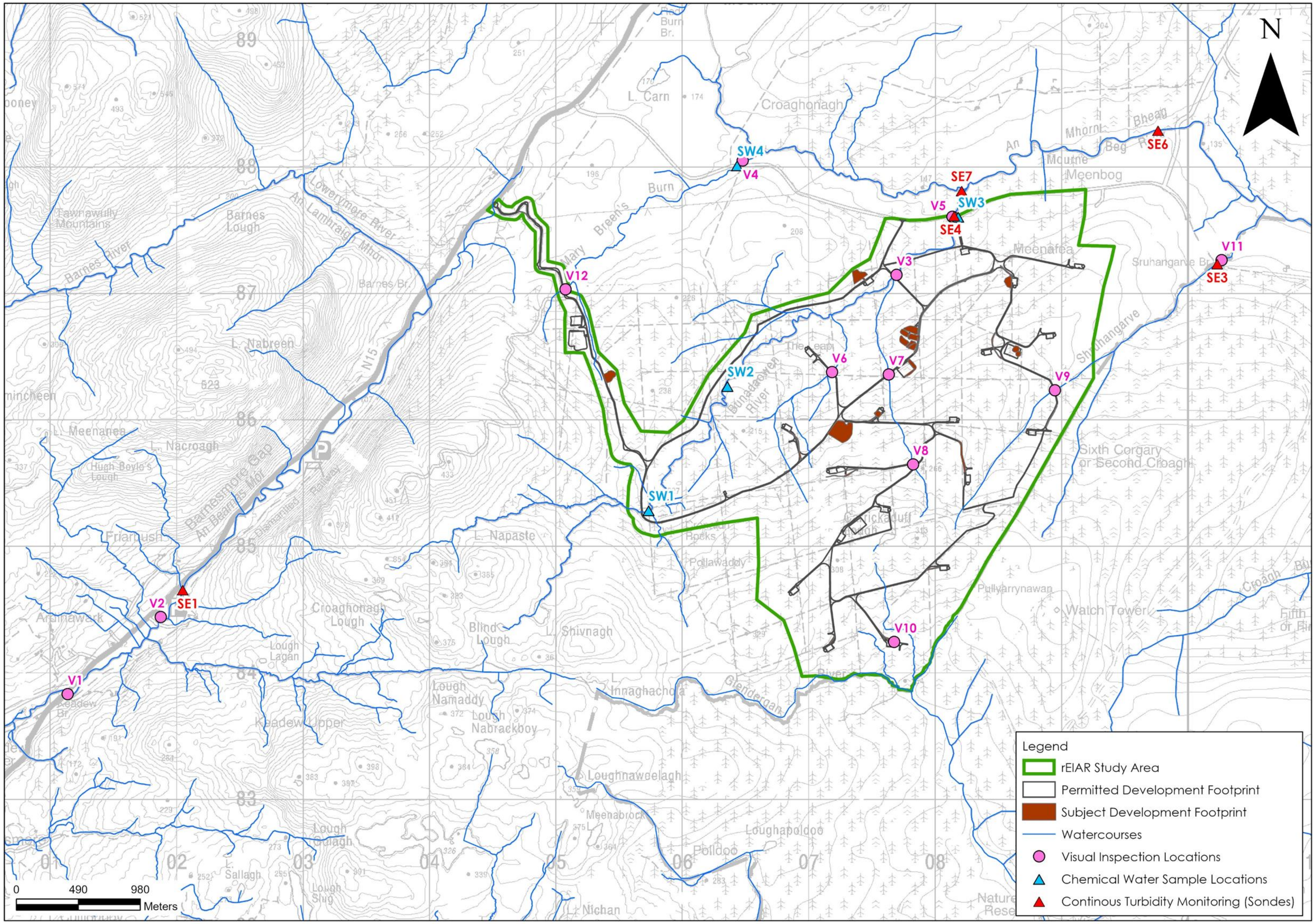


Figure 7-11: Construction Phase Monitoring Locations

Table 7.12: Water Quality Monitoring During and Post Construction

Sampling Location ID	Watercourse	SS	BOD	Ammonium	Ammonia	Ortho-P	Nitrite	Nitrate	Chloride	Total P
		mg/l	mg/l	$mgNH_4/l$	$mgNH_3/l$	$mgPO_4/l$	$mgNO_4/l$	$mgNO_3/l$	mgCl/l	mgP/l
SW1	Bunadaowen	1 - 10	1	0.03 – 0.09	0.03 – 0.08	0.03 – 0.12	0.02	0.2 – 0.3	4 – 38.5	0.005 – 0.41
SW2	Bunadaowen	1 - 68	1	0.03 – 0.1	0.03 – 0.09	0.03 – 0.06	0.02	0.2 – 1.3	4.7 – 38.5	0.005 – 0.047
SW3	Bunadaowen	1 - 10	1 - 2	0.03 – 0.14	0.03 – 0.13	0.03 – 0.06	0.02	0.2 – 1.5	5.8 – 41.8	0.005 – 0.065
SW4	Mary Breen's Burn	1 - 10	1	0.03 – 1.91	0.03 – 1.8	0.03 – 0.06	0.02 – 0.31	0.2 – 30.8	5.1 – 37.7	0.005 – 0.052
EQS		≤25[4]	High: ≤2.2 (95%ile)[5]	≤1[(4)]	High: ≤0.09 (95%ile)[(5)]	High: ≤0.045(95%ile)[(5)]	≤0.05[(4)]	37.5[6]	250[(4)]	0.4[(6)]
No. Samples		147	147	147	147	147	147	147	147	147
No. Exceedances		1	0	3	4	16	1	0	0	0
% Compliant		99.3	100	97.9	97.3	89	99.3	100	100	100

[4] *S.I. 293/2988: European Communities (Quality of Salmonid Waters) Regulations*
[5] *S.I. 272/2009. Surface Water Regulations*
[6] *WFD Ireland Threshold for Good Water Quality Status*

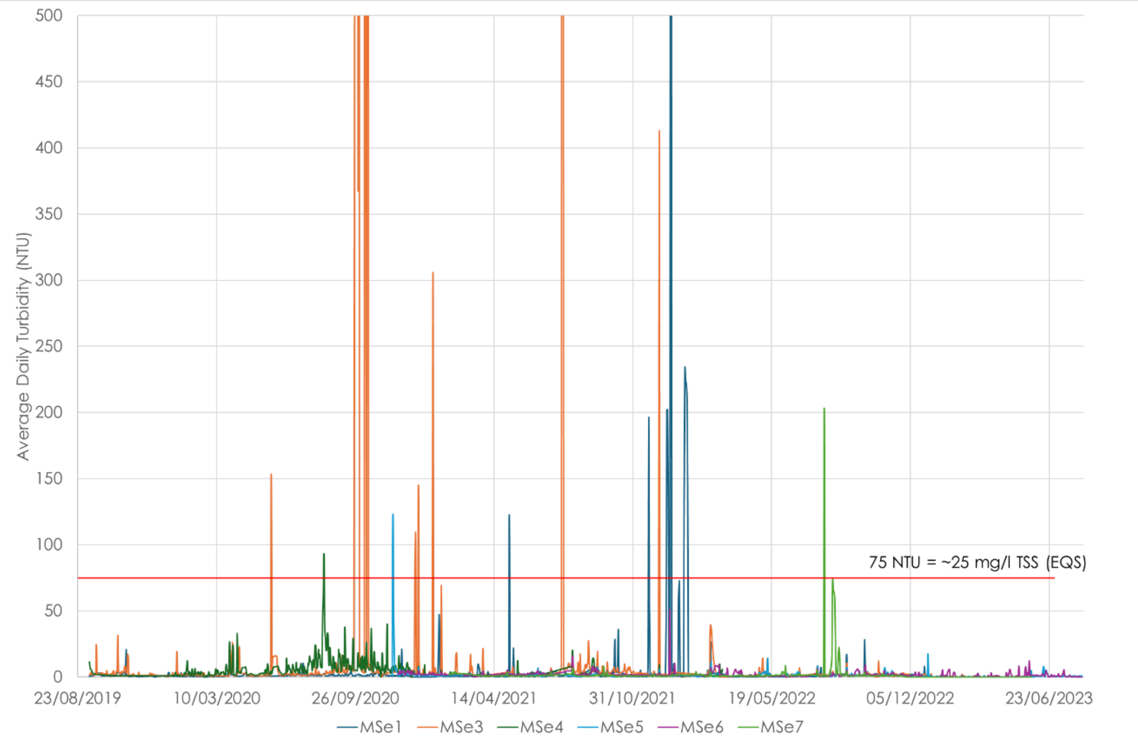


Figure 7-12: Continuous Turbidity Monitoring Data

7.3.7.5 Summary Water Quality

A comprehensive dataset has been obtained in relation to water quality in all watercourses draining the Site.

The following is a brief summary of the preceding sections:

- The water quality data indicates that, with the exception of the Shruhangarve, there has been no deterioration in water quality in any of the watercourses draining the Site;
- The combined EPA biological monitoring and biological monitoring completed as part of the Meenbog Windfarm indicate that, based on biological factors, there has been no deterioration in water quality in the Mourne Beg, Lowerymore and Bunadaowen waterbodies;
- The biological monitoring data shows a deterioration in water quality in the Shruhangarve and downstream Mourne Beg River associated with the November 2020 Peatslide. The monitoring data now indicates a recovering trend in the Shruhangarve, whilst the Mourne Beg River downstream is exceeding its pre-construction baseline status;
- Data obtained from the Northern Ireland Environmental Agency also indicates that there has been an improvement in status in the Glendergan River from its baseline condition; and,
- The water quality monitoring during the construction phase shows that the samples obtained from the Bunadaowen River and Mary Breen's Burn do not indicate a decrease in water quality.

7.3.8 Hydrogeology

The Site is underlain by Precambrian quartzites, gneisses and schists. These rocks are classified by the GSI as being a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones (Pl) (www.gsi.ie). A bedrock geology aquifer map is attached as **Figure 7-13**.

In terms of Groundwater Bodies (GWBs), the vast majority of the Site, all but one of the deviations, is underlain by the Castlederg GWB. Meanwhile, a small area in the west, at deviation No. 1, is underlain by the Donegal south GWB. Both GWBs are characterised by poorly productive bedrock.

The Precambrian rocks generally have an absence of inter-granular permeability, and most groundwater flow is expected to be in the uppermost part of the aquifer comprising a broken and weathered zone typically less than 3m thick, a zone of interconnected fissuring 10m thick, and a zone of isolated poorly connected fissuring typically less than 150m (GSI, 2004). Recharge occurs diffusely through the thin/permeable subsoil and rock outcrops, although is limited by any thicker till/peat and the low permeability bedrock itself. Therefore, most of the effective rainfall is not expected to recharge the aquifers.

Based on site-specific observations from the bedrock exposures at the existing borrow pits (which were noted to be largely competent and massive) limited groundwater flow will be restricted to the top of the rock or within a very thin weathered zone (0.2 – 03m). Also, the pockets of mineral subsoil (where present) are not expected to act as preferential groundwater flowpaths due to their silty composition, limited thickness and disconnected lateral distribution. Therefore, the overall potential for groundwater flow at the base of the peat is anticipated to be insignificant.

No significant groundwater flow is expected either in the deeper bulk of bedrock as any jointing or fractures visible at the exposures were noted to be very tight. Some of the existing borrow pits have depths of up to 5 - 6m below the local ground surface and no groundwater seepage (or evidence of past or intermittent seepage) was noted.

Groundwater flowpaths (where present) are likely to be short (30-300m), with groundwater discharging to nearby streams and small springs. Groundwater flow directions are expected to follow topography and therefore groundwater directions within the Site are expected to be towards the primary streams draining the Site (GSI, 2004).

Based on observations at the site, groundwater baseflow contribution to local streams is expected to be very low all year round. Overall, the hydrology of the Site is dominated by surface water runoff on the bog surface and within the existing drainage channels.

Local groundwater flow directions will mimic topography, whereby groundwater flows from topographic high points to lower elevated discharge areas at local streams (GSI, 2004).

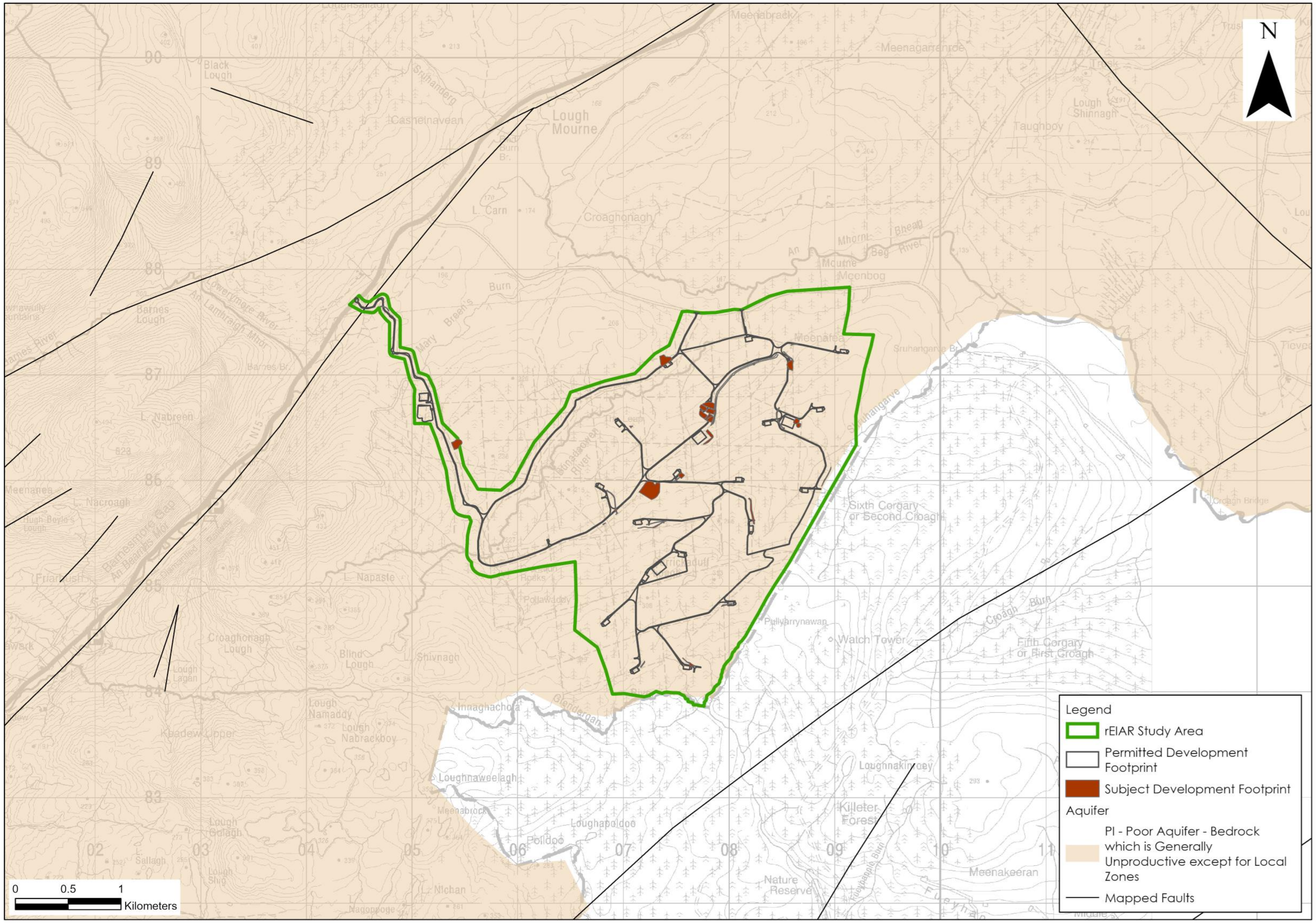


Figure 7-13: Bedrock Aquifer Map

7.3.9 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 vulnerability rating of the bedrock aquifer underlying Site is mapped by the GSI (www.gsi.ie) to range from Moderate to Extreme-X. Most of the Site has a vulnerability rating of Moderate to High, with the Extreme rating relating to areas where subsoil is shallow or absent and where bedrock is outcropping.

In relation to the Subject Development, a total of 15 no. deviations are mapped by the GSI to be situated in areas of Moderate groundwater vulnerability. Meanwhile, 10 no. deviations are mapped in areas of High vulnerability.

Site investigations at the Site comprising of peat probes, trial pits and gouge cores have revealed that the depth to rock is typically shallow. Given the shallow depth to rock and the nature of the subsoils (silts, clays, sands and gravels), the vulnerability at the Site ranges from High to Extreme in accordance with **Table 7.13.**

However, due to the low permeability nature of the underlying bedrock aquifers, groundwater flowpaths are likely to be short (30 – 300m), with recharge emerging close by and discharging into local surface water streams. This means there is a low potential for groundwater dispersion and movement within the aquifer, therefore surface water bodies such as drains and streams/rivers are more vulnerable (to contamination from human activities) than groundwater at the Site.

Table 7.13: Groundwater Vulnerability and Subsoil Permeability and Thickness

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.

7.3.10 Groundwater Hydrochemistry

There are no groundwater quality data for the Site and groundwater sampling would generally not be undertaken for this type of development in terms of EIAR reporting, as groundwater quality impacts would not be anticipated.

Based on data from GSI publication, Calcareous/Non-calcareous classification of bedrock in the Republic of Ireland (WFD,2004), alkalinity for this bedrock type generally ranges from 14 – 400mg/L while electrical conductivity and hardness were reported to have mean values of 446µS/cm and 200mg/L respectively.

7.3.11 Water Framework Directive Water Body Status & Objectives

The River Basin Management Plan was adopted in 2018 and has amalgamated all previous river basin districts into one national river basin management district. The River Basin Management Plan (2022 - 2027) objectives, which have been integrated into the design of the Subject Development, 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.

7.3.12 Groundwater Body Status

Local Groundwater Body (GWB) and Surface water Body (SWB) status information is available from (www.catchments.ie).

The Castlederg and Donegal South GWBs, which underlie the Site, achieved 'Good' status in all 3 no. WFD cycles (2010-2015, 2013-2018 and 2016-2021) which is defined based on the quantitative status and chemical status of the GWB. These GWBs have been deemed to be 'not at risk' of failing to meet their respective WFD objectives. Furthermore, no significant pressures have been identified on these GWBs.

Summary WFD information for these GWBs is presented in **Table 7.14** below.

Table 7.14: WFD Groundwater Body Status

GWB	Overall Status 2010-2015	Overall Status 2013-2018	Overall Status 2016-2021	3rd Cycle Risk Status	WFD Pressures
Castlederg	Good	Good	Good	Not at risk	None
Donegal South	Good	Good	Good	Not at risk	None

7.3.13 Surface Water Body Status

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) in the vicinity and downstream of the Site are shown in **Table 7.15** below.

Within the Foyle surface water catchment, the Mourne Beg_010 SWB in the vicinity of the Site achieved 'Poor' status in all 3 no. WFD cycles (2010-2015, 2013-2018 and 2016-2021). Meanwhile, the status of the Bunadaowen_010 SWB improved from 'Poor' to 'Moderate' status in the latest WFD cycle (2016-2021). The east of the Site is drained by the Mourne Beg River (Derrygoonan) SWB which achieved 'Moderate' status in the last 2 no. WFD cycles. The status of the Glendergan River has deteriorated from 'Moderate' to 'Poor' in the latest WFD cycle. Downstream of the Site the Mourne Beg River (Lisnacloone) and the Derg River (Milbrook) SWBs are of 'Moderate' status.

The majority of the waterbodies in the vicinity and downstream of the Site within the Foyle catchment have been deemed to be 'at risk' of failing to meet their respective WFD objectives.

The 3rd Cycle Draft Foyle Catchment Report (EPA, 2021) state that the significant pressure affecting the greatest number of waterbodies in this catchment is agriculture. The significant pressures impacting the SWBs in the vicinity and downstream of the Site are as follows:

- Agriculture is only listed as a significant pressure on the Derg River (Milford).
- Forestry is a significant pressure on the Mourne Beg_010, Bunadaowen_010 and Mourne Beg River (Derrygoonan) SWBs in the vicinity of the Site. The catchment report states that the significant issues are arising primarily as a result from clearfelling and associated operations, which results in nutrient loads, acidification and sediment loads.
- Abstraction for the Lough Mourne Public Water Supply was identified as a significant pressure on the Mourne Beg_010 with habitat alternation due to hydrological changes identified as the issue.
- Peat drainage and peat extraction (i.e. extractive industry) have been identified as a significant pressure on the Mourne Beg River (Derrygoonan) and the Derg River (Milbrook).
- Unknown anthropogenic pressures are also listed to be impacted several SWBs including the Mourne Beg River (Derrygoonan) SWB.

Within the Donegal Bay North surface water catchment, the Loneymore_010 and _020 SWBs in the vicinity and downstream of the Site achieved 'High' status in the latest 2 no. WFD cycles. Further downstream, the Eske_010 river waterbody and the Eske lake waterbody are of 'Good' status. With regard to risk status, the status of the Eske lake waterbody is currently under review while the Lowerymore River is 'not at risk'. No significant pressures have been identified on these SWBs.

Further details are provided in the WFD Compliance Assessment attached as **Appendix 7-4**.

Table 7.15: WFD Surface Waterbody Status

SWB	Overall Status 2010-2015	Overall Status 2013-2018	Overall Status 2016-2021	3rd Cycle Risk Status	WFD Pressures
Foyle Catchment					
Mourne Beg_010	Poor	Poor	Poor	At risk	Forestry & abstractions
Bunadaowen_010	Poor	Poor	Moderate	At risk	Forestry
Mourne Beg River (Derrygoonan)	Unassigned	Moderate	Moderate	At risk	Forestry, anthropogenic & extractive industry
Glendergan River	Unassigned	Moderate	Poor	Under review	None
Mourne Beg River (Lisnacloone)	Unassigned	Moderate	Moderate	At risk	Anthropogenic
Derg River (Milbrook)	Unassigned	Moderate	Moderate	At risk	Anthropogenic, extractive industry & agriculture
Donegal Bay North Catchment					
Lowerymore_020	High	High	High	Not at risk	None
Lowerymore_030	Good	High	High	Not at risk	None
Eske_010	Moderate	Good	Good	Not at risk	None
Lough Eske	Moderate	Good	Good	Under review	None

7.3.14 Designated Sites and Habitats

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs). Within Northern Ireland designates sites include Special Areas of Conservation (SACs), Areas of Special Scientific Interest (ASSIs), Local Nature Reserves (LNRs) and National Natures Reserves (NNRs). A designated site map for the area is shown as **Figure 7-14**.

The Subject Development is not located within any designated conservation site, however, there are designated sites within the Site boundary and in close proximity to some of the Subject Development components. Small sections of Croaghonagh Bog SAC/pNHA (Site Code: 000129) and Cashelnavean Bog NHA (Site Code: 000122) are located within Site. The Subject Development is also hydrologically connected to some downstream designated sites including the Lough Eske and Ardnamona Wood SAC (Site Code: 000163) along the Lowerymore River and the River Finn SAC along the Mourne Beg River.

The connectivity of all local designated sites to the Subject Development are assessed as follows:

- Croaghonagh Bog SAC/pNHA (Site Code: 000129) is located immediately to the east of Deviation No.1. This area of the Site is located in the catchment of the Lowerymore River. The SAC/pNHA is located upstream of this deviation area, therefore limiting the potential for effects to occur. However, the SAC/pNHA are predominantly located in the catchment of Mary Breen's Burn Stream and is therefore hydrologically connected to Deviation No: 2.
- Cashelnavean Bog NHA (Site Code: 000122) is located ~200m west of Deviation No. 1 and within the catchment of the Loweymore River. However, no direct hydrological connections exist between the deviation area and this NHA. The Lowerymore River acts as a hydrological barrier between the designated site and the deviation area.
- Barnesmore Bog NHA (Site Code: 002375) is located ~400m west of the Site. This NHA is located upstream of the Subject Development and all deviation areas. Therefore, there is no potential hydrological and hydrogeological connectivity.
- Lough Eske and Ardnamona Wood SAC/pNHA (Site Code: 000163) are located ~5km southwest of the Site. The Lowerymore River provides a direct hydrological connection between the Site and this SAC. Deviation No. 1 is located in the catchment of the Lowerymore River.
- The River Finn SAC (Site Code: 002301) is located downstream of the Subject Development along the Mourne Beg River. 24 of the 25 no. deviations are hydrologically connected with this SAC.

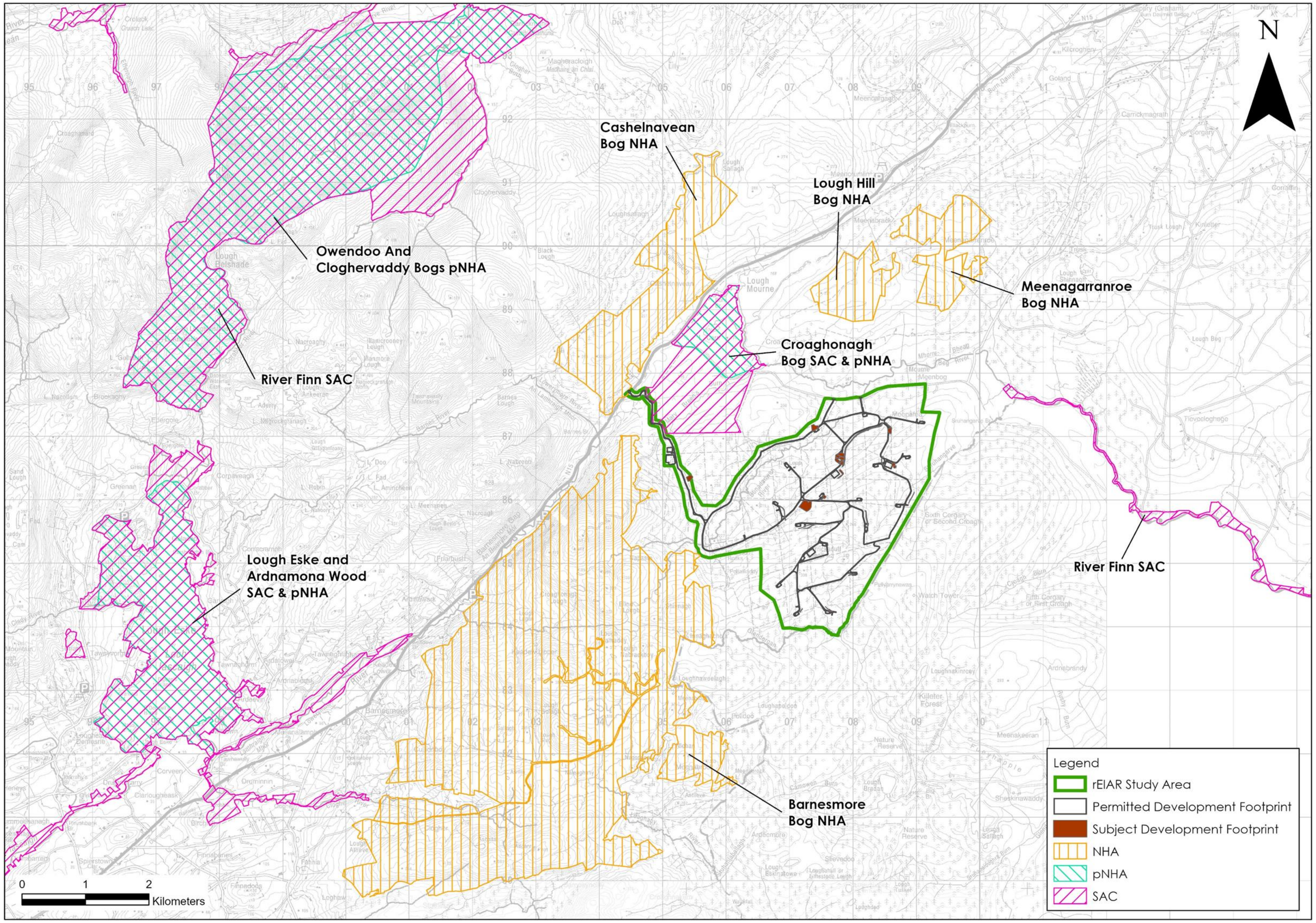


Figure 7-14: Designated Sites Map

7.3.15 Water Resources

7.3.15.1 Groundwater Resources

The GSI do not map the presence of any National Federation registered Group Water Schemes (GWS) or Public Water Schemes (PWS) or an associated Source Protection Area (SPA) within the Site or in the surrounding lands.

A search of private well locations (accuracy of 1 – 50m only) was undertaken using the GSI well database (www.gsi.ie). The GSI database does not record any wells in the vicinity of the Site. The closest mapped groundwater wells are located ~2km northeast of the Site and are reported as having a poor yield class.

A map of nearby mapped groundwater wells is included as **Figure 7-15**.

7.3.15.2 Surface Water Resources

There are no mapped Drinking Water Protected Areas (DWPA) within or immediately downstream of the Site. The closest DWPA is Lough Mourne located upstream of the Site. However, Uisce Éireann abstract water from the Bunadaowen River within the Site and pump it to Lough Mourne Reservoir, ~1.7km to the north. This abstraction is currently not mapped on the online WFD database (www.catchments.ie).

In the Donegal Bay North Catchment, the Eske_020 SWB upstream of Donegal Town and downstream of Lough Eske is listed as a DWPA.

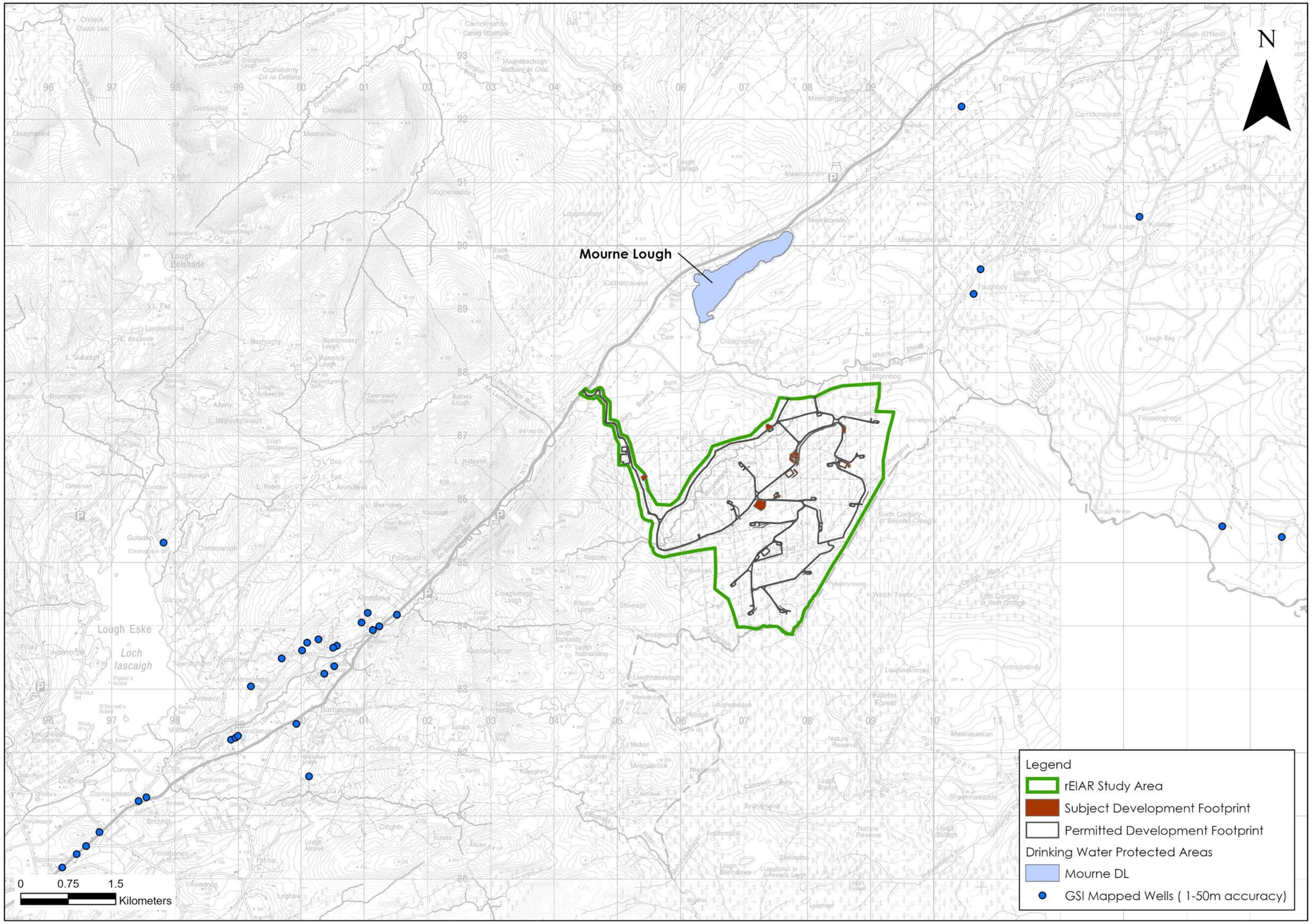


Figure 7-15: Local Water Resources (www.gsi.ie)

7.3.16 Receptor Sensitivity and Importance

This section discusses the sensitivity of the receiving hydrological and hydrogeological environment in terms of the Subject Development and identifies those receptors which will be carried forward into the impact assessment.

Due to the nature of Subject Development, comprising of near surface construction activities, combined with the local hydrogeological regime (low permeability peat soils overlying a Poor Bedrock Aquifer), effects on groundwater quality and quantity were generally negligible. The primary risks to groundwater would have been from hydrocarbon spillages and leakages. These risks are common potential effects at all construction sites (such as road works and industrial sites) and were assessed in the EIAR for the Permitted Development. All potential contamination sources were carefully managed at the Site during the construction phase and mitigation measures were implemented to deal with these effects.

The following groundwater receptors are identified for impact assessment:

- The Poor Bedrock Aquifer underlying the Site. Based on the criteria set out in **Table 7.3**, this aquifer can be considered as being of Low Importance; and,
- The WFD status of the Castlederg and Donegal South GWBs underlying the Site.

Due to the nature of Subject Development, comprising of near surface construction activities, and the local hydrological regime (low rates of groundwater recharge and high rates of surface water runoff), surface waters are considered to be the most sensitive receptor. The quantification of flow volumes presented in Section 7.3.4 indicates that the surface watercourses in the immediate vicinity of the Site would have been most susceptible to potential effects. Further downstream, the watercourses would be less susceptible to potential effects due to increasing flow volumes which provide a greater dilution effect. Furthermore, the potential for surface water quality effects also relates to the number and nature of the deviations within the catchment of each waterbody. As detailed above in **Table 7.6**, 17 no. deviations are located in the catchment of the Bunadaowen River whilst only 1 no. deviation is mapped in the catchment of the Lowerymore River. Therefore, the Bunadaowen River would have been more susceptible to effects than other watercourses in the area of the Subject Development.

The following surface water receptors are identified for impact assessment:

- All watercourses within and downstream of the Site including Mary Breen's Burn, Shruhangarve Stream, Bunadaowen, Glendergen, Mourne Beg and Lowerymore Rivers. Prior to the onset of construction and based on the criteria detailed in **Table 7.2**, the Mourne Beg and Lowerymore Rivers were considered to be of Very High Importance based on their assigned Q-rating status. Meanwhile, the Bunadaowen River was considered to be of High Importance;
- The WFD status of all SWBs downstream of the Site; and
- The Lough Mourne DWPA which is partly sourced from the Bunadaowen River.

In terms of designated sites, only those designated sites which are hydrologically/hydrogeologically linked with the Site have been included in the impact assessment. These were the only designated sites which could have been impacted by the Subject Development and include the:

- Lough Eske and Ardnamona Wood SAC/pNHA (Site Code: 000163) and the River Finn SAC (Site Code: 002301). Based on the criteria detailed in **Table 7.2**, these sites can be considered to be of Extremely High Importance. The River Finn SAC would have been most susceptible to potential effects, as 24 of the 25 no. deviations that make up the Subject Development are located within the upstream catchment of the Finn River. Meanwhile, only 1 no. deviation is located within the catchment of the Lough Eske and Ardnamona Wood SAC/pNHA.
- Croaghonagh Bog SAC/pNHA (Site Code: 00129) can also be considered to be of Extremely High Importance. This designated site is located downstream of Deviation 2 and in close proximity to Deviation 1.

7.4 Characteristics of the Subject Development

The Subject Development is described in full in Chapter 3.

The Subject Development comprises 25 no. deviations from the Permitted Development for which substitute consent is being sought. These deviations are described in full in Chapter 3 (**Table 3-1**) and have a total development footprint of ~8.8ha.

7.5 Assessment of Significant Effects and Mitigation Measures

7.5.1.1 Do -Nothing Scenario

The 'Do Nothing' Scenario is an alternative scenario to maintaining and regularising the Subject Development. Under the Do-Nothing scenario, the 25 deviations that comprise the Subject Development would be removed and restored to the greatest extent practicable. The Meenbog Windfarm would then be completed in accordance with the current planning permission (ABP Ref: PA05E.300460).

This approach may lead to effects on the hydrological and hydrogeological environment due to the potentially extensive groundworks required to remove and restore the existing peat cells, portions of access roads, laybys, hardstands, and peat containment berm. New access road sections and hardstands would then have to be constructed in the slightly different, and less optimal, locations shown on the plans for the Permitted Development. The borrow pits which form part of the Subject Development would be backfilled to the greatest extent possible with peat/spoil and revegetated. The peat cells which form part of the Subject Development would be dismantled and the stored peat material would be removed from the Site for disposal elsewhere.

The effects of the Do-Nothing Scenario on the hydrological and hydrogeological environment are assessed as follows:

- The effect of the restoration of the deviation areas, combined with the construction of the Permitted Development footprint would result in the disturbance, excavation and removal of soils, subsoils and bedrock at most deviation locations. These activities would have the potential to result in the entrainment of suspended solids in surface watercourses.
- The increased volume of construction traffic and machinery would increase the risk of contamination of surface and groundwater via hydrocarbons.
- There would be an increased risk of the release of cement-based compounds due to the additional work being undertaken at the Site.

Based on the above, it is considered that the "Do-Nothing" scenario would likely have a greater effect on the land, soils and geological environment than the proposed option of leaving in-situ and regularising the Subject Development through the substitute consent process.

7.5.2 Construction Phase – Assessment of Effects and Mitigation Measures

7.5.2.1 Earthworks Resulting in Suspended Solids Entrainment in Surface Waters

Construction phase activities at the Subject Development locations required varying degrees of earthworks which resulted in the excavation of peat, subsoil and occasionally bedrock. Potential sources of sediment-laden water included:

- Drainage and seepage water resulting from excavations;
- Drainage water from felled areas;
- Stockpiled excavated material providing a point source of exposed sediment; and,
- Erosion of sediment from emplaced site drainage channels.

These activities could have resulted in the release of suspended solids to surface watercourses, resulting in an increase in the suspended sediment load, increased turbidity which in turn could have affected the water quality and fish stocks of downstream water bodies. The effects on all watercourses downstream of the Site could have been significant if not mitigated against.

Note that potential effects associated with sediment entrainment in runoff from peat and spoil storage areas are dealt with separately in Section 7.5.2.2 below.

Pathways: Drainage and surface water discharge routes.

Receptors: Surface watercourses in the vicinity and downstream of the Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadaowen River, Shruhangarve stream), the Glendergan and the Lowerymore River and the associated water-dependant ecosystems.

Mitigation Measures:

The EIAR for the Permitted Development prescribed detailed mitigation measures relating to earthworks, and the release of suspended solids in surface waters, for the protection of surface water quality.

Whilst the location, alignment and size of components of the Subject Development differ from the Permitted Development plans , these infrastructure elements were constructed as per the methodology and guidelines prescribed in the EIAR for the Permitted Development and detailed in the CEMP.

<u>Mitigation by Avoidance</u>

The key mitigation measure implemented during the construction phase was the avoidance of sensitive hydrological features where possible, by application of suitable buffer zones (i.e. 50m to main watercourses).

The majority of the Subject Development was located outside of the delineated 50m natural watercourse (river and stream) buffer zones. Only 4 no. deviations (Deviation 2, 3, 9 and 19) are located within 50m of a natural watercourse, where specific additional measures were put in place to protect water quality.

The large setback distance from sensitive hydrological features meant that adequate room was maintained for the drainage mitigation measures (discussed below) to be properly installed and operate effectively. The buffer zone:

- Avoided physical damage (river/stream banks and river/stream beds) to watercourses and associated release of sediment;
- Avoided excavations within close proximity to surface watercourses;
- Avoided the entry of suspended sediment from earthworks into watercourses; and,
- Avoided the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

Mitigation by Design:

The following controls and treatment systems were implemented during the construction phase:

- Source controls:
    - Interceptor drains, erosion and velocity control measures such as use of sand bags and other similar/equivalent or appropriate systems.
    - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls:
    - Interceptor drains, oversized swales, erosion and velocity control measures such as check dams, straw bales, silt bags, silt fences, sedimats, and collection sumps, temporary sumps, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriate systems.
- Treatment systems:
    - Temporary sumps and ponds, temporary storage lagoons, sediment traps, and settlement ponds.

It should be noted for this site that an extensive network of forestry and roadside drains already existed, and these were integrated and enhanced as required and used within the Meenbog Windfarm drainage system. The integration of the existing forestry drainage network and the Meenbog Windfarm drainage network was relatively simple. The key elements were the upgraded and improvements to water treatment elements, such as in line controls and treatment systems, including silt traps, settlement ponds and buffered outfalls.

The main elements of interaction with the pre-existing drainage were as follows:

- Apart from interceptor drains, which conveyed clean runoff water to the downstream drainage systems, there was no direct discharge (without treatment for sediment reduction, and attenuation for flow management) of runoff from the wind farm drainage system into the pre-existing site drainage network. This reduced the potential for any increased risk of downstream flooding or sediment transport/erosion;
- Silt traps were placed in the pre-existing drains upstream of any streams where construction works / tree felling occurred, and these were diverted into interceptor drains, or culverted under/across the works area;
- Runoff from individual work areas was not discharged into the pre-existing drain network but discharged locally at each work location through settlement ponds and buffered outfalls onto vegetated surfaces;
- Numerous buffered outfalls have been used to promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the pre-existing drains of the Site; and,
- Drains running parallel to the existing roads which were upgraded were targeted to the opposite side of the road. Velocity and silt control measures such as check dams, straw bales and silt fences were used during the construction works. Regular buffered outfalls were also added to drains to protect downstream surface waters.

The full details of the drainage implemented at the Site are prescribed in the CEMP including details on the use of interceptor drains, swales, check dams, level spreaders, vegetation filters, settlement ponds, silt bags and silt fences.

Pre-emptive Site Drainage Management:

The works programme for the construction phase of the development also considered weather forecasts, and predicted rainfall in particular. Large excavations and movements of soil/subsoil or vegetation stripping were suspended or scaled back when heavy rain was forecast. The extent to which works were scaled back or suspended related directly to the amount of rainfall forecast.

Management of Runoff from Peat and Subsoil Storage Areas:

Excavated peat was used for landscaping throughout the Site and any excess peat was stored in the onsite borrow pits and the peat storage cells. All the borrow pits were located outside the 50m watercourse buffer zones.

During the initial placement of peat and subsoil, silt fences, straw bales and biodegradable geogrids were used to control surface water runoff from the storage areas.

Drainage from peat storage areas was ultimately routed to an oversized swale and a number of settlement ponds with appropriate storage and settlement designed for a 1 in 100 year 6 hour return period before being discharged to the on-site drains.

Peat/subsoil storage areas were sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised peat/subsoil storage areas were no longer a potential source of silt laden runoff.

Management of Runoff from Felling Areas:

Details on the mitigation measures designed to reduce the risk of the entrainment of suspended solids and nutrient release in surface watercourses are set out in the CEMP. These measures are best practice methods and were derived the following guidance:

- Forestry Commission (2011): Forests and Water Guidelines;
- Forestry Commission, Edinburgh;
- Coillte (2013) Forest Operations & Water Protection Guidelines;
- DAFM (2017). Felling and Reforestation Policy;
- Coillte (2009) Methodology for Clear Felling Harvesting Operations;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service,
- DAF, Johnstown Castle Estate, Co. Wexford; and,
- Forest Service, (2000): Code of Best Forest Practice – Ireland. Forest Service,
- DAF, Johnstown Castle Estate, Co. Wexford.

The mitigation measures detailed in the CEMP are reproduced below:

- Machine combinations were chosen which were most suitable for the ground conditions at the time of felling and to minimise soils disturbance;
- Use of buffer zones for aquatic zones as per the Forest service (2000) guidance;
- Roads and culverts were checked and maintained during felling operations;
- No tracking of vehicles through watercourses occurred;
- Where possible, existing drains were not disturbed during felling works;
- Ditches which drain from the felling area towards existing surface watercourses were blocked, and temporary silt traps were constructed. No direct discharge of such ditches to watercourses occurred during felling. Drains and sediment traps were installed during ground preparation works. Collector drains were excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains from collector drains included water drops and rock armour, as required, where there were steep gradients, and were not placed at right angles to the contour;
- Sediment traps were sited outside of buffer zones and had no direct outflow into the aquatic zone. Machine access was maintained to enable the accumulated sediment to be excavated. Sediment was carefully disposed of away from all aquatic zones. Where possible, all new silt traps were constructed on even ground and not on sloping ground;
- In areas, particularly sensitive to erosion, it was necessary to install double or triple sediment traps. This measure was reviewed on site during construction works;
- All drainage channels tapered out before entering the aquatic buffer zone. This ensured that discharged water gently fanned out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps were installed at the end of the drainage channels, to the outside of the buffer zone;

- Drains and silt traps were maintained throughout all felling works, ensuring that they were clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth ensured that erosion and sediment build-up were minimised and controlled;
- Brash mats were used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding could occur. Brash mat renewal took place when they became heavily used and worn. Provision was made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there was a risk of severe erosion occurring, extraction was suspended during periods of high rainfall;
- Timber was stacked in dry areas, and outside a local 50m stream buffer zone. Straw bales and check dams were emplaced on the down gradient side of timber storage/processing sites;
- Works were carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off;
- Refuelling or maintenance of machinery was not permitted within 50m of an aquatic zone. Dedicated refuelling areas were used during the felling works; and,
- Branches, logs or debris were not allowed to build up in aquatic zones. All such material was removed when harvesting operations were completed, but care was taken to avoid removing natural debris deflectors.

Management of Drainage From Works within Hydrological Buffer Zone

As detailed above only 4 no. deviations (deviations 2, 3, 9 and 19) are located within the 50m hydrological buffer zone.

Silt fences were installed as an additional water protection measures around existing watercourses in certain locations, particularly where works occurred within the hydrological buffer zone. The silt fences were installed as single, double or triple silt fences depending on the space available and the anticipated loading. Further details in silt fences are included in the CEMP.

Timing of Site Construction Works:

Construction of the site drainage system was only carried out during periods of low rainfall, therefore, minimising runoff rates. This reduced the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during this period also ensure that attenuation features associated with the drainage system were in place and operational for all subsequent construction works.

Monitoring:

An inspection and maintenance plan for the on-site drainage system was prepared in advance of commencement of any works. Regular inspections of all installed drainage systems were undertaken, especially after heavy rainfall, to check for blockages, and ensure there was no build-up of standing water in parts of the systems where it is not intended. Inspections were also completed after tree felling. The inspections were completed by the ECoW and Project Hydrologist.

Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, was removed.

During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs was undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly and event based).

The detailed surface water quality monitoring plan for the construction phase was set out in the CEMP.

Assessment of Effects:

No significant increase in suspended solids entrainment was recorded in downstream surface watercourses. No significant increase in suspended solids entrainment was recorded in local surface watercourses during the construction of the Subject Development. The continuous turbidity monitoring recorded several peaks in turbidity concentrations. However, these were short-lived, with the turbidity quickly returning to background concentrations. Short-lived spikes in turbidity concentrations can occur naturally in peatland environments following periods of intense rainfall. The November 2020 Peatslide, resulted in an increase in downstream turbidity concentrations, however, assessments have concluded that the Subject Development did not contribute in any way to the peat slide.

Monthly water quality sampling indicates that there has been no deterioration in water quality from the pre-construction condition. EPA monitoring data indicates that, based on biological factors, that there has been no deterioration in water quality. Therefore, it can be concluded that the construction of the Subject Development has not had a significant effect on downstream water quality.

Residual Effects: The potential for the release of suspended solids to watercourse receptors during tree felling is a risk to water quality and the aquatic quality of the receptor. Proven best practice measures to mitigate the risk of releases of sediment have been implemented at the Site and broke the pathway between the potential sources and the receptor.

Any residual effects on surface water quality due to earthworks were therefore, at worst, a negative, indirect, imperceptible and temporary effect.

Significance of Effects: For the reasons outlined above, no significant effects on the surface water quality occurred as a result of the Subject Development.

7.5.2.2 Effects Associated with Runoff from Peat and Subsoil Storage Areas

Surface waters are very sensitive to potential contamination from sediment entrainment. Peat and subsoil storage areas can be a significant source of sediment laden runoff. In the absence of mitigation measures this can result in the release of suspended sediment to downstream surface watercourses.

A total of 7 no. deviations, as follows, relate to peat and subsoil storage areas:

- Deviation 2 is a peat storage cell located in the catchment of May Breen's Burn; and,
- A total of 6 no. deviations relating to peat storage (deviations 4, 11, 15, 17, 18 and 25) are located in the catchment of the Bunadaowen River.

Pathway: Overland flow and site drainage network.

Receptors: All watercourses in the vicinity and downgradient of the peat and spoil storage areas, including Mary Breen's Burn, the Bunadaowen River and the Mourne Beg River and the associated water-dependant ecosystems.

Mitigation Measures:

Mitigation measures to prevent sediment entrainment in runoff from peat and subsoil storage areas included the following.

- During the initial placement of peat and subsoil, silt fences, straw bales and biodegradable geogrids were used to control surface water runoff from the storage area;
- Drainage from the peat storage areas were routed to oversized swales before being discharge to the on-site drainage network; and,
- Peat/subsoil storage areas were sealed with a digger bucket and vegetated as soon as possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised, the peat and spoil storage areas were no longer a potential source of sediment laden water.

Additional deviation-specific mitigation measures were implemented at the peat storage areas and borrow pits are described as follows:

- While surface water was contained in these excavations, the design proposal was to control the level of water by creating a single point outlet from the basin-like area that ensured the water does not overtop. Run-off from the peat cell areas was controlled via a single outlet that was installed at the edge of the peat cell. The single outfall point was constructed to handle runoff from the peat cell and its immediate surrounds. Interceptor drains were already installed upgradient of the peat cell area before any extraction began; and,
- During the construction phase of the project, it was necessary to keep the borrow pits free of standing water while rock was still being extracted. This was achieved by using a mobile pump, which pumped water into the same series of drains, settlement ponds and level spreader, which receives the water from the single outlet.

Assessment of Effects: No significant increase in suspended solids entrainment was recorded in downstream surface watercourses. No significant increase in suspended solids entrainment was recorded in local surface watercourses during the construction of the Subject Development. Monthly water quality sampling indicates that there has been no deterioration in water quality from the pre-construction condition. EPA monitoring data indicates that, based on biological factors, that there has been no deterioration in water quality. Therefore, it can be concluded that the construction has not had a significant effect on downstream water quality.

Residual Effect: The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. However, there was no direct discharge to surface watercourses during the construction phase. Proven and effective measures to mitigate the risk of releases of sediment have been implemented and broke the pathway between the potential sources and the receptor.

The residual effect at worst, a brief, imperceptible, negative effect.

Significance of the Effects: For the reasons outlined above, no significant effects on the downstream surface watercourses occurred as a result of the Subject Development.

7.5.2.3 Excavation Dewatering and Potential Effects on Surface Water Quality

Some minor groundwater/surface water seepages may have occurred in excavations and the borrow pits. This would have created additional volumes of water to be treated by the runoff management system. Inflows required management and treatment to reduce suspended sediments.

Whilst minor groundwater seepages may have occurred at all excavation locations, the deepest excavations would have had the greatest potential for inflows. Some minor surface water seepages could have occurred during the excavation of the borrow pits and the peat cells which would have created additional volumes of water to be treated by the runoff management system.

Pathway: Overland flow and site drainage network.

Receptors: Surface watercourses in the vicinity and downstream of the Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadaowen River, Shruhangarve stream), the Glendergan and the Lowerymore River and the associated water-dependant ecosystems.

Mitigation Measures:

Management of groundwater seepages and subsequent treatment prior to discharge into the drainage network was completed as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations were put in place;
- If required, pumping of excavation inflows prevented build-up of water in the excavation;
- The interceptor drainage discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;

- The pumped water volumes were discharged via volume and sediment attenuation ponds adjacent to excavation areas, along with use of more specialist treatment systems such as a Siltbags;
- There was no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination occurred; and,
- Daily monitoring of excavations by a suitably qualified person occurred during the construction phase. If high levels of seepage inflow occurred, excavation work was immediately stopped and a geotechnical assessment undertaken.

Assessment of Effects: No significant increase in suspended solids entrainment was recorded in downstream surface watercourses. No significant increase in suspended solids entrainment was recorded in local surface watercourses during the construction of the Subject Development. Daily monitoring of the receiving waterbodies by the project ECOW found no evidence of gross siltation. Monthly water quality sampling indicates that there has been no deterioration in water quality from the pre-construction condition. EPA monitoring data indicates that, based on biological factors, that there has been no deterioration in water quality. Therefore, it can be concluded that the construction has not had a significant effect on downstream water quality.

Residual Effect: The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. However, there was no direct discharge to surface watercourses during the construction phase. Proven and effective measures to mitigate the risk of releases of sediment have been implemented and broke the pathway between the potential sources and the receptor.

The residual effect at worst, brief, imperceptible, negative effects.

Significance of the Effects: For the reasons outlined above, no significant effects on downstream surface watercourses occurred as a result of the Subject Development.

7.5.2.4 Effects on Groundwater Levels During Excavation Works

No groundwater level effects have occurred at most deviation locations due to the shallow nature of the works.

However, some deviations have been identified which may have had the potential to effect local groundwater levels. There deviations related to the deeper ground excavations at the borrow pits.

Nonetheless, significant groundwater level effects would not have occurred due the local hydrogeological regime and the location of the deeper excavations. Furthermore the excavation method limited the potential for effects (horizontal extraction rather than vertical deepening).

Pathway: Groundwater flowpaths.

Receptor: Groundwater levels within the underlying Castlederg GWB.

Assessment of Effects:

The deviations are located in bedrock that has been classified as a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones (Pl).

Dewatering at the deeper excavations was achieved through the intermittent use of pumping, indicating a very low level of groundwater incursion. The hydrogeological setting of the Subject Development meant that no significant groundwater dewatering occurred during the construction phase.

The elements of the Subject Development which had the greatest potential to effect groundwater levels were the excavation at the borrow pits. Moreover, direct rainfall and surface water runoff were the main inflows that required water volume and water quality management. For the avoidance of doubt we would generally define dewatering as a requirement to permanently drawdown the local groundwater table by means of over pumping, e.g. as would be required for the operation of a bedrock quarry in a valley floor. We consider that this example is very different in scale and operation from that of a temporary shallow borrow pit on the side of a hill. In order to explain this thoroughly we will outline our reasoning in a series of bullet points as follows:

- Firstly, the borrow pit areas are located on the side of local hills where the ground elevations are between 200 and 300m OD;
- These elevations are significantly above the elevations of the local valleys and streams;
- The borrow pits extend to approximately 8 – 15m below ground level. However, in the context of the topographical/elevated setting of the borrow pits, this depth range is relatively shallow;
- The local bedrock comprises quartzites, gneisses and schists is known to be generally unproductive. This means that groundwater flows are minor;
- Observations from the borrow pit exposures show that the bedrock is massive with very little, if any fractures. Any jointing / fractures that were seen were noted to be very tight;
- No significant groundwater inflows were recorded at any of the borrow pits. Limited groundwater flow was restricted to the top of the rock or within a very thin zone of weathered rock;
- The flow paths (i.e. the distance from the point of recharge to the point of discharge) in this type of geology will be short, localised, and will also be relatively shallow;
- No regional groundwater flow regime, i.e. large volumes of groundwater flow, will be encountered at these elevations;
- Therefore shallow groundwater inflows are largely fed by recent rainfall, and possibly by limited groundwater seepage from localised shallow bedrock;
- The sloping nature of the ground on the hills where the borrow pits are located along with the coverage of peat means groundwater recharge is going to be very low;
- As such the shallow groundwater flow system is small in comparison to the expected surface water flows from the bog surface;
- This means that there is a preference for high surface water runoff as opposed to groundwater recharge and flow; and,
- Hence, we consider that the management of surface water formed the largest proportion of water to be managed and treated.

Relevant environmental management guidelines from the EPA quarry 2006 guidance document – "Environmental Management in the Extractive Industry" in relation to groundwater issues were implemented during the construction phase. The mitigation measures and construction methodologies for the borrow pits were detailed in full in the CEMP.

Residual Effects: Due to large topographic elevation and hydrogeology of the Site, the residual effects on groundwater levels were, at worst, localised, short term, imperceptible, and of negative effect. Effects would have been limited to the immediate vicinity (less than 30 – 300m) of the excavations.

Significance of Effects: For the reasons outlined above, no significant effects on local groundwater levels occurred as a result of the Subject Development.

7.5.2.5 Release of Hydrocarbons During Construction and Storage

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water 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 death of aquatic organisms.

Pathway: Groundwater flowpaths and surface water via the site drainage network.

Receptors: Surface watercourses in the vicinity and downstream of the Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadaowen River, Shruhangarve stream), the Glendergan and the Lowerymore River and the associated water-dependant ecosystems.

Mitigation Measures:

The EIAR for the Permitted Development prescribed detailed mitigation measures relating to hydrocarbon storage and use, for the protection of surface water quality.

Whilst the location, alignment and size of components of the Subject Development differ from the Permitted Development plans, these infrastructure elements were constructed as per the methodology and guidelines prescribed in the EIAR for the Permitted Development and implemented as per the CEMP.

The mitigation measures implemented to avoid release of hydrocarbons at the Site were as follows:

- All plant was inspected and certified to ensured that they were leak free and in good working order prior to use.
- Wherever possible, vehicles were refuelled off-site, particularly for regular road-going vehicles.
- On-site refuelling of machinery was carried out at designated refuelling areas at various locations throughout the Site.
  - Heavy plant and machinery were refuelled on-site by a fuel truck that came to the Site as required on a scheduled and organised basis.
  - Other refuelling was carried out using mobile double skinned fuel bowser. All refuelling was carried out outside designated watercourse buffer zones.
  - Mobile measures such as drip trays and fuel absorbent mats were used during refuelling operations as required.
  - All plant and machinery were equipped with fuel absorbent material and pads to deal with any event of accidental spillage.
- Onsite refuelling was carried out by trained personnel only;
- A permit to fuel system was put in place;
- Fuels stored on site were minimised.
- The plant used during construction was regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages was included within the Construction and Environmental Management Plan (Appendix 4-3). Spill kits were available to deal with and accidental spillage in and outside the re-fuelling area. However no spills were recorded during the construction of the Subject Development.

Assessment of Effects: No spills were recorded during construction of the Subject Development. Therefore, it was not necessary to employ any of the emergency response measures in relation to hydrocarbons.

Residual Effect: The potential for the release of hydrocarbons to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. However, no spills were recorded on site. Proven and effective measures to mitigate the risk of releases of hydrocarbons were implemented and broke the pathway between the source and each receptor.

The residual effect is a negative, imperceptible, indirect, short—term effect on water quality.

Significance of Effects: For the reasons outlined above, no significant effects on surface water or groundwater quality occurred as a result of the Subject Development.

7.5.2.6 Groundwater and Surface Water Contamination from Wastewater Disposal

Release of effluent from on-site temporary wastewater treatment systems has the potential to impact on groundwater and surface water quality if conditions are not suitable for an on-site percolation unit. Impacts on surface water quality could affect fish stocks and aquatic habitats.

Pathway: Groundwater flowpaths and site drainage network.

Receptors: Surface watercourses in the vicinity and downstream of the Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadaowen River, Shruhangarve stream), the Glendergan and the

Lowerymore River and the associated water-dependant ecosystems. Groundwater quality in the underlying GWBs.

Mitigation Measures: The EIAR for the Permitted Development prescribed detailed mitigation measures relating to wastewater disposal for the protection of surface and groundwater quality.

Whilst the location, alignment and size of components of the Subject Development differ from the Permitted Development plans, these infrastructure elements were constructed as per the methodology and guidelines prescribed in the EIAR for the Permitted Development and implemented as per the CEMP.

The mitigation measures implemented to avoid release of wastewater at the Site were as follows:

- A self-contained port-a-loo with an integrated waste holding tank was used for welfare facilities, maintained by the providing contractor; and,
- No water was sourced on the site or discharged on the site.

Assessment of Effects: No pollution incidents in relation to wastewater were recorded.

Residual Effects: The potential for contamination resulting from wastewater disposal is a risk to surface and groundwater quality. This is a risk common to all construction sites containing welfare facilities. Proven and effective measures to mitigate the release of wastewater on site were implemented and broke the pathway between the source and each receptor.

The residual effect is a negative, imperceptible, indirect, short—term effect on water quality.

Significance of Effects: For the reasons outlined above, no significant effects on surface water or groundwater quality occurred as a result of the Subject Development.

7.5.2.7 Effects on the Lough Mourne Surface Water Abstractions

Donegal Uisce Éireann abstracts surface water from the Bunadaowen River and pumps it to Lough Mourne Reservoir.

A total of 17 no. deviations (refer to **Table 7.6**) are located in the catchment of the Bunadaowen River. Any deterioration in surface water quality associated with these deviations could have had a negative effect on the Lough Mourne drinking water supply.

Pathway: Surface water flowpaths.

Receptor: Down-gradient water quality and designated sites.

Mitigation Measures:

Mitigation measures relating to the protection of surface water quality and quantity were implemented during the construction of the Subject Development.

- The mitigation measures implemented in relation to the entrainment of suspended solids are detailed in Sections 7.5.2.1 and 7.5.2.2 and 7.5.2.3;
- The implemented mitigation measures with respect to hydrocarbons are detailed in Section 7.5.2.5; and,
- The implemented mitigation measures with respect to wastewater contamination are detailed in Section 7.5.2.6.

Assessment of Effects: No significant increase in suspended solids entrainment was recorded in the Bunadaowen River. No pollution events occurred during the construction phase. Daily monitoring of the Bunadaowen River by the project ECOW found no evidence of gross siltation. Monthly water quality sampling indicates that there has been no deterioration in water quality from the pre-construction condition. EPA monitoring data indicates that, based on biological factors, that there has been no deterioration in water quality.

Residual Effect: Construction activities posed a threat to downstream surface water abstractions hydrologically linked with the Subject Development. Proven and effective measures to mitigate the risk of surface water contamination have been implemented and broke the pathway between the source and the downstream receptor. These mitigation measures ensured that surface water runoff from the Site was equivalent to baseline conditions. Therefore there was no significant impact on downstream surface water quality and/or surface water abstractions.

The residual effect is a negative, imperceptible, indirect, short—term effect on water quality.

Significance of Effects: No significant effects on downstream surface water abstractions occurred as a result of the Subject Development.

7.5.2.8 Effects on Hydrologically Connected Designated Sites

The Subject Development drains to the Mourne Beg River and the Derg River (within Northern Ireland) which also forms part of the River Foyle and Tributaries ASSI and SAC designated site. A small area in the northwest of the Site, including Deviation 1, is drained by the Lowerymore River which drains to Lough Eske which is a designated SAC. Furthermore, an area in the northwest of the Site, and directly downstream of Deviation 2 via the Mary Breen's Burn, forms part of the Croaghonagh Bog SAC/pNHA.

Effects on water quality and the water-dependent aspects of these designated could have been significant in the absence of mitigation.

There was no potential to impact any other designated site.

Pathway: Surface water flowpaths.

Receptor: Down-gradient water quality and designated sites.

Mitigation Measures:

Mitigation measures relating to the protection of surface water quality and quantity were implemented during the construction of the Subject Development.

- The mitigation measures implemented in relation to the entrainment of suspended solids are detailed in Sections 7.5.2.1, 7.5.2.2 and 7.5.2.3;
- The implemented mitigation measures with respect to hydrocarbons are detailed in Section 7.5.2.5; and,
- The implemented mitigation measures with respect to wastewater contamination are detailed in Section 7.5.2.6.

Assessment of Effects: No significant increase in suspended solids entrainment was recorded in downstream surface watercourses. No significant increase in suspended solids entrainment was recorded in local surface watercourses during the construction of the Subject Development. Monthly water quality sampling indicates that there has been no deterioration in water quality from the pre-construction condition. EPA monitoring data indicates that, based on biological factors, that there has been no deterioration in water quality. The continuous turbidity monitoring recorded several peaks in turbidity concentrations. However, these were short-lived, with the turbidity quickly returning to background concentrations. The November 2020 peat slide, resulted in an increase in downstream turbidity concentrations, however, assessments have concluded that the Subject Development did not contribute in any way to this peat slide.

Residual Effect:

The residual effect is considered to be, at worst, a negative, indirect, imperceptible and temporary effect. Any effects would have been localised and over a very short time period.

Significance of Effects: No significant effects on designated sites occurred as a result of the Subject Development.

7.5.2.9 Potential Effects on Surface Water and Groundwater 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.

The WFD status for GWBs and SWBs underlying and downstream of the Subject Development are defined in Section 7.3.12 and Section 7.3.13 respectively.

A detailed WFD Compliance Assessment Report has been completed in combination with this rEIAR Chapter and is included in **Appendix 7-4**.

Pathway: Surface water flowpaths.

Receptor: WFD status of downstream surface water bodies and underlying GWBs.

Mitigation Measures:

Mitigation measures relating to the protection of surface water quality and quantity were implemented during the construction of the Subject Development.

- The mitigation measures implemented in relation to the entrainment of suspended solids are detailed in Sections 7.5.2.1, 7.5.2.2 and 7.5.2.3;
- The implemented mitigation measures with respect to hydrocarbons are detailed in Section 7.5.2.5; and,
- The implemented mitigation measures with respect to wastewater contamination are detailed in Section 7.5.2.6.

Similarly, mitigation measures for the protection of groundwater quantity and quality have been detailed above:

- The mitigation measures implemented with respect to groundwater levels are detailed in Section 7.5.2.4.
- The implemented mitigation measures with respect to hydrocarbons are detailed in Section 7.5.2.5; and,
- The implemented mitigation measures with respect to wastewater contamination are detailed in Section 7.5.2.6.

Assessment of Effects: No deterioration in downstream surface water quality occurred as a result of the Subject Development. Similarly, no spills or pollution incidents occurred which could have impacted local groundwater quality. No significant effects occurred with respect to groundwater levels due to the local hydrogeological regime.

Residual Effects: The implementation of the mitigation measures for the protection of surface and groundwater during the construction phase of the Subject Development ensured the qualitative and quantitative status of the receiving waters was not altered by the Subject Development.

Therefore, there was no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the Subject Development. There was no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs were protected from any potential deterioration.

No residual effect on Groundwater Body WFD status has occurred.

No residual effect on Surface Water Body WD status has occurred.

Significance of Effects: For the reasons outlined above, no significant effects on WFD Groundwater Bodies and Surface Water Bodies status, risk or future objectives occurred as a result of the Subject Development.

7.5.3 Continued Construction Phase – Likely Significant Effects and Mitigation Measures

In the event that the Substitute Consent is obtained, the Subject Development would be left in situ and would become part of the consented wind farm development infrastructure. There would be no additional environmental effects associated with the Subject Development.

7.5.4 Operational Phase – Likely Significant Effects and Mitigation Measures

7.5.4.1 Progressive Replacement of Natural Surface with Lower Permeability Surfaces

Progressive replacement of the peat or vegetated surface with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the Site and increase flood risk downstream of the development. In reality, the access roads have a higher permeability than the underlying peat. However, it is conservatively assumed in this assessment that the access roads and hardstands are impermeable. The assessed footprint of the Subject Development relates to wind farm roads and hardstand areas, peat storage and containment measures, borrow pits, environmental and water quality mitigation measures, and ancillary works.. During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on aquatic ecosystems.

Pathway: Site drainage network.

Receptor: Surface watercourses in the vicinity and downstream of the Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadaowen River, Shruhangarve stream), the Glendergan and the Lowerymore River and the associated water-dependant ecosystems.

Pre-Mitigation Potential Effect: Negative, moderate, direct, permanent, likely effect on all downstream surface water bodies.

Mitigation Measures and Assessment of Effects:

<u>Mitigation by Design</u>:

The operational phase drainage system of the Subject Development has been installed and constructed in conjunction with and in accordance with the Permitted Development drainage system as follows:

- Interceptor drains have been installed up-gradient of the Subject Development infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. This water will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,

- Settlement ponds will be designed in consideration of the greenfield runoff rate.

Assessment of Effects:

The emplacement of the Subject Development footprint (8.8ha), as described in Chapter 3 of the EIAR, (assuming emplacement of impermeable materials across the footprint of the Subject Development as a worst-case scenario) could result in an average total site increase in surface water runoff of approximately 141m^3/month. This represents a potential increase of approximately 0.25% in the average daily/monthly volume of runoff from the Site in comparison to the baseline pre-development runoff conditions (**Table 7.16**). This is a very small increase in average runoff and results from the naturally high surface water runoff rates and the relatively small area of the Subject Development, the footprint representing 1% of the Site area of 903ha.

Table 7.16: Baseline Site Runoff V Development Runoff

Site Baseline Runoff/wettest month (m^3)	Baseline Runoff/day (m^3)	Subject Development Footprint (m^2)	Hardstanding Area 100% Runoff/month (m^3)	Hardstanding Area 93% Runoff/month (m^3)	Net Increase/month (m^3)	Net Increase/day (m3)	% Increase from Baseline Conditions at Subject Development Locations (m^3)	% Increase from Baseline Conditions across Wind Farm Site (m^3)
1,855,936	59,869	8,800	1,945	1,804	141	4.5	0.25	0.0003

The additional volume is low due to the fact that the runoff potential from the Site is naturally high (96%). Also, the calculation assumes that all hardstanding areas will be impermeable which will not be the case as access tracks will be constructed of permeable stone aggregate. The increase in runoff from the Subject Development will, therefore, be negligible. This is even before mitigation measures will be put in place.

Residual Effect: Direct, negative, neutral, long term, likely effect. Proven and effective measures to attenuate runoff and mitigate the risk of flooding will be employed. The residual effect will be - Neutral, indirect, long term, likely effect on down gradient streams/rivers.

Significance of Effects: No significant effects on downstream flood risk will occur during the operational phase of the Subject Development.

7.5.4.2 Runoff Resulting in Contamination of Surface Waters

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads and hardstand areas. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.

These minor activities could, however, result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies. Potential effects could be significant if not mitigated against.

During such maintenance works there is a small risk associated with release of hydrocarbons from site vehicles, although it is not envisaged that any significant refuelling works will be undertaken on site during the operational phase.

Maintenance works will be contained within the Site.

Pathways: Drainage and surface water discharge routes.

Receptors: Surface watercourses in the vicinity and downstream of the Site including the Mourne Beg River and its tributaries (Mary Breen's Burn, Bunadaowen River, Shruhangarve stream), the Glendergan and the Lowerymore River and the associated water-dependant ecosystems.

Pre-Mitigation Potential Effect: Negative, slight, indirect, temporary, likely effect.

Proposed Mitigation Measures:

Mitigation measures for sediment control are the same as those outlined above for the construction phase (refer to Sections 7.5.2.1).

Mitigation measures for control of hydrocarbons during maintenance works are similar to those outlined in Section 7.5.2.5.

Post-Mitigation Residual Effects: With the implementation of the drainage measures as outlined above, and based on the post-mitigation assessment of runoff, we consider that residual effect are - Negative, imperceptible, indirect, temporary, unlikely effect on downstream water quality.

Significance of Effects: For the reasons outlined above, no significant effects on the surface water quality will occur.

7.5.4.3 Assessment of WFD Effects

There is no direct discharge from the Subject Development to downstream receiving waters. Mitigation for the protection of surface water during the operational phase of the Subject Development will ensure the qualitative status of the receiving SWBs will not be altered by the Subject Development.

Similarly there is no direct discharge to groundwaters associated with the Subject Development. Mitigation for the protection of groundwater during the operational phase of the Subject Development will ensure that the qualitative status of the receiving GWB will not be altered by the Subject Development.

A full assessment of the potential effects of the operational phase of the Subject Development on the status of the receiving waterbodies is included in WFD Compliance Assessment Report attached as **Appendix 7-4**.

7.5.5 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

The potential effects associated with decommissioning of the consented Meenbog Wind Farm development will be the same regardless of whether the Subject Development is granted Substitute Consent.

Given the nature of the Subject Development it will have no bearing on the decommissioning phase of the Meenbog Windfarm. The Subject Development will not alter the decommissioning plan for the Meenbog Windfarm and it is likely that the components of the Subject Development would remain in situ in the event of decommissioning of the Meenbog Windfarm.

An outline decommissioning plan is contained in the CEMP in Appendix 3.2. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agree with the competent authority at that time.

As noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the Proposed Wind Farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".

No significant effects on the hydrological and hydrogeological environment will occur during the decommissioning phase.

7.5.6 Risk of Major Accidents and Disasters

The main risk of Major Accidents and Disasters at peatland sites is related to peat stability.

Comprehensive peat stability assessments were completed by FT and Ionic following the November 2020 Peatslide. The Ionic assessment (Ionic, 2021), which was based on a quantum of site-specific data, concluded that the "the overall site is currently stable based upon this detailed assessment carried out along all roads, hardstandings, borrow pits, peat storage areas and peat stabilisation areas. Furthermore, AFRY completed a site inspection in October 2023 and concluded that all infrastructure, including the Subject Development, are stable (AFRY, 2023). Furthermore, the FT report (FT, 2021) prescribes a monitoring plan in relation to potential future ground movements. Given the results of the peat stability assessments and the prescribed mitigation measures, the risk of a future peatslide occurring is low.

Flooding can also result in downstream Major Accidents and Disasters. However, due to the small scale of the Subject Development footprint and with the implementation of the mitigation measures, the increased flood risk associated with the Subject Development is low.

7.5.7 Assessment of Potential Health Effects

Potential health effects arise mainly through the potential for surface and groundwater contamination which may have negative effects on public and private water supplies. There are no mapped public or group water scheme groundwater protection zones in the area of the Site. Furthermore, no private wells are located in close proximity to the Subject Development. Notwithstanding this, the Subject Development design and mitigation measures ensure that the potential for effects on the hydrogeological have not been and will not be significant.

The Lough Mourne surface water abstraction is located within the Site and the assessment of effects is presented in Section 7.5.2.7 above. Notwithstanding this, the site design and mitigation measures have ensured that no significant effects have or will occur on the water environment.

Flooding of property can cause inundation with contaminated flood water. Flood waters can carry waterborne disease and contamination/effluent. Exposure to such flood waters can cause temporary health issues. A detailed Flood Risk Assessment has also shown that the risk of the Subject Development contributing to downstream flooding is very low, as the long-term plan for the Site is to retain and slow down drainage water within the existing site. On-site drainage control measures will ensure no downstream increase in flood risk.

7.5.8 Cumulative Effects

This section presents an assessment of the cumulative effects associated with the construction phase of the Subject Development and other developments (existing and/or proposed) on the hydrological and hydrogeological environment.

The main likelihood of cumulative effects is considered to relate to the hydrological environment (surface water) rather than the hydrogeological (groundwater) environment. Due to the hydrogeological setting of the Site (i.e. low permeability peat overlying a Poor Bedrock Aquifer) and the near surface nature of construction activities associated with the Subject Development, cumulative effects with regard groundwater quality or quantity arising from the Subject Development are assessed as unlikely.

The cumulative hydrological study area includes:

- The catchment of the Mourne Beg River downstream as far as its confluence with the River Derg;
- The catchment of the Glendergan River downstream as far as its confluence with the River Derg; and,
- The Lowerymore River downstream as far as Lough Eske.

There will be no potential for cumulative effects beyond this cumulative hydrological study area due to increases in flow volumes in the River Derg, the large volumes of water within Lough Eske and the increasing distance from the Site.

The main likelihood of cumulative effects occurred during the construction of the Subject Development as this is when earthworks were completed and there was the greatest potential for qualitative effects on the hydrological environment. The potential for cumulative effects during the operational phase of the Subject Development will be significantly reduced in comparison to the construction phase. During this phase there will be no exposed excavations, there will be no sources of sediment to reach watercourses, there will be no use of cementitious materials and fuels/oil will be kept to a minimum at the Site. These effects are equivalent to what was assessed in the EIAR for the Permitted Development. During the decommissioning phase, the potential cumulative effects are similar to the construction phase, but to a lesser degree with less ground disturbance. These effects are equivalent to what was assessed in the EIAR for the Permitted Development.

Cumulative Effects with Forestry

The Site is located in an area of coniferous forestry. The most common water quality problem 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 changes in land drainage.

Due to the close proximity of the Subject Development to forested areas and given that they drain to the same watercourses as the Subject Development, there was potential for cumulative effects on downstream surface water quality to occur.

However, the continuous turbidity monitoring did not record any significant increase in suspended solids entrainment in downstream watercourses during the construction of the Subject Development. Additionally, the monthly water quality sampling indicates that there has been no deterioration in the water quality of downstream watercourses from the pre-construction phase. Biological monitoring also indicates that there has been no deterioration in downstream water quality.

Therefore, based on the large dataset of water quality data, it can be concluded that there was no significant cumulative effect associated with the commercial forestry activities.

Permitted Development

The construction of the Subject Development began in November 2019 concurrently and in conjunction with the Permitted Development. In the absence of mitigation measures, there would have been the potential for cumulative effects on the hydrological environment due to the earthworks being completed at the Site.

The EIAR for the Permitted Development details potential hydrological and hydrogeological issues relating to the construction, operation and decommissioning phases of the windfarm and prescribes a suite of best practice mitigation measures designed to ensure that the Permitted Development does not in any way have a negative effect on downstream surface water quality and quantity. These mitigation measures were detailed in the CEMP. All works completed for both the Permitted Development and the Subject Development were completed in accordance with the mitigation measures prescribed in the CEMP. This ensures also that the Subject Development would not have any significant effects on the hydrological environment.

Therefore, with the implementation of the prescribed mitigation measures (both in the EIAR and the CEMP), there would be no potential for cumulative effects during the construction, operational or decommissioning phases.

The large hydrological dataset indicates that no significant cumulative effects have occurred to date. Given that the Subject Development is already constructed, there would be limited potential for effects during the operational and decommissioning phases.

November 2020 Peatslide

On the 12th November 2020 at peatslide occurred during the construction of a permitted access road to T7. The works that were being completed at the time in the area where the peatslide occurred were fully permitted and in line with the project design that had been subject to both an EIA and AA. Subsequent investigations and assessments found that the Subject Development was not a contributory factor to the peatslide and that the site is currently stable.

The potential cumulative effects associated with the November 2020 Peatslide and the associated emergency works and environmental remediation measures could have had the potential to effect downstream surface water quality.

However, all works associated with the Subject Development were completed in accordance with the mitigation measures prescribed in the CEMP. The large hydrological dataset indicates that there has been no deterioration in downstream surface water quality. There was an initial deterioration in water quality in the Shruhangarve and Mourne Beg rivers as a result of the Peatslide and the available data indicates that these watercourse have since recovered.

Therefore, based on the above, it can be concluded that there was no significant cumulative effect associated with the November 2020 Peatslide.

Other Developments

Due to the remedial nature of this rEIAR and cumulative assessment, a search of local planning applications dated from 2016-2021 was completed within the hydrological study area. The period from 2016-2021 was chosen to include any potential developments which may have occurred during the construction phase of the Subject Development.

The planning applications identified within the hydrological study area relate to one-off housing developments and associated domestic water treatment systems. These developments are small scale and localised in nature. No significant effects on water quality or flows (surface water or groundwater) would result from such developments. Therefore, there were no hydrological cumulative effects with respect to the Subject Development.

7.5.9 Post Consent Monitoring

No monitoring is required specifically in relation to the Subject Development. Water quality monitoring will be completed throughout the construction phase of the Meenbog Windfarm development.

7.6 Bibliography

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