

10. Geology and Water Environment

Introduction

Terms of Reference

- 10.1. This chapter considers the likely significant effects on the receiving hydrological, geological, and hydrogeological environments associated with the construction, operation and decommissioning of the proposed Carnbuck wind farm (adjacent to the operational Gruig Wind Farm), near Cloughmills, Co. Antrim, hereinafter referred to as the 'Proposed Development'.
- 10.2. The impacts caused by the construction, operation and decommissioning phases of the Proposed Development are assessed, and mitigation measures are provided where required.
- 10.3. The assessment also identifies where hydrological features may constrain the layout of the Proposed Development.

Supplementary Assessments

- 10.4. This Chapter is supported by:
 - Technical Appendix 10.1: Surface Water Management Plan
 - Technical Appendix 10.2: Flood Risk & Drainage Assessment
 - Technical Appendix 10.3: Geotechnical Assessment including Peat Slide Risk Assessment
 - Technical Appendix 10.4: Outline Peat Management Plan
 - Technical Appendix 10.5: Consultation Records
 - Figures 10.1 to 10.4
- 10.5. Reference should be made to Chapter 1: Introduction & Proposed Development for information regarding detailed construction proposals.
- 10.6. Changes to the hydrological / hydrogeological regime may create resultant effects on ecology within hydrological dependent ecosystems. Therefore, this chapter is further supported by:
 - Chapter 6: Vegetation and Peatland;
 - Chapter 7: Terrestrial Fauna; and
 - Chapter 9: Fisheries & Aquatic Ecology Assessment

Statement of Authority

- 10.7. The assessment has been carried out by McCloy Consulting Ltd.; an independent environmental consultancy specialising in the water environment, with specialist knowledge of hydrological and hydrogeological assessments.

10.8. The key staff members involved in this project are as follows:

- Iain Muir MSc CEnv MIEI - Senior Project Consultant and Chartered Environmentalist experienced in Environmental Impact Assessment (EIA) specialising in the water environment, undertaking hydrology, water quality and flood risk assessments for major infrastructure projects in highland environments, and renewable energy projects in the UK and Ireland; and
- Kyle Somerville BEng (Hons) CEng MIEI - Director and Chartered Engineer with over 10 years' experience specialising in the fields of hydrology, surface water management, groundwater screening assessments and geology assessments for wind farm developments in the UK and Ireland, and has overseen outline and detailed design of surface water management for in excess of thirty onshore wind farm developments in the UK and Ireland.

Scope of Assessment

10.9. This report will assess the effects of the Proposed Development on hydrology and surface water quality, hydrogeology and groundwater quality, and geological features. The assessment covers the construction, operational, maintenance and decommissioning phases of the Proposed Development.

10.10. This assessment identifies the hydrological constraints within lands under applicant control, herein referred to as the 'Preliminary Site Boundary', and assesses the potential effects of the following;

- Existing natural and artificial drainage patterns;
- Water quality of surface water and groundwater;
- Surface and groundwater dependent ecosystems;
- Usage of surface water and groundwater including abstractions;
- Groundwater - surface water interactions;
- Aquifer systems and their vulnerability;
- Superficial and bedrock geology at the site;
- Structural geology of the area and its environs;

10.11. In order to quantifiably assess the preceding, this report:

- Outlines relevant policy relating to the water environment;
- Summarises consultations provided in response to scoping requests;
- Provides baseline information and identifies sensitive receptors;
- Identifies potential likely effects, including potential likely cumulative effects;
- Assesses the significance of any adverse effects and resulting impacts based on the magnitude of the impact and the sensitivity of the receptors;
- Discusses management of design evolution and details mitigation measures;
- Provides a residual impact assessment; and

- Discusses the cumulative effects of the development in conjunction with other proposed and existing developments in the vicinity.

Legislation and Planning Policy

10.12. Relevant Environmental planning legislation and policy and industry best-practice guidance relevant to an assessment of hydrogeology and the water environment are summarised in Table 10.1 and the following sections.

Relevant Legislation and National Planning Policy

Table 10.1: Relevant Legislation and National Planning Policy

Legislation	
NI	Control of Pollution (Oil Storage) (Amendment) Regulations (Northern Ireland) 2011
	Drainage (Environmental Impact Assessment) Regulations (Northern Ireland) 2017
	Water Resources (Environmental Impact Assessment) Regulations (Northern Ireland) 2017
	The Environmental Liability (Prevention and Remediation) (Amendment) Regulations (NI) 2009
	The Groundwater (Amendment) Regulations (Northern Ireland) 2016
	Nature Conservation and Amenity Lands (NI) Order 1985
	The Private Water Supplies Regulations (Northern Ireland) 2017
	The Surface Waters (Dangerous Substances) (Classifications) Regulations (NI) 1998
	Drainage (Northern Ireland) Order 1973 / Drainage (Amendment) (Northern Ireland) Order 2005
	The Environment (Northern Ireland) Order 2002
	Fisheries (Northern Ireland) Act 1966
	Water (Northern Ireland) Order 1999
	The Water Supply (Water Quality) Regulations (Northern Ireland) 2017
	Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017
	Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (NI) 2015
	The Water (Amendment) (Northern Ireland) (EU Exit) Regulations 2019
Groundwater (Amendment) Regulations (Northern Ireland) 2016	
The Surface Waters (Dangerous Substances) (Classifications) Regulations (NI) 1998	
UK	UK Environmental Standards and Conditions Phase 1 and Phase 2 (UK TAG 2008)

Regional and Local Planning Policy

- 10.13. The Proposed Development has been reviewed in relation to local planning policy specific to geology and the water environment. A detailed planning policy and legislation review is included within **Chapter 2: Planning Policy**.

Regional Development Strategy 2035

- 10.14. The RDS promotes a sustainable approach to the provision of water and sewerage services and flood risk management including grey water recycling, rainwater harvesting and sustainable surface water management e.g., Sustainable Drainage Systems (SuDS).

Planning Policy Statements

Strategic Planning Policy Statement (SPPS)

- 10.15. In working towards sustainable development, the Department will aim to conserve both the archaeological and built heritage and natural resources (including wildlife, landscape, water, soil and air quality), taking particular care to safeguard designations of national and international importance.

PPS15 – Revised Planning and Flood Risk

- 10.16. Revised PPS15 sets out planning policies to "minimise flood risk to people, property and the environment", emphasising sustainable development and the conservation of biodiversity. The policy refers to the use of Sustainable Drainage Systems (SuDS) to minimise effects on the receiving water environment.
- 10.17. The policy that development proposals facilitating sustainable drainage would be considered favourably by the planning authority as such a sustainable drainage approach should be adopted by the Development.
- 10.18. Flood risk and drainage planning policy is similarly established by the Strategic Planning Policy Statement (SPPS). Transitional arrangements stated in the SPPS at paragraph 1.10 to 1.12 confirm that until a Plan Strategy is adopted, existing policies will apply together with the SPPS. Where the SPPS is silent or less prescriptive on a matter then this should not be judged to lessen the weight afforded to the retained policy.
- 10.19. In relation to flood risk planning policy, RPPS15 is more prescriptive on all aspects of matters for consideration, and the policy direction contained in RPPS15 is consistent with that stated in the SPPS.

PPS18 – Renewable Energy

- 10.20. The PPS18 sets out the planning policy for development that generates energy from renewable resources and aims to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environments.

- 10.21. Policy RE 1 of PPS18 states that, 'Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on...local natural resources, such as air quality or water quality.'

Local Plans

- 10.22. The Proposed Development straddles the borders of Causeway Coast & Glens Borough Council and Mid & East Antrim Borough Council.

Larne Borough Council, Larne Area Plan 2010

- 10.23. Mid & East Antrim Borough Council are currently preparing a new Local Development Plan (LDP) for the Borough up to 2030. In the interim, the current area plan for MEABC is the Larne Area Plan 2010.
- 10.24. The Larne Area Plan 2010 contains no policy or guidance relevant to geology, hydrogeology, or hydrology. Drainage policy DR2 within the policy states that "Where a designated watercourse runs adjacent to or through a development site the department will require the provision of a 5m wide working strip along at least one bank of the watercourse.
- 10.25. The department will monitor all new development proposals to ensure that storm water run-off can be adequately catered for and does not compound existing flood problems". The plan also states that policies regarding utilities and new infrastructure are set out in "the Rural Strategy" and that "the need for such facilities will be balanced against the objective of conserving the environment and protecting amenity".
- 10.26. The Larne Area Plan 2010 highlights the importance of the designation of a hierarchy of sites which are of high nature conservation importance. The scale of importance of summarised in the below table.

Mid & East Antrim Borough Council, Local Development Plan 2030 (Draft)

- 10.27. The Draft Local Area Plan 2030, although not yet adopted, outlines planning policy pertinent to the water environment.
- 10.28. CS8 sets out policy to protect main river corridors by ensuring floodplain capacity is not hindered as well as considering water quality and pollution prevention to protect aquatic and riverine ecosystems.
- 10.29. FRD1 to FRD6 sets out policy to manage development that may be at risk from flooding or that may increase the risk of flooding elsewhere; to protect flood defence and drainage infrastructure; and to promote sustainable drainage solutions to improve water quality.
- 10.30. As the draft Plan Strategy is only at consultation stage it holds no material weight in decision making.

Northern Area Plan 2016

- 10.31. The current Plan covering the Causeway Coast and Glens Borough Council area is the Northern Area Plan 2016 (NAP).
- 10.32. The plan contains limited information regarding planning policy related to water environments but highlight the importance of the designation of a hierarchy of sites which are of high nature conservation importance. The scale of importance of summarised in the below table.

Table 10.2: Designations Summary

Scale of Importance	Designation Type	Designated By
INTERNATIONAL Nature Conservation Importance	Ramsar Sites	Convention on Wetlands of International Importance 1975
	Special Protection Areas Special Areas of Conservation	European Commission Directive on the Conservation of Wild Birds (79/409/EEC) The Conservation (Natural Habitats, etc.) Regulations (NI) 1995
NATIONAL Nature Conservation Importance	Nature Reserves, National Nature Reserves, Marine Nature Reserves Areas of Special Scientific Interest	Nature Conservation and Amenity Lands (NI) Order 1985
LOCAL Nature Conservation Importance	Sites of Local Nature Conservation Importance and Earth Science Interests / Assets	Northern Ireland Council Area Plans

Guidance on Conservation of Geological Features - Earth Science Conservation Review

- 10.33. The Earth Science Conservation Review (ESCR) is the means whereby areas of geological interest in Northern Ireland are assessed to determine their importance to science and hence to earth science conservation.
- 10.34. The objective of the ESCR is to define systematically all earth science localities (geological and/or geomorphologic) in Northern Ireland. The overall aim of the process is to encourage conservation of such areas to protect them from potential threats such as landfill, changes to natural systems and coastal defence work.

Industry Guidelines

- 10.35. The Pollution Prevention Guidelines (PPGs), published by the Northern Ireland Environment Agency (NIEA) in conjunction with the Environment Agency for England and Wales, and the Scottish Environment Protection Agency (SEPA) are currently being replaced by updated Guidance for Pollution Prevention (GPPs). Guidance notes relevant to the Development include:
- NIEA Guidance for Pollution Prevention (GPPs):

- GPP 1: Understanding Your Environmental Responsibilities - Good Environmental Practice;
- GPP 2: Above ground oil storage tanks;
- GPP 3: Use and Design of Oil Separators in Surface Water Drainage Systems
- GPP 4: Treatment and disposal of Wastewater where there is no connection to the public foul sewer;
- GPP 5: Works and Maintenance in or near Water;
- GPP 8: Safe Storage and Disposal of Used Oils;
- GPP 20: Dewatering Underground Ducts and Chambers;
- GPP 21: Pollution Incident Response Planning;
- GPP 22: Dealing with Spills; and
- GPP 26 Safe Storage - Drums and Intermediate Bulk Containers.
- In the absence of revised specific guidance, works shall similarly consider the lapsed NIEA Pollution Prevention Guidance Notes (PPGs):
 - PPG 6: Working at Construction and Demolition Sites;
 - PPG 7: The Safe Operation of Refuelling Facilities; and
 - PPG 18: Managing Fire Water and Major Spillages.

10.36. Other relevant industry guidance includes:

- BS6031: 2009 Code of Practice for Earthworks;
- BS 5930 2015: Code of Practice for Ground Investigations (+A1:2020);
- CIRIA C523 - Sustainable Urban Drainage Systems; Best Practice Manual (2001);
- CIRIA C532 - Control of Water Pollution from Construction Sites (2001);
- CIRIA C741 - Environmental Good Practice On-Site (2015);
- CIRIA C609 - Sustainable Drainage Systems: hydraulic/structural/water quality (2004);
- CIRIA C753- The SuDS Manual (2015);
- CIRIA C786- Culverts, Screen and Outfall manual (2019);
- DEFRA Construction Code of Practice for Sustainable Use of Soils on Construction Sites (2009);
- DAERA - A Guide to EIA and Planning Considerations: Environmental Advice for Planning Practice Guide - Water Features Survey (2018);
- DAERA - A Guide to EIA and Planning Considerations: Wind Farms and Groundwater Impacts (2019);
- DAERA Standing Advice on Pollution Prevention Guidance;
- DAERA Standing Advice on Commercial or Industrial Developments;

- DAERA Standing Advice on Culverting;
- DAERA Standing Advice on Abstraction and Impoundments;
- DAERA Standing Advice on Sustainable Drainage Systems; and
- DAERA Standing Advice on Discharges to the Water Environment.

Consultation

10.37. Pre-application consultation and data gathering to form opinion and requirements with regards to the hydrological and geological environments was sought from local and regional stakeholder organisations, including organisations who would be anticipated to be consulted by the planning authority in relation to the planning application. The consultation is intended to pre-empt any pre-application or in-application consultation that would be undertaken on notification or submission of the planning application and EIA. The informal consultation excludes NIEA:NED whose concerns are addressed separately in **Chapter 6: Vegetation and Peatland**.

10.38. A summary of the specific data provided by, and information / concerns raised by the various stakeholders is included in the following table. Site specific input provided is included in the following baseline assessment. Stakeholder responses are included in **Technical Appendix 10.5**.

Table 10.3: Consultee Summary

Consultees		Summary of Response	Addressed in Assessment
Causeway Coast and Glens Borough Council	Environmental Health	Details of one property within 5km radius of the proposed windfarm site were provided. One property is known to have a private groundwater supply (borehole) located on Reservoir Road, Corkey. Details of a water sample collected from the property in 2011 were also provided – the test for Coliforms was found to be satisfactory. The response also highlighted that Altnahinch Dam on Altnahinch Road is within 5km of the location and NI Water may be contacted with regards water supply from the dam.	9.96
Mid and East Antrim Borough Council	Environmental Health	Stated there are no Private Water Supplies located within the enquiry area surrounding the development. MEABC also confirmed that information held by the Borough Council is limited and NIEA DWI / PWS team should be consulted. ¹	
DAERA	NIEA Private Water Supply / Drinking Water Inspectorate	Confirmed there is one private water supply registered with the inspectorate within 5km of the outlined site. Provided associated drinking water quality data.	

¹ Personal comms. (phone call) between Sam Mills (Environmental Health Officer – MEABC) and Iain Muir (Project Consultant – McCloy Consulting) 19/06/2019.

Consultees		Summary of Response	Addressed in Assessment
		Stated that DWI does not hold information on private water supplies which supply single dwellings and any details should be obtained from the Environmental Health Department of Mid and East Antrim Borough Council.	
DAERA	Fisheries Inspectorate	Stated that there were no issues or concerns from an aquaculture perspective as there are no aquaculture sites in proximity to the development.	9.152
DAERA	Inland Fisheries	<p>Highlighted that the watercourses that will be mainly affected in this instance will be the Aghanagheeragh River and Killagan River that are tributaries in the River Main catchment. Sites on this catchment are used for monitoring of salmonid populations by AFBI and DAERA Inland Fisheries, as they support populations of salmonid species (Salmon and Brown/ Sea Trout).</p> <p>Fish populations are sensitive to reductions in water quality and fisheries habitat is susceptible to siltation from suspended solids. Consideration of potential impacts of project methodology on the aquatic environment and water quality should be considered.</p> <p>Disturbance to watercourses during operations may require authorisation under section 48 of the Fisheries Act (NI) 1966 (as amended) and it is an offence under section 47 of the Fisheries Act (Northern Ireland) 1966 to cause pollution which is subsequently shown to have a deleterious effect on fish stocks.</p>	Chapter 8: Fisheries & Aquatic Ecology Assessment
DAERA	Environmental Crime Department	Confirmed no records of unlicensed landfills within 2km of the development.	9.77
DAERA	NIEA Water Management Unit	<p>Conducted a search of the groundwater monitoring database and found there are no groundwater abstraction points within the search area.</p> <p>WMU also noted that all the information requested (except for groundwater quality), is available on the new Water Information Request Viewer.</p>	9.123
Northern Ireland Water	Information Management Unit	Confirmed that the intake at Altnahinch Reservoir is operational and provided guidance in relation to measures that it would prefer to see implemented to ensure protection of the quality and quantity within the upstream catchment draining to the abstraction location.	9.138
Department for Infrastructure	Rivers	Confirmed there are no designated watercourses or culverts under the terms of the Drainage (Northern Ireland) Order 1973 within or bounding the site.	9.141

Consultees		Summary of Response	Addressed in Assessment
		<p>Stated there may be undesignated rivers about which DfI Rivers is unaware.</p> <p>Confirmed the DfI had no record of any historical flood calls at the location of the Development.</p>	
Department for Economy	Geological Survey of Northern Ireland (GSNI)	<p>Stated the Site is adjacent to a number of disused mines > 300m to the Southeast driven into the hillside in a westerly/north-westerly direction towards the site. Although the entrances lie outside the boundary, consideration of the risk they pose to the site should be considered in the Environmental Statement.</p> <p>Consideration should be given to the stability of the site with a peat slide risk assessment conducted based on site specific geotechnical data and incorporating the hydrogeological interaction within the peat deposits.</p> <p>Confirmed GSNI do not hold any other records of groundwater boreholes or springs within a 1 km of the site.</p> <p>GSNI also advised that there may be groundwater abstractions in the area; however, could not provide the information and recommended that the Drinking Water Inspectorate be consulted.</p>	9.66 & 9.79
Department for Economy	Geological Survey of Northern Ireland (GSNI) - Minerals	<p>Confirmed the current licence is for all minerals vested in the Department for the Economy. In addition, the company has options for gold and silver from the Crown Estate.</p> <p>The proposed site location has had limited regional exploration activity carried out by the DfE license holder. This regional exploration has not generated areas for focussed follow up and as such, there are currently no constraints to development of the area, based on mineral prospectivity.</p>	9.82
DAERA	Water Management Unit – Pollution Prevention Team	<p>Pollution Prevention Team provided general information in relation to pollution prevention.</p> <p>Recommends all necessary source control and mitigation measures to prevent pollution of the water environment during construction, operational or maintenance phase of a project are identified and employed.</p> <p>Highly recommends the relevant PPGs and GPPs are identified and their precepts adhered to, in particular PPG5 and PPG6.</p> <p>Recommends the NIEA Pollution Prevent Team be consulted about any work, to be conducted in or near a waterway, or liable to affect any waterway, to agree a Method Statement with contractors (8 weeks) prior to the commencement of any works.</p>	9.233 to 9.243

Consultees	Summary of Response	Addressed in Assessment
	<p>Risks to the water environment, potential pollution pathways, best practices principles and mitigation measures to minimise risks should be identified, incorporated in contractors' Method Statements and be in place prior to the commencement of any works.</p> <p>Provided examples of mitigation measures; Construction phase site drainage plans should be considered at an early, to ensure site water is minimised (e.g. utilising cut off channels) collected, channelled and treated prior to discharge.</p> <p>Water should be collected in cut of drains and check dams and channelled to settlement features (built and maintained according to industry best practice) for treatment of suspended solids prior to discharge.</p> <p>Phased stripping and minimisation of exposed land to control suspended solid generation should be considered.</p> <p>Use of settlement systems for settlement of suspended solids from site drainage. These should be built and maintained according to industry best practice.</p> <p>Any works in a waterway must be conducted 'in the dry' e.g. behind coffer dams, use of over pumping, the use of temporary diversions etc. The NIEA Pollution Prevention Team do not permit machinery to enter any waterway at any time. NIEA must be consulted prior to commencement of any such works to ensure appropriate mitigation measures are in place. The Pollution Prevention Team work with contractors to ensure minimal disturbance and generation of suspended solids during the placement and removal of cofferdams/diversions etc.</p> <p>The NIEA do not encourage in stream settlement as a primary mitigation measure, the contractor must strive to ensure the generation of suspended solids is prevented/minimised in the first instance. The use of downstream settlement measures is considered a secondary line of protection.</p> <p>Management and maintenance of mitigation measures to ensure effective functioning.</p> <p>Prevent pollution by fuel/oil, from leaking machinery, there must be regular inspections of machinery working near any waterway.</p> <p>Safe refuelling, handling and storage practices for earth stockpiles and secondary containment for chemicals, oil, fuels etc.</p> <p>Compliance with the requirements of Control of Pollution (Oil Storage) Regulations (NI) 2010.</p>	

Consultees		Summary of Response	Addressed in Assessment
		Emergency spill procedures should be addressed Highlights requirements of the Control of Pollution (Oil Storage) Regulations, the primary requirement being secondary containment must be provided for oil stored in above ground containers over 200L with 110% capacity.	
Department for the Economy	Geological Survey of Northern Ireland (GSNI)	Advice peat slide risk assessment (PSRA) requirements.	Technical appendix 10.3 (PSRA)

Assessment Methodology

Baseline Characterisation

10.39. This qualitative assessment has been undertaken based on experienced professional judgement and assessment of compliance with statutory and industry guidance, including site visits for verification.

Study Area

10.40. Potential effects were considered within the 'Preliminary Site Boundary' (refer to para 9.10) within which the planning application boundary lies (hereafter referred to as the 'Site'), and the wider geological and hydrogeological setting of the area.

10.41. The hydrological study area includes surface water catchments draining the area within the Site and the downstream river reaches affected by this area as defined by the relevant River Basin Management Plans, Local Management Areas (LMAs) and Catchment Stakeholder Groups.

10.42. The hydrogeological and geological study area extends to the underlying aquifer catchments and extents of the geological units.

Additional Areas Considered

10.43. Consideration has been given to potential likely significant effects in respect of the proposed turbine delivery route and access route. Details of the work comprising junction widening, passing bays and general road widening, and potential effects on the geology and water environment are summarised within **Chapter 12: Transport & Traffic**.

10.44. A potential grid connection route is described within **Technical Appendix 1.4: Assessment of Potential Grid Connection**. Although the grid route is not part of the Proposed Development, consideration has been given to potential likely significant effects.

Desk Study

10.45. The desktop study involved collation and assessment of the relevant information from the following sources:

- Close scale Ordnance Survey mapping in addition to aerial photography to assess land use and environs and to identify water features and watercourse catchments;
- Local authority and regulatory body consultation responses;
- NIEA river quality data and natural heritage data;
- DfI Rivers Flood Maps NI;
- NIEA Drinking Water Inspectorate and Water Management Unit data;
- Review of CEH Flood Estimation Handbook (web portal) for details of river catchment data;
- Review of Inland Fisheries information;
- Review of detailed site topographic survey;
- GSNI GeoIndex (1:10,000 bedrock and superficial geology maps);
- GSNI GeoIndex (aquifers and aquifer vulnerability);
- GSNI GeoRecords database;
- General Soil Type Map of Northern Ireland at 1:250 000 scale;
- NIEA Groundwater quality data and abstractions / discharges database; and
- NIEA Drinking Water Inspectorate and Water Management Unit data.

Determination of Sensitivity, Magnitude, Likelihood and Significance

10.46. This assessment determines the nature, scale and significance of the effects of the Development on the baseline (current) scenario in accordance with a methodology stated within The Institute of Environmental Management and Assessment guidance².

10.47. The potential impact significance is defined by the combination of the sensitivity of the receptor and the magnitude of the effect. Following this, an overall impact significance is determined by considering the potential impact significance and the likelihood of the effect occurring.

Sensitivity Criteria

10.48. The scale and sensitivity of the receiving environment (receptor) has been categorised on a scale of "Very High" to "Low". The sensitivity criteria used for this assessment are presented in Table 10.4 and are based on:

² Institute of Environmental Management and Assessment (2004) Guidelines for Environmental Impact Assessment.

- Vulnerability of a receptor to a particular pressure (degree of environmental response to any particular effect); and
- The importance or 'value' of the receptor e.g. an area of international importance should be considered more sensitive to effect than a local area of little or no conservation value.

Table 10.4: Evaluation of Hydrological / Hydrogeological Receptor Sensitivity Criteria

Scale / Sensitivity of the Environment (Receptor)		
International and / or Very High	Attribute has a very high quality / rarity at an international scale.	Important on a European or global level, e.g. Ramsar Sites, SAC, SPA and Habitats Directive Sites with dependence on the water environment.
National and / or High	Attribute has a high quality and rarity at a national scale.	Important in Northern Ireland, e.g. ASSI or National Nature Reserve (NNR) with respect to the hydrological environment. WFD classification of 'High' with the watercourse providing a nationally important resource or supporting river ecosystem. Public water supplies and highly productive aquifers or local water supplies, including private water supplies where there is no alternative to private supplies. Principal aquifer providing a nationally important resource. Source Protection Zone 2 (Outer Source Protection Zone).
Regional and / or Medium	Attribute has a medium quality and rarity at a regional scale.	Important in the context of the region, e.g. catchment scale issues, main river within the catchment, local Nature Reserves or Sites of Local Importance for Nature Conservation (SLNCI). WFD classification of 'Good' with the watercourse providing an important resource or supporting river ecosystem or upstream of a designated fishery. Active floodplain area. Designated fishery, catchment regionally important for fisheries. Domestic private water supplies located within vicinity of mains water supply or private water supplies used only for agricultural purposes and not drinking water. Groundwater dependent terrestrial ecosystems in hydraulic continuity with the Site. Principal aquifer providing a regionally important resource e.g. industrial use with limited connection to surface water. Source Protection Zone 3 (catchment of groundwater source).

Scale / Sensitivity of the Environment (Receptor)		
Local and / or Low	Attribute has a low quality and rarity at a local scale.	<p>WFD classification of 'Moderate' or less with the watercourse providing a locally important resource or supporting river ecosystem.</p> <p>Domestic private water supplies located within vicinity of mains water supply or private water supplies used only for agricultural purposes and not drinking water.</p> <p>Groundwater dependent terrestrial ecosystems in hydraulic continuity with the Site.</p> <p>Aquifer providing a locally important resource e.g. For agricultural or small-domestic supplies.</p>

Magnitude of Effect

10.49. The magnitude of change / effect is influenced by the timing, scale, size and duration of the hazardous effect; magnitude has been categorised on a scale of "High" to "Low"; defined in Table 10.5.

Table 10.5: Evaluation of Magnitude of Effect Criteria

Magnitude of Effect / Description		Definition of Criteria	
High	Fundamental change resulting in loss of an attribute and /or the quality and integrity of conditions.	Water Quality	Potential high risk of pollution to surface water changing water quality status.
		Water Supply	Loss of local water supply or change in quality with respect to drinking water standards (DWS).
		Flood Risk / Erosion Potential	Significant increase in risk due to a significant change in the proportion of hard standing and altered surface water flows.
		Groundwater	Significant change in groundwater levels, flow regime, groundwater quality or extensive change to an aquifer.
		Surface Water Dependent Ecosystem	Loss of, or extensive change to, a surface water dependent ecosystem or fishery.
		Geology and Soils	Partial (greater than 50%) or total loss of a geological site or mineral deposit. Major or total loss of topsoil, soils or peatland.
Medium	Detectable change to conditions resulting in non-fundamental	Water Quality	Potential medium risk of pollution to surface water, changing water quality status.

Magnitude of Effect / Description		Definition of Criteria	
	temporary or permanent consequential changes.	Water Supply	Temporary loss of local water supply or minor change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	Detectable increase in flood risk and erosion potential due to a medium change in the proportion of hardstanding and altered surface water flows.
		Groundwater	Measurable change in groundwater levels, groundwater flow regime, groundwater quality or identifiable change to an aquifer.
		Surface Water Dependent Ecosystem	Partial loss or change to a surface water dependent ecosystem or fishery.
		Geology and Soils	Partial (between 15% - 50%) loss of topsoil, soils or peatland, or where the value of the area would be affected, but not to a major degree
Low	Results in minor effect on attribute of insufficient magnitude to affect the use or integrity.	Water Quality	Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations.
		Water Supply	No change in pressure or flow to local water supply or minor change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	Minor changes in the proportion of hardstanding and altered surface water flows result in no detectable increase in flood risk and erosion potential.
		Groundwater	Minor alteration to one or more characteristics, features or elements or no observable effect
		Surface Water Dependent Ecosystem	Any measurable change in groundwater levels does not affect groundwater flow regime, groundwater quality with regards to DWS or result in any change to an aquifer.

Magnitude of Effect / Description		Definition of Criteria	
		Geology and Soils	Small effect on a geological/geodiversity site or mineral deposit (up to 15%). Partial loss of topsoil, soils or peatland, or where soils will be disturbed but the value of the area would not be affected.
Negligible	Results in negligible effect on attribute	Water Quality	No perceptible change in water quality.
		Water Supply	No change in pressure or flow to local water supply and negligible change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	No measurable change in the proportion of hardstanding and altered surface water flows result in no detectable increase in flood risk and erosion potential.
		Groundwater	No alteration to groundwater characteristics, features or elements.
		Surface Water Dependent Ecosystem	No measurable change in groundwater levels, groundwater flow regime, groundwater quality with regards to DWS. No change to an aquifer.
		Geology and Soils	Very slight change from geological, mineral and soil baseline conditions

Impact Significance Criteria

10.50. The magnitude of effect and receptor sensitivity are combined to evaluate and qualify if an impact is of high, moderate, low, or negligible significance as outlined in Table 10.6.

Table 10.6: Evaluation of Potential Effect Significance

Scale / Sensitivity of the Environment (Receptor)	Magnitude of Effect			
	Negligible	Low	Medium	High
International / Very High	Moderate	Moderate	High	High
National / High	Low	Moderate	Moderate	High
Regional / Medium	Negligible	Low	Moderate	Moderate
Local / Low	Negligible	Negligible	Low	Low

Likelihood of Occurrence Criteria

10.51. The likelihood of the potential effects occurring is assessed based on historical data, quantitative analysis and professional judgement based on relevant experience as shown in Table 10.7.

Table 10.7: Evaluation of Likelihood of Occurrence

Likelihood of occurrence	Criteria
Certain	Likely consequential effect in medium term and inevitable in long term (within the life of the development).
Likely	Possible consequential effect in the medium term and likely but not inevitable in the long term.
Unlikely	Unlikely that any consequential effect would arise within the lifetime of the development.
Rare	It is unlikely that any consequence would ever arise.

Determination of Overall Impact Significance

10.52. Potential Impact Significance (Table 10.6) and Likelihood of Occurrence (Table 10.7) are combined to determine an Overall Impact Significance as shown in the matrix in Table 10.8.

Table 10.8: Evaluation of Overall Significance

Potential Significance	Likelihood of Occurrence			
	Rare	Unlikely	Likely	Certain
High	Minor	Moderate	Major	Major
Moderate	Minor	Minor	Moderate	Major
Low	Not Significant	Minor	Minor	Moderate
Negligible	Not Significant	Not Significant	Minor	Moderate

Site Characteristics & Baseline Conditions

Site Description

10.53. The Proposed Development is located approximately 4 km to the north-east of Cloughmills. The assessment area (survey boundary) considered within this assessment occupies an area of approximately 4.2 km².

Topography

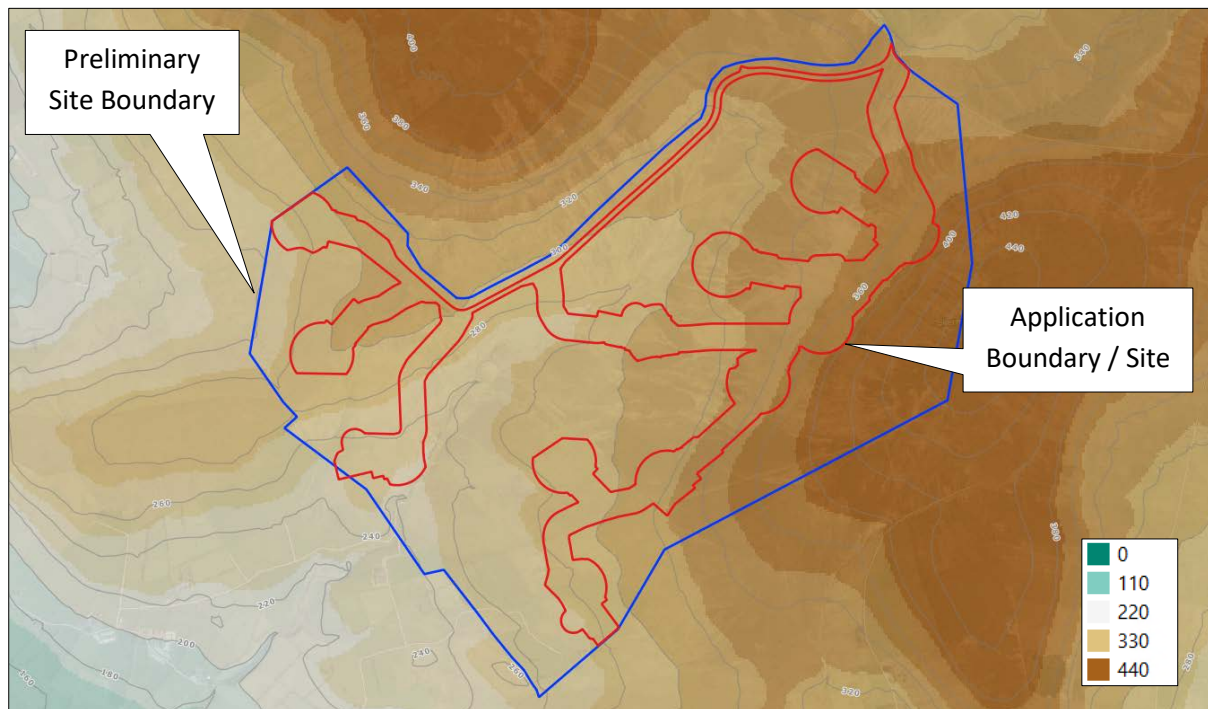
10.54. The Site is located across the north-western slopes of Skerry Hill to the south-eastern slopes of Slievenahanaghan where existing Gruig Wind Farm turbines are located. Maximum ground level within the application boundary is c. 443 m OD at the summit of Skerry Hill. The lowest ground levels are c. 235 m OD at the western extent of the Site where the Aghanageeragh River flows away from the Preliminary Site Boundary.

Land Cover

10.55. Much of the land within the Preliminary Site Boundary supports bog and heath vegetation, which can vary markedly in species composition over short distances. Both wet and dry modified bog types are present over the valley sides and floor. Lower slopes and parts of the valley floor support heath vegetation on shallow peat. Towards the south and west of the site, there have been some attempts to improve the peat substrate for agriculture. Further information on land cover and species present within the Preliminary Site Boundary is provided in detail within **Chapter 6: Vegetation and Peatland**.

10.56. Access to the site is available via Altnahinch Road to the north-east of the site.

Plate 10-1: Topography



Meteorological Data Summary

- 10.57. The Standard Percentage Runoff (SPR) is a parameter used in runoff and flood estimation, which represents the percentage of total rainfall likely to contribute to direct runoff and storm flow. Review of the site in relation to FEH catchment descriptors indicates a SPR of approximately 56.9%. For context, SPR values in the UK range from 2% (sand or chalk with slow response / low runoff) to a maximum of 60% (peat bog with rapid response / high runoff).
- 10.58. Rainfall data from the Ballypatrick Forest climate station³ (approx. 12 km north-east from the Proposed Development) records an annual average rainfall total of 1325 mm during the 1991 - 2020 climatic period. Based on the Meteorological Office banding of annual average rainfall (1981 - 2010), rainfall in the vicinity of the site is within the fourth highest of nine bands (1250 - 1500 mm) and is typical for high elevation regions in Northern Ireland.

Geology

Agricultural Land Classification

- 10.59. DAERA published a classification index for Agricultural Land Classification (ALC) in 1997 based on a document "Agricultural Land Classification of England and Wales" published by the Ministry of Agriculture and Fisheries and Food (now Department

³ Met Office, Banagher Caugh Hill Climate. Available at <https://www.metoffice.gov.uk/public/weather/climate/gcg9gvrs8> Accessed 28/03/2022

for Environment, Food and Rural Affairs)⁴ in 1988. The index classifies agricultural land into five grades based on climate, topography, soil, slope and altitude characteristics; with Grade 1 excellent quality and Grade 5 very poor quality.

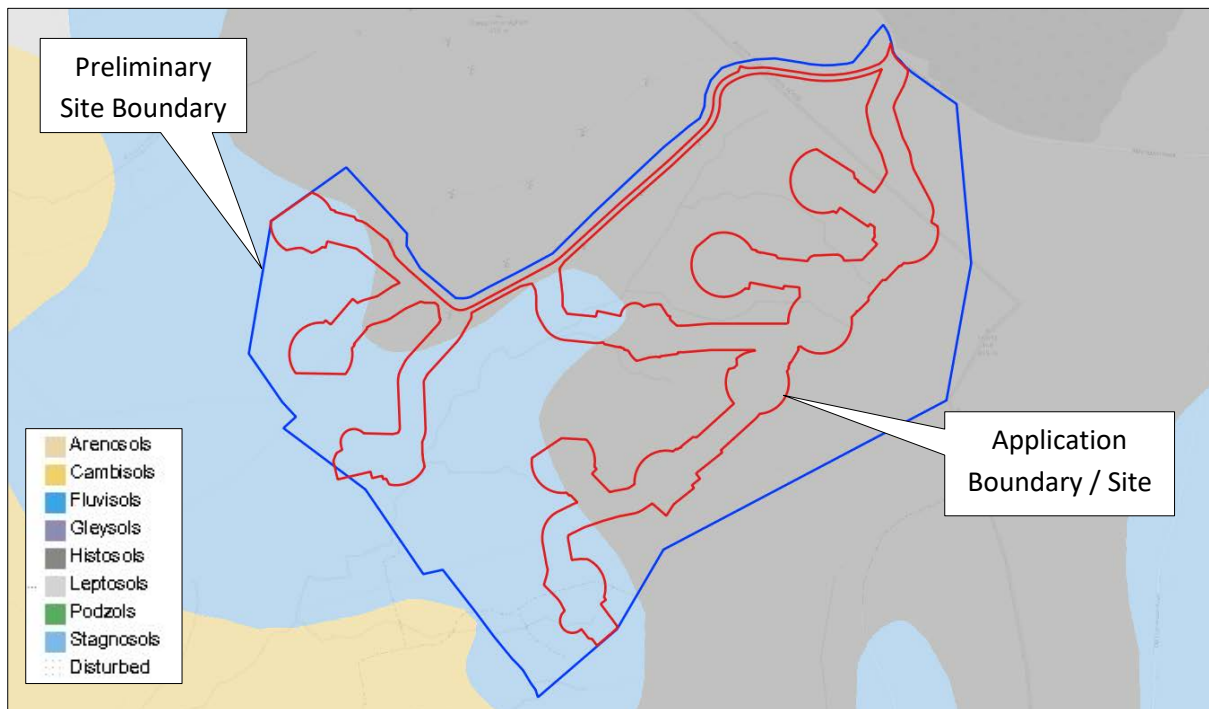
- 10.60. Using the guidance from the ALC of England and Wales, along with available site information, including site walkover observations and gradients of the land, the most suitable land classifications for the site range from Grade 3b - 'moderate quality agricultural land' to Grade 4 - 'poor quality agricultural land'.
- 10.61. The loss or partial loss of agricultural function on the site is therefore not significant and does not inform constraints to development.

Soil Conditions

- 10.62. A review of the UK Soil Observatory interactive map viewer indicates a varied soil type coverage on the site.
- 10.63. The majority of the Site over the higher elevations is characterised by 'Histosols' comprising peaty soils with a deep surface layer of organic material. Histosols are generally poorly draining due to high clay content and high organic content.
- 10.64. The western and south-western section of the Site is comprised of 'Stagnosols' which are usually developed on unconsolidated materials, such as, glacial till and alluvial deposits due to stagnating water and poor drainage. For use of agricultural purposes, this soil type requires drainage channels, however, in areas with low permeability subsoil engineered drainage channels are often insufficient. In summary, they comprise very poorly draining clay soils.

⁴ Ministry of Agriculture, Fisheries and Food: Agricultural Land Classification of England and Wales (1988)
<http://publications.naturalengland.org.uk/file/5526580165083136>

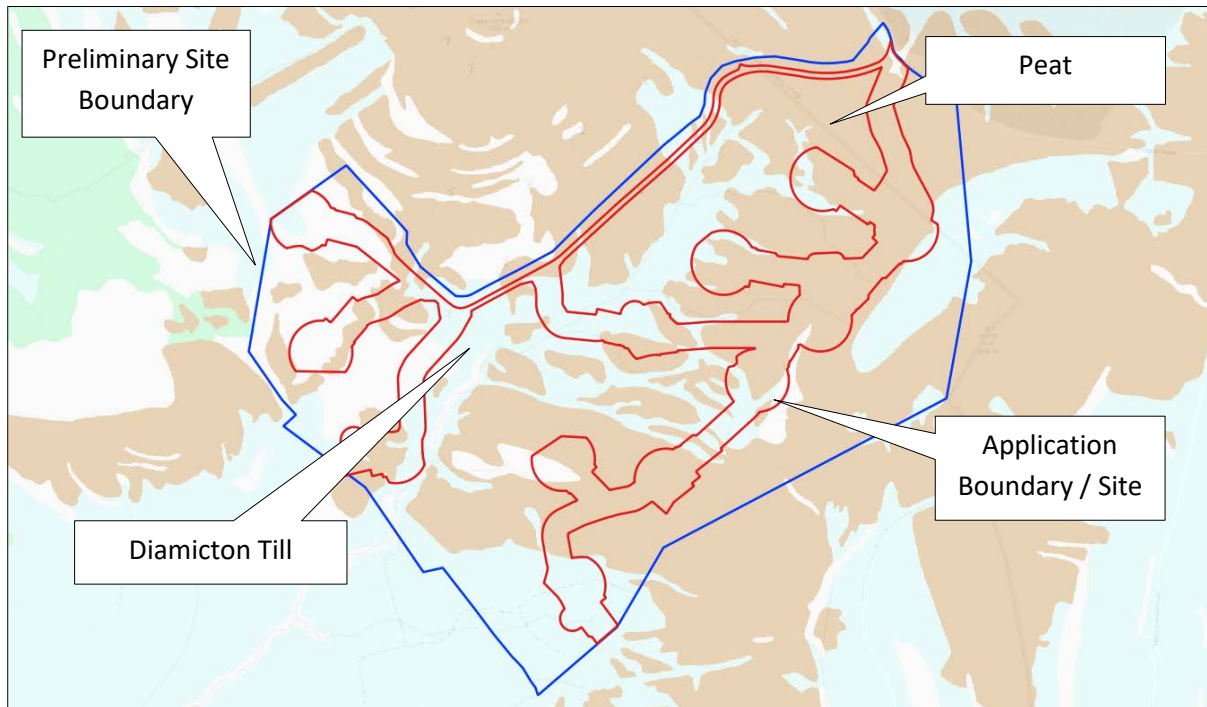
Plate 10-2: Soils



Superficial Deposits

10.65. The Site has been reviewed in relation to the 1:10,000 mapping available from the GSNI GeoIndex WMS layers. The majority of the Site is overlain with peat deposits particularly on the higher ground. Diamicton till is present throughout the Preliminary Site Boundary, most notably along the route of the Aghanageeragh River on lower ground between Skerry Hill and Slievenahanaghan; however, the PSRA (Technical Appendix 10.3) notes that till likely also underlies the peat deposits.

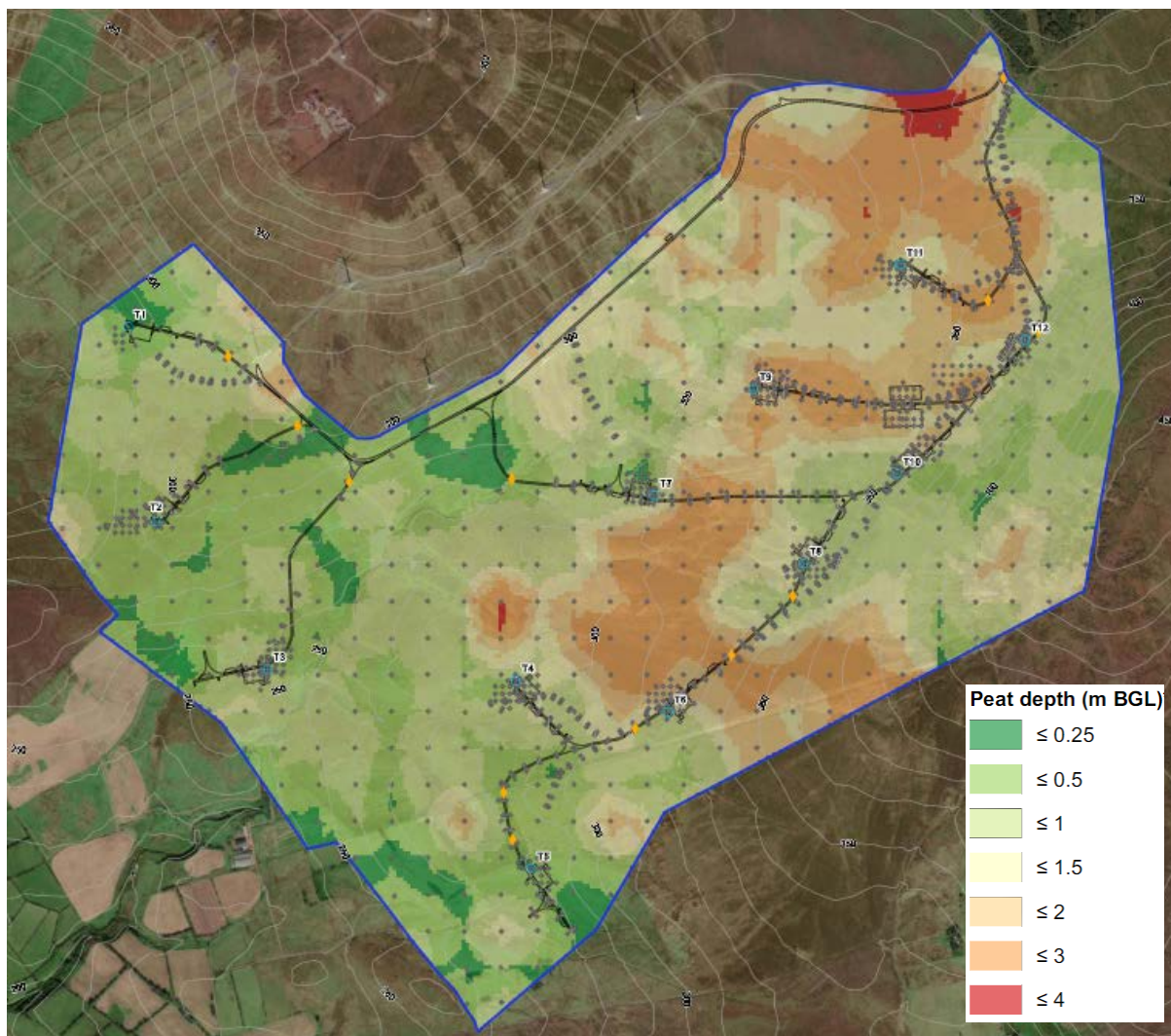
Plate 10-3: Superficial Deposits



Peat

- 10.66. The presence of peat coverage is initially identified by GSNI 1:10,000 mapping (shown on Plate 10-3) and the NIEA Natural Environment Map Viewer, both of which indicate peat coverage within the Site. A Peat Slide Risk Assessment (PSRA) has been produced by a 3rd party for the applicant and is included in **Technical Appendix 10.3** and the findings of that intrusive investigation take precedent over desktop sources in relation to peat coverage at the Site.
- 10.67. The PSRA confirmed peat is present across much of the Site. Where peat is present, an interpolated peat depth map of the 1,640 soil probes collected during the peat survey is shown on Plate 10.4 below. The deepest recorded areas of peat are in excess of 4.0 m, these are in localised pockets and avoided by any proposed windfarm infrastructure. The PSRA is included as **Technical Appendix 10.3**.

Plate 10-4: Peat Depth (excerpt from PSRA - Technical Appendix 10.3.)



Bedrock Geology

10.68. The bedrock geology of the site has been reviewed in relation to the 1:10,000 mapping available from the GSNI GeoIndex WMS layers. The majority of the site is underlain by Lower Basalt Formation with an area of Upper Basalt Formation to the south-east. Thin bands of Interbasaltic Formation comprised of lithomarge, subordinate bauxitic clay and oxides, and hydroxides of iron, form intermediary layers between upper and lower formations.

10.69. Three igneous intrusions are present within the Preliminary Site Boundary intruding the basalt formations defined on the GeoIndex mapping, comprising microgabbro dykes. These are trending north-west to south-east in the west of the Preliminary Site Boundary.

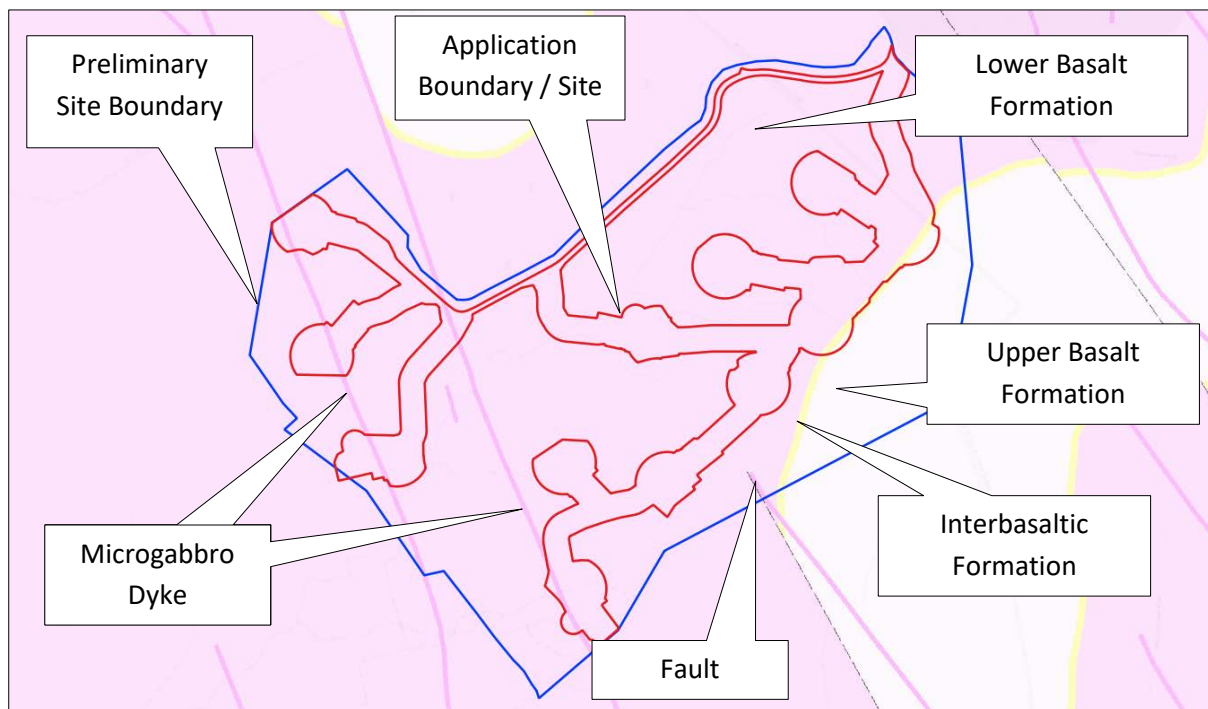
Exposed Bedrock

10.70. Exposed bedrock was not observed during the site walkover. Superficial mapping indicates pockets of no superficial deposits in the west of the Preliminary Site Boundary. It is likely that rockhead will be at or near ground level in these areas.

Faults

10.71. A short length (c. 100m) of downthrow fault is located within the Preliminary Site Boundary. The locations of large regional fault systems are inferred from the BGS mapping. Its presence is not noted in the Geotechnical Assessment (technical Appendix 10.3); therefore, it is not considered further as a source of potential local ground instability.

Plate 10-5: Solid Geology



Mass Movement

10.72. A review of the 1:10,000 mapping on the GSNI GeoIndex did not identify areas of mass movement within the Preliminary Site Boundary. The PSRA (Technical Appendix 10.3) noted an area of existing peat slide located c. 360m upslope (Skerry Hill) from the proposed access track at turbine T8, measuring approximately 3,000 m² in area. The PSRA states that the recorded run-out distance of the historic slide and proximity of the proposed infrastructure results in T8, T10 and T12 being at a low risk of impact from future events.

Radon

10.73. The UK interactive radon map⁵, based on the Indicative Atlas of Radon in Northern Ireland⁶, indicates that the site area is situated in the lowest band of radon potential i.e., less than 1 % of homes above the Action Level.

Waste and Minerals

Waste Site Licence Exemptions and Sites

10.74. A review of the opensource NIEA authorised landfill sites dataset does not identify any features within the vicinity of the Proposed Development.

10.75. A review of waste site licenses and exemptions within a 2 km radius of the Preliminary Site Boundary indicated Corkey Quarry, 1.5 km north-west of the boundary, holds a waste exemption certificate. Waste materials at this site include concrete; bricks; mixtures of concrete, brick, tiles, or ceramics; waste bituminous mixtures; and waste gravel and rocks. The identified site does not have any linkage to the site and is not a constraint to development.

Landfills

10.76. A review of the opensource NIEA authorised landfill sites dataset does not identify any features within 1 km of the Preliminary Site Boundary.

10.77. An information request made to the DAERA Environmental Crime Department confirmed the department is not aware of any unlicensed landfills within 2 km of the Site.

Industrial Consents

10.78. Review of DAERA mapping identified five industrial consents within 2 km of the Preliminary Site Boundary. They are described as private sewage (4 No.) and quarry site drainage (1 No.). All are located down gradient from the Site and, therefore, are not considered a constraint to the Proposed Development.

Historic Quarries / Mines

10.79. A review of GSNI Historic Mine Workings (Group) dataset did not identify any mapped shafts and /or adits within the Preliminary Site Boundary that would be considered a constraint to the Proposed Development.

Active Quarries

10.80. Consultation of the GSNI GeoIndex (records from 2000) identified Corkey Quarry (quarrying basalt and igneous rock) approximately 1.8 km north of the Preliminary

⁵Public Health England (2015) UK Maps of Radon. Available at <http://www.ukradon.org/information/ukmaps>. Accessed 28/03/2022

⁶Public Health England (2015) Radon in Northern Ireland: Indicative Atlas. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/453711/PHE-CRCE-017__maps_with_place_names_.pdf. Accessed 28/03/2022

Site Boundary. The Proposed Development is not constrained by, and would not affect, operations at this location.

Mineral Occurrences

10.81. Information available on the GSNI GeoIndex shows there are two mineral occurrences approximately 1.5 km east of the Preliminary Site Boundary. Large disused ironstone mines, approximately 450 m north-west of Salmon's Drift (another disused mine) and, approximately 600 m south-east, an iron ore mine approximately (7-12 cm thick) between Upper Basalt and pavement. The occurrences are not a constraint to development.

Mineral Prospecting Licences March

10.82. Consultation of the GSNI GeoIndex showed the Preliminary Site Boundary is within a mineral prospecting licence zone. GSNI Mineral Branch advised that the licence is issued for all minerals vested in the Department for the Economy (DfE). In addition, the licence holder has options for gold and silver from the Crown Estate.

10.83. The Preliminary Site Boundary has had limited regional exploration activity carried out by the DfE license holder and this regional exploration has not generated areas for focussed follow; therefore, there are currently no constraints to development of the area, based on mineral prospectivity.

Summary of Geohazards

Table 10.9: Summary of Identified Geohazards

Geohazard Type	Applicable to the Development?	Rationale / Potential Constraint	Consider Further?
Extractions	No	No active quarries were identified within 1 km from the Site. GSNI confirmed there is no known economic mineralisation in the area to constraint development at this time.	No
Adit / Shafts (Mine Entries)	No	None located within the Preliminary Site Boundary.	No
Land Slip	Yes	The PSRA (Technical Appendix 10.3) identified an area of historic peat slide c. 360 m upslope (Skerry Hill) from the proposed access track at turbine T8. The PSRA concludes infrastructure associated with the Proposed Development is at a low risk of impact from future events.	No
Peat	Yes	Peat is present within the Preliminary Site Boundary. The occurrence of peat is a potential constraint to development. The PSRA (Technical Appendix 10.3.) concludes that the deepest recorded areas of peat are c. 4.7 m but are avoided by any proposed windfarm infrastructure. The PSRA found that risk of run out and significant damage to the wider hydrological environment is deemed low, provided the relevant control	No

Geohazard Type	Applicable to the Development?	Rationale / Potential Constraint	Consider Further?
		measures outlined in the PSRA are implemented at site.	
Running Sands	No	No mapped sands on site.	No
Compressible Ground	Yes	Peat is present within the area of proposed turbines T3, T4, T6, T8, T9, T10, T11, T12, the control building and energy storage facility. The PRSA (Technical Appendix 10.3) has assigned an overall 'low' risk at each location. The PSRA outlines key control measures which are required to ensure the risk of peat slide remains at residual (low) levels.	No
Landfill	No	There is no evidence (current or historic) of landfill(s) present within the Preliminary Site Boundary.	No
Karst Features	No	No recorded features within the vicinity of the Site.	No
Radon	Yes	The site is situated in the lowest band of radon potential i.e., less than 1 % of homes above the Action Level.	No

Hydrogeology

Aquifer Classifications

- 10.84. A review of the online data available on GSNI GeoIndex indicates the bedrock aquifer underlying the Proposed Development is classified as Bm(f), indicating it has high to moderate productivity⁷ but dependence on fracture flows makes poorer yields possible.
- 10.85. The GSNI Groundwater Vulnerability Map indicates that groundwater within the Preliminary Site Boundary has a classification ranging from 4c and 5, on a vulnerability scale of 1 (very low) to 5 (very high). The majority of the Preliminary Site Boundary is classed as 4c. Note: Class 4 can be further subdivided according to the nature of the pathway and 4c is categorised as 'low permeability cover'.
- 10.86. The vulnerability mapping indicates the areas classed as 4c are associated with land at higher elevations underlain by peat, and the areas classed as 5 are absent of superficial deposits or correspond to the lower reach alignment of Aghanageeragh River as it flows west away from the Site.
- 10.87. The groundwater body underlying the majority of the Preliminary Site Boundary is the Ballymena Groundwater Body which has an overall WFD status of "Poor". The north-east section of the Site is located above the Ballycastle Armoys Groundwater Body which has an overall WFD status of "Good". The overall status relates to both

⁷ Geological Survey Northern Ireland (2005) WFD Aquifer Classification Scheme for Northern Ireland. Available from <https://www.daera-ni.gov.uk/>

the quantitative and chemical (water quality) characteristics of the groundwater body.

- 10.88. There are no superficial aquifers mapped within the Preliminary Site Boundary and there are not expected to be any unmapped potential aquifers present due to the absence of any superficial sand deposits within the boundary.
- 10.89. A review of the GSNI GeolIndex viewer indicates there is a potential superficial aquifer located approximately 1.4 km west of the Site coinciding with alluvium (unlithified sand and silt deposits) west of the village of Corkey.

Groundwater Recharge

- 10.90. Recharge will be direct where bedrock is at or close to surface (e.g., in the western section of the Preliminary Site Boundary where no superficial deposits are mapped). A proportion of recharge through overlying till deposits may also occur especially where these are thin. Recharge is expected to be reduced where thicker tills and/or peat overlie bedrock.
- 10.91. Average rainfall is between 1500 - 2000 mm/a. The long-term average recharge rates are approximately 332 mm/a (for Bm(f) aquifers the actual recharge rate is likely to be limited and assumed to be 100 mm/a).

Groundwater Flow

- 10.92. Groundwater flow is controlled by fractures within the bedrock. Flow paths are generally considered to be short (tens to hundreds of metres) with flow mainly following topography. The dominant flow zone will be in the upper weathered zone (top 10 - 30m).
- 10.93. Groundwater flow within the bedrock is expected to be mainly shallow and discharging locally to surface waters especially in upland areas.

Springs / Wells

- 10.94. A review of the OSNI historical maps available from PRONI⁸ and the Historical Map Viewer⁹ indicated there are no historical springs within the Preliminary Site Boundary and immediate vicinity. GSNI do not hold records of any springs within 1 km of the Preliminary Site Boundary.

Boreholes

- 10.95. GSNI, MEABC and CCGBC confirmed they do not hold records of any boreholes within 1 km of the Preliminary Site Boundary.

⁸ PRONI Historical Maps. Available from <https://apps.spatialni.gov.uk/EduSocial/PRONIApplication/index.html>

⁹ Department for Communities Historical Environment Map Viewer. Available from <https://dfcgis.maps.arcgis.com/apps/webappviewer/index.html?id=6887ca0873b446e39d2f82c80c8a9337>

Groundwater Abstractions

10.96. In order to identify potential groundwater users, data was sought from a number of sources. Findings from this is summarised as follows:

- NIEA Water Management Unit carried out a search of the Groundwater Monitoring Database. They advised they found no groundwater monitoring points within 5km of the Site. Their response is included in **Technical Appendix 10.4**.
- NIEA Drinking Water Inspectorate (DWI) confirmed there is one private drinking water supply registered with the Inspectorate (Ref: MA021D) within 5 km of the Site under the Private Water Supplies Regulations (Northern Ireland) 2017. The PWS was noted to be spring-fed and is located c. 2.8 km south of the Preliminary Site Boundary.

It is considered that due to the distance, and the breaks in hydrological connection inferred by sub-catchment delineation between the Site and the PWS, it could not feasibly be affected by works associated with the Proposed Development. Therefore, no further consideration is required within this assessment. The DWI response is included in **Technical Appendix 10.5**.

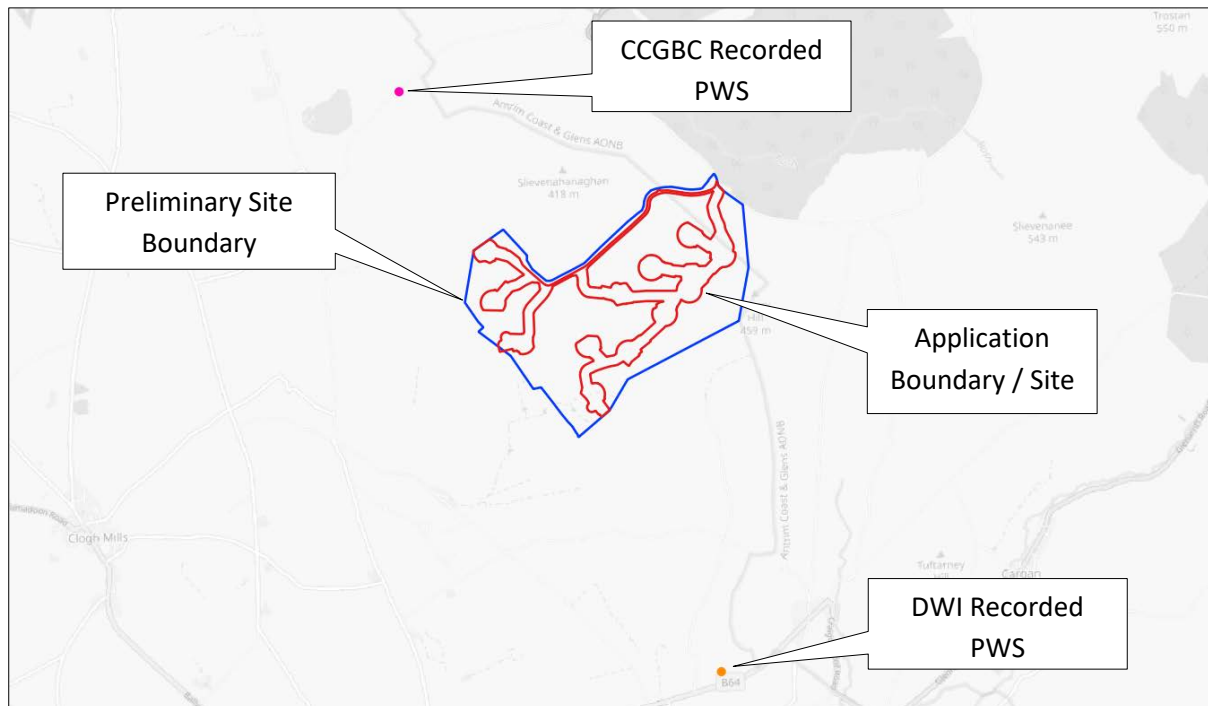
- Causeway Coast and Glens Borough Council was contacted with respect to information on private water supplies which supply single dwellings. They confirmed they have record of 1 no. private water supply within a 2 km radius of the Site. The PWS is a borehole abstraction at a residence in the village of Corkey. The PWS was found to be located c. 1.7 km north-west of the Preliminary Site Boundary.

It is considered that due to the distance, and the breaks in hydrological connection inferred by numerous surface water features between the Site and the dwelling, the PWS could not feasibly be affected by works associated with the Proposed Development. Therefore, no further consideration is required within this assessment. The CCGBC response is included in **Technical Appendix 10.5**.

- Mid and East Antrim Borough Council was contacted with respect to information on private water supplies which supply single dwellings. They confirmed they held no records of any in the vicinity of the Proposed Development. Their response is included in **Technical Appendix 10.5**.
- The DAERA Abstraction and Impoundment Licencing (AIL) information available on the Water Information Request Viewer was reviewed for licenced groundwater-fed abstractions within 1 km of the Site. None were identified.
- There is a borehole on the existing Gruig wind farm site to serve the substation. The borehole is set back c. 5 m from the existing track, on the same side as the substation.

Proposed upgrades to the access tracks are located downgradient from the borehole location, and as such, are not considered to have any drainage or similar effect that would affect the integrity of the water supply, and are discounted from further consideration.

Plate 10-6: Recorded Water Supplies



- 10.97. In addition to identification of potential abstractions from records, the various consultees indicated that they do not hold a definitive database of individual properties served by a private water supply. In order to ensure a robust assessment, screening has been undertaken to identify properties potentially served by local, unrecorded water abstractions within the vicinity of the Proposed Development based on property and occupancy information determined by the applicant.
- 10.98. To ensure a conservative assessment, a 500 m screening radius (i.e., 2 x NIEA Guidance) has been applied to the Preliminary Site Boundary. Screened properties are shown on the following Plate 9-7 and scheduled in Table 10.10.

Plate 10-7: Property Screening

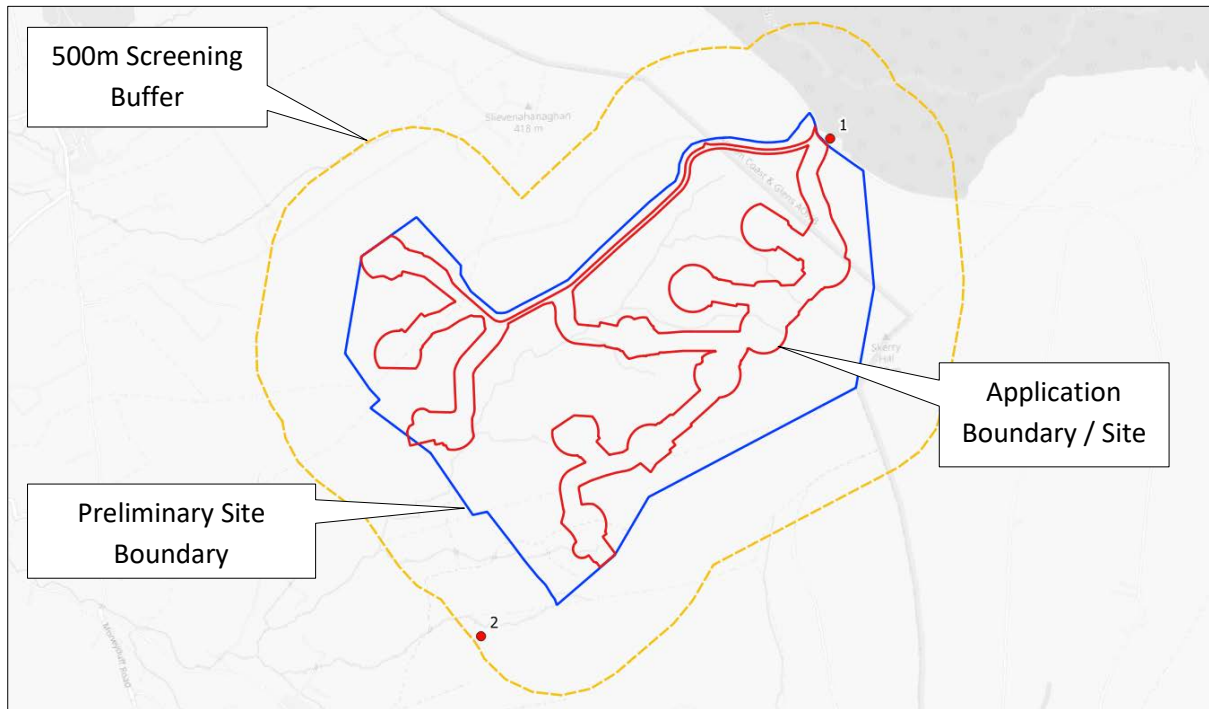


Table 10.10: Summary of Dwellings

Feature ID	Description	Significance and Rationale for Scoping Out
1	Uninhabited property	Uninhabited building, no drinking water requirements.
2	Uninhabited property	Uninhabited building, no drinking water requirements.

10.99. The screening exercise confirms no additional properties downgradient from the Preliminary Site Boundary within the screening buffer that are likely to rely on private water supply abstractions; therefore, no private water supplies are likely to be affected by the Proposed Development.

Catchment Hydrology

Surface Water Bodies

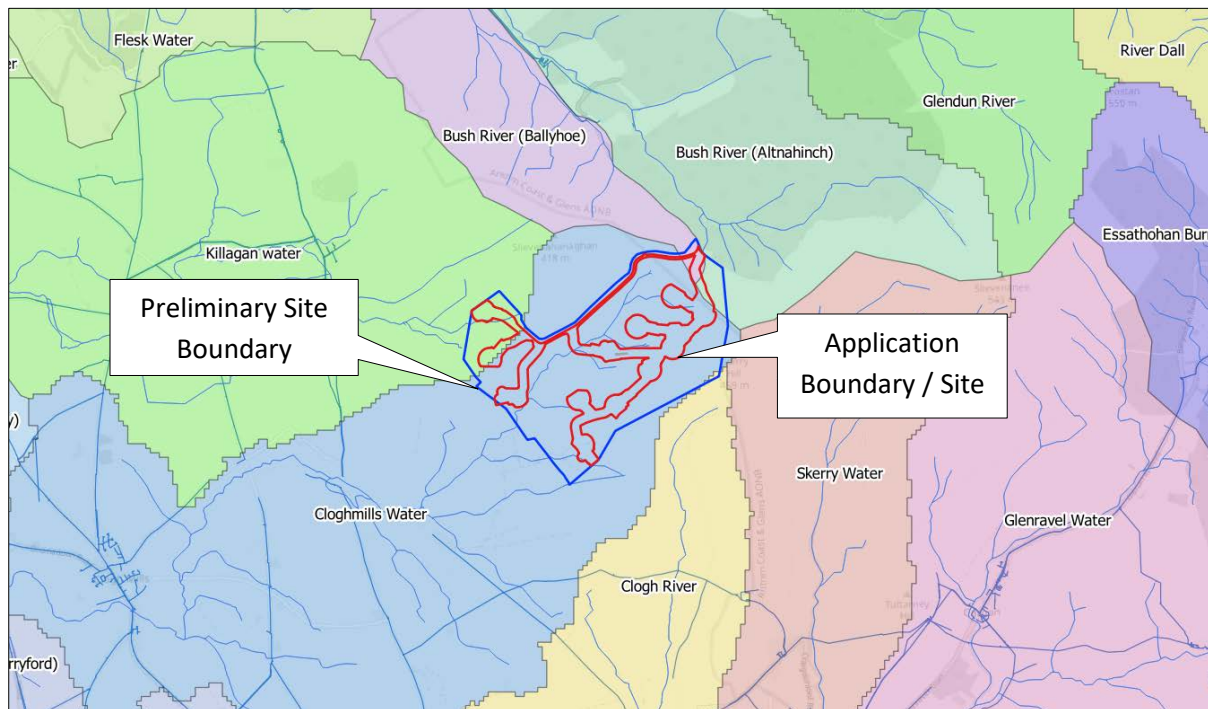
10.100. DfI Rivers map of 'Designations approved by the Drainage Council (NI)' indicate there are no designated watercourses within the Preliminary Site Boundary. All watercourses within the boundary are subject to riparian ownership and maintenance only.

10.101. Site reconnaissance observations indicate that the current hydrology of the Site consists of several natural source watercourses and streams and artificially modified drainage ditches and peat drains.

10.102. The hydrological regime of the Site and discharge locations of onsite watercourses as determined by desktop studies and site walkovers are shown on Figure 10.1: Site Hydrology.

- 10.103. NIEA River Water Body dataset boundaries show the Site drains to five delineated and named waterbodies. The majority of the Preliminary Site Boundary (c. 87%) is located within the Cloghmills Water catchment (UKGBNI1NB030302234) which has an overall area of 26.1 km² and drains south-west away from the Site. Aghanageeragh River forms the upper reaches of this catchment and overall, c. 3.6 km² of the Site is located within this catchment.
- 10.104. The north-western extent of the Site (c. 0.36 km²) is located within the Killagan Water (UKGBNI1NB030302212) which has an overall catchment of area 25 km². A small section (c. 0.012 km²) of the Site is located within the upper reaches of the Clogh River catchment (UKGBNI1NB030308211) which has an overall area of 65.3 km². Cloghmills Water, Killagan Water and Clogh River form part of the wider River Maine catchment which discharges to Lough Neagh c. 42 km south of the Site.
- 10.105. At the north and north-eastern extent of the Proposed Development, the NIEA River Water Body dataset shows c. 0.013 km² of the Site boundary is located within the River Bush (Altnahinch) (UKGBNI1NE040405128) catchment, and c. 0.07 km² located within River Bush (Ballyhoe) (UKGBNI1NE040405127) catchment. The overall areas of these catchments are 15.1 km² and 40.1 km², respectively. The River Bush discharges to the North Channel at Bushfoot Strand, Portballintrae c. 40 km north-west of the Site.

Plate 10-8: Watersheds and NIEA Waterbodies



10.106. Internal site drainage on elevated parts within the Preliminary Site Boundary comprises headwaters of minor drains, peat drainage, and artificial trackside drains. More significant watercourses are sited at lower elevations within the centre and west of the Site. Detailed site hydrology identified following several walkovers, tracing surveys, and desktop analysis of flow routes and catchments based on height data is shown on Figure 10.1: Site Hydrology.

Sub-catchments / Watersheds

10.107. For purposes of differentiation of effects and consistency with associated assessments (i.e., Chapter 9 - Fisheries), hydrology of the Site can be split into 13 no. sub-catchments which discharge to the Cloghmills Water, Killagan Water and River Bush catchments. Those sub-catchments / main internal streams are shown on Figure 10.4.

Aghanageeragh River

10.108. The Aghanageeragh River is the significant watercourse within the Preliminary Site Boundary. It drains, in a south-westerly direction, the main area of the Proposed Development where surrounding land use is a mixture of rough grazing by cattle and sheep, and blanket bog. Within the survey boundary the watercourse exhibits a varied morphology. In the lower reaches the watercourse has steep incised banks, fast flow with pebbles, cobbles and boulder-sized material in the channel. It has a meandering planform, with channel widths >2m and a varied morphological flow regime of riffles, runs and occasional deep long pools.

- 10.109. The upper reaches are characterised by a meandering planform with shallower banks, narrower channel (c. 1 - 1.5m) and slow flows. Channel morphology in the upper reaches consists of silts, gravels, and pebbles.
- 10.110. The Fisheries & Aquatic Ecology assessment (Chapter 9) suggests that the lower reaches (dominated by boulder and cobble) are good quality salmonid nursery habitat. It notes the upper reaches exhibit good habitat with high potential for supporting trout.

Flisk Tributary

- 10.111. This watercourse drains a small area in the north-east of the Preliminary Site Boundary of mainly blanket bog, initially flowing north before flowing north-west beyond the boundary where it runs parallel to the Altnahinch Road. This headwater stream has been diverted from its original path; it previously crossed beneath the road via a culvert to join the upper River Bush amongst plantation forestry but now flows through a series of culverts into the Flisk Burn approximately 2 km downstream. Thereafter, the Flisk Burn joins the Bush River after a further 2.5 km.
- 10.112. The stream is initially very narrow and cuts through steep sided peat banks where it flows over cobble substrate within the Preliminary Site Boundary. The Fisheries & Aquatic Ecology assessment (Chapter 9) suggests the stream is steep with good flow and a mixture of salmonid nursery habitat.

Aghanageeragh Tributary - 1

- 10.113. This minor watercourse is a small left bank tributary (c. 0.5 m wide) of the Aghanageeragh River located in the southern part of the survey boundary. The upper part of the watercourse is formed by a series of small drains before flowing west / south-west downstream of the Site. It is crossed by a farm track approximately 300m downstream of the survey boundary. The watercourse drains an area of rough grazing and 'rushy' pasture and is incised above the farm track. The banks are poached by cattle and sheep although the depth is good with moderate flows and a substrate of coarse sand, silt and pebbles. Fisheries potential here is low. Below the farm track, the channel is subject to heavy livestock poaching and appears "drain-like". Substrate is mainly fines with occasional cobbles and boulder. The Fisheries & Aquatic Ecology assessment (Chapter 9) notes that fisheries potential is low throughout the watercourse.

Aghanageeragh Tributary - 2

- 10.114. This minor watercourse is a very small left bank tributary (c. 0.2 m wide) of the Aghanageeragh River located in the southern part of the survey boundary draining an area of heathland. The channel is vegetated throughout its length with silts and fines noted. It is not assessed as part of the Fisheries & Aquatic Ecology assessment (Chapter 9); therefore, it is considered to have limited fisheries potential.

Aghanageeragh Tributary - 3

10.115. This watercourse is a left bank tributary of the Aghanageeragh River located in the southern part of the survey boundary draining an area of heathland. The channel width is uniform throughout (c. 0.3m) with steep incised and heavily vegetated channel and banks. The channel is relatively straight inferring it has been artificially created to improve drainage in this section of the Site. Review of historic mapping suggests it has existed in this form since the 1800s. Another small tributary (heavily vegetated and shallow channel) enters the watercourse from the north. Neither are assessed as part of the Fisheries & Aquatic Ecology assessment (Chapter 9); therefore, both are considered to have limited fisheries potential.

Aghanageeragh Tributaries - 4, 5, 6 & 7

10.116. These watercourses are a left bank tributaries of the Aghanageeragh River located in the central section of the survey boundary draining an area of heathland. The channels are incised with sinuous planforms. Their substrates are noted to have material of pebbles and cobbles sizes through their reaches. They are not assessed as part of the Fisheries & Aquatic Ecology assessment (Chapter 9); therefore, they are considered to have limited fisheries potential.

Aghanageeragh Tributary - 8

10.117. This watercourse is a left bank tributary of the Aghanageeragh River located in the eastern part of the survey boundary draining an area of heathland. The channel width is uniform throughout (< 0.3m) with steep incised and heavily vegetated channel and banks. The channel is relatively straight inferring it has been artificially created to improve drainage in this section of the Site. Review of historic mapping suggests this occurred in the latter half of the 1800s.

10.118. It is not assessed as part of the Fisheries & Aquatic Ecology assessment (Chapter 9); therefore, it is considered to have limited fisheries potential.

Aghanageeragh Tributary - 9

10.119. This watercourse is a right bank tributary of the Aghanageeragh River located in the western section part of the survey boundary originating in an area within the existing Gruig wind farm. It flows through an area of heath and grassland. The substrate is noted to have material of pebbles and cobbles sizes through the reach and the channel is incised with steep banks. It is not assessed as part of the Fisheries & Aquatic Ecology assessment (Chapter 9); therefore, it is considered to have limited fisheries potential.

Aghanageeragh Tributaries - 10, 11, 12 & 13

10.120. These watercourses are right bank tributaries of the Aghanageeragh River located in the central section of the Preliminary Site Boundary draining the southern slopes of Slievenahanaghan. The channels are narrow and heavily vegetated flowing through heathland and grasses. They are culverted under the access track of the

existing Gruiq wind farm. They are not assessed as part of the Fisheries & Aquatic Ecology assessment (Chapter 9); therefore, they are considered to have limited fisheries potential.

Skerry Hill Drain

10.121. This watercourse drains the south-western flanks of Skerry Hill. It has steep cut banks (c. 1m high) with uniform bed width of c. 0.5 m and is heavily vegetated throughout. It is not assessed as part of the Fisheries & Aquatic Ecology assessment (Chapter 9); therefore, it is considered to have limited fisheries potential.

Killagan Eastern Tributary

10.122. The upper part of the Killagan Eastern Tributary is formed by a series of small drains before flowing west/ south-west downstream of the Preliminary Site Boundary. The stream is narrow (c. 0.5 - 0.7m wide), shallow, and relatively steep with heavy bank poaching by sheep. Another small tributary entering the watercourse from the south is incised with high levels of peat bank erosion and collapse. The bed is a mixture of boulder, cobble, pebble and coarse fines. The Fisheries & Aquatic Ecology assessment (Chapter 9) suggests the watercourse exhibits poor quality salmonid habitat and is unsuitable for trout.

Surface Water Quality

10.123. The following section is intended to provide a qualitative appraisal of existing surface water quality in those catchments the Proposed Development lies within.

10.124. Following the publication of the Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015 waterbodies are given a classification based on annual average / percentile results from several individual monitoring stations.¹⁰

10.125. The WFD classification is a combination of chemical, biological and hydromorphological elements; whereby, the overall status is the lowest of the combined constituents.

10.126. Approximately 86% of the Preliminary Site Boundary is located within the Cloghmills Water catchment, approximately 8.5% is within the Killagan Water catchment, and 0.5% within the Clogh River catchment. These watercourses ultimately discharge in the River Maine catchment and on to Lough Neagh.

10.127. Approximately 3% of the Preliminary Site Boundary is located within the River Bush (Altnahinch) catchment and 2% in the River Bush (Ballyhoe) catchment. The River Bush ultimately discharges to the North Channel (Irish Sea).

¹⁰ The European Water Framework Directive (2000/60/EC) has been transposed into Northern Ireland regulations through The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. The Water (Amendment) (Northern Ireland) (EU Exit) Regulations 2019 ensures that the Water Framework Directive (as transposed) and the various supporting pieces of water legislation continue to operate here after 1 January 2021 (<https://www.daera-ni.gov.uk/articles/water-framework-directive>)

10.128. The status of the receiving river waterbodies is summarised in the table below.

Table 10.11: River Water Body Status

River Waterbody	2018 Status	2021 Target	2027 Target
Cloghmills Water UKGBNI1NB030302234	Good	Good	Good
Killagan Water UKGBNI1NB030302212	Good	Good	Good
Clogh River UKGBNI1NB030308211	Good	Good	Good
River Bush (Altnahinch) UKGBNI1NE040405128	Moderate Ecological Potential	Good Ecological Potential	Good Ecological Potential
River Bush (Ballyhoe) UKGBNI1NE040405127	Good	Good	Good

10.129. Cloghmills Water (including Aghanageeragh River) and Bush River Upper were designated under the WFD as Freshwater Fish Directive protected areas due to the presence of economically significant species. The Directive 2006/44/EC has since been revoked, however NIEA:WMU continues to recognise them as protected areas containing economically significant species.

Project Specific Water Quality Assessment

10.130. In addition to a review of water quality data held by statutory bodies, independent water quality monitoring has been undertaken as part of this assessment to provide baseline water quality standards of water features within the Preliminary Site Boundary prior to any development.

10.131. Sampling was carried out on the 7th March 2019. On the morning preceding sampling and during sampling the prevailing weather conditions were dry. The baseline assessment collected and assessed representative water samples from watercourses draining the Site for a range of physio-chemical parameters. Monitoring locations are shown on Figure 10.2.

10.132. Water quality results were assessed for compliance against key parameter limits outlined in the Water Framework Directive (2000/60/EC), transposed in Northern Ireland through the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017, and the Directive 2013/39/EU is transposed through the Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015. In terms of the key indicators of water quality and / or pre-existing pollutants, chemical results obtained showed:

- pH results were within the naturally expected range and classified 'Moderate' to 'High', based on WFD standards for this parameter;
- Dissolved oxygen levels are classified as 'High' under the WFD;

- Orthophosphate levels were below the LOD at all sample locations;
- TSS and Turbidity concentrations were found to be within the expected range under normal conditions;
- BOD results signified 'High' water quality in all locations based on WFD classifications; and
- Alkalinity concentrations were found to be within the expected range under normal conditions.

10.133. Water quality for watercourses draining the Site is generally consistent with the WFD status of 'Good' or 'Moderate (Ecological Potential)' for the downstream waterbodies outlined previously. Therefore, preservation of the baseline water quality results within the upper reaches would be important at a local level to preserve the downstream NIEA classifications.

Surface Water Abstractions

10.134. In order to allow assessment of potential for the Proposed Development to affect surface water abstractions in the catchment at and up to 5 km downstream of the Site, an initial screening review of the NIEA WMU Water Information Request Viewer was carried out.

10.135. A 500 m screening radius has also been applied to the Site boundary. No surface water abstractions were identified.

10.136. Within the survey boundary, a well has been installed into the channel of a field drainage ditch. Runoff from the upper catchment (agricultural rough grazing) is intercepted by the drainage ditch and routed to the well. In accordance with NIEA guidance for water features used for drinking water (public or private), a 250 m buffer has been applied to the location of the well. All proposed infrastructure is sited outside this buffer.

Northern Ireland Water Infrastructure

10.137. Altnahinch Dam is located approximately 1.5 km north of the Preliminary Site Boundary. The dam takes water from the Bush River (Altnahinch) catchment which is designated as Drinking Water Protected Area (DWPA) under the WFD (Altnahinch - UKGBNIPA1_10011).

10.138. NIW Information Management Unit has confirmed that the offtake is operational and has provided guidance in relation to measures that it would prefer to see implemented to ensure protection of the quality and quantity within the upstream catchment draining to the abstraction location.

10.139. The area of the DWPA / Bush River (Altnahinch) catchment within the application boundary is c. 0.13 km². This constitutes c. 0.8% of the wider Bush River (Altnahinch) catchment contributing to the abstraction location.

Flood Risk

10.140. The Proposed Development was assessed in relation to Flood Maps (NI) and similar DfI Rivers datasets, which provide an indication of predicted flood extents for a 1% Annual Exceedance Probability (AEP) fluvial flood and 0.5% AEP Surface Water Flood, and for reservoir inundation. DfI Rivers have also been consulted regarding flooding; the response (Ref: IN1-19-246) is included in Technical Appendix 10.5.

Historical Flood Extents

10.141. Flood Maps (NI) indicates no recorded incidents of historic flooding in the vicinity of the Site. In their consultation response, DfI Rivers confirmed they held no record of floods on or immediately downstream from the proposed Site.

Fluvial Flooding

10.142. Out of bank flooding in the upper reaches of Aghanageeragh River is identified on the Flood Maps (NI) indicative predicted 1 % AEP fluvial (river) flood extents.

10.143. A site-specific flood modelling exercise has been undertaken to better define flood risk to the land, and supersedes data shown on the indicative flood map. The outcomes of that assessment are detailed in a Flood Risk and Drainage Assessment, refer to Technical Appendix 10.2 - Flood Risk & Drainage Assessment and mapped on Figure 10.1.

Pluvial Flooding

10.144. Surface water flooding is predicted by the indicative 0.5 % AEP surface water flood extent mapping at a limited number of discrete locations within the survey boundary, and generally coincides with the headwaters of watercourses. Surface water flooding coinciding with watercourses is more appropriately assessed as fluvial and would be superseded by the site-specific flood modelling described above.

10.145. Surface water flooding would not constrain development but would inform design of the infrastructure with a view to ensuring that surface water flow paths are maintained, and a suitable standard of protection if afforded to any development adjacent to areas predicted to be affected by flooding.

Reservoir Flooding

10.146. The risk of reservoir flooding was assessed using Reservoir Flood Mapping for Emergency Planning¹¹, which shows the indicative area that may flood from an uncontrolled release of water from all possible dam failure scenarios. The Proposed Development is unaffected.

¹¹ DfI Rivers (2017) Reservoir Flood Mapping for Emergency Planning. Available at <http://riversagency.maps.arcgis.com/apps/webappviewer/index.html?id=006872dcdd7b43b89d352e0b93190e67>. Accessed 31/03/2022

Summary

10.147. Flood extents are shown on Figure 10.1: Site Hydrology. Mitigation of flood risk is described in subsequent sections and is addressed in detailed in Technical Appendix 10.2 - Flood Risk & Drainage Assessment in the format normally requested by DfI Rivers in consultation.

Eco-Hydrology & Water Dependent Habitats / Species

10.148. Consideration has been given to local surface water and groundwater dependent ecosystems and habitats dependent on, or prone to change due to variation in surface water and groundwater patterns on the Site within Chapter 6: Vegetation and Peatland. No further consideration is given to those aspects within this chapter.

Fisheries

10.149. Detailed consideration has been given to fisheries on and downstream of the Site within Chapter 9: Fisheries and Aquatic Ecology.

10.150. The criteria by which Chapter 9 assigns sensitivity / importance of receptors is not as per those outlined in Table 10.4 of this chapter. Therefore, the criteria provided in Chapter 9 should be consulted to provide context on the points listed below. That assessment, when considering a wider survey boundary, has determined that:

- Aghanageeragh River is of very high sensitivity with trout present.
- Aghanageeragh Tributary (named Aghanageeragh Tributary - 1 in this chapter) is of high sensitivity with trout present.
- Magheraboy Burn is of very high sensitivity with trout present.
- Tullykittagh Water is of very high sensitivity with trout present.
- Flisk Burn Tributary is of very high sensitivity although no fish present.
- Killagan Eastern Tributary is of high sensitivity. Trout locally absent but present downstream at low abundance.
- Main downstream receiving watercourses (Killagan, Cloghmills, Clogh, Upper Bush) are of very high sensitivity with salmon and trout present with potential for lamprey.

10.151. Further details, including figures of watercourses downstream of the Site, are included in Chapter 9: Fisheries and Aquatic Ecology and associated appendices.

Aquaculture

10.152. DAERA Fisheries Inspectorate confirmed no aquaculture sites in the vicinity of the Site and, therefore, is not considered further in this assessment.

Water Framework Directive - Fisheries Classification

10.153. Cloghmills Water and Bush River Upper were given status under the now revoked Directive 2006/44/EC 'on the quality of fresh waters needing protection or

improvement in order to support fish life'; more commonly known as the Freshwater Fish Directive.

10.154. NIEA Water Management Unit data, on the NIEA River Basin Planning Mapviewer¹² designates this river as protected areas containing economically significant species.

Designated Sites

10.155. Designated sites such as Special Areas of Conservation (SAC), Special Protected Areas (SPA), Areas of Special Scientific Interest (ASSI), Ramsar sites, and similarly designated environmental receptors, have been identified as part of this assessment. Sites were identified utilising the datasets available on the NIEA Natural Environment Map Viewer and Join Nature Conservation Committee¹³ website and were screened to identify:

- Hydrological sites with sensitivities to the water environment that are connected to the Site, i.e. sites which lie in the upstream catchment of or are on downstream streamlines of the watercourses draining the Site;
- Terrestrial sites of geological importance on or immediately adjacent to the Site.

10.156. Only sites meeting these criteria are discussed further in this assessment. Terrestrial sites with ground or surface water-dependent habitats are considered in **Chapter 6: Vegetation and Peatland**. Terrestrial sites with water-related reliance for birds (i.e., Antrim Hills SPA) are not considered further within this assessment and are considered in **Chapter 8: Ornithology**.

Table 10.12: Initial Screening of Designated Sites

Name	Designation	Reason for designation and qualifying features relevant to this assessment	Distance from Preliminary Site Boundary at Nearest Point (km)	Considered further and rationale.
Slieveanorra and Croaghan	ASSI	This area is of special scientific interest because of its peatland flora and associated fauna - the is a largely intact blanket bog.	1.8 km north-east	No: Although located in the Bush River (Altnahinch) catchment, the ASSI is hydrologically discrete from the Proposed Development.

¹² <https://www.daera-ni.gov.uk/articles/daera-map-viewers> (Accessed 31/03/2022)

¹³ Joint Nature Conversation Committee (2016) Protected Sites. Available at: <http://jncc.defra.gov.uk/page-4> . Accessed 31/03/2022

Name	Designation	Reason for designation and qualifying features relevant to this assessment	Distance from Preliminary Site Boundary at Nearest Point (km)	Considered further and rationale.
Glarryford	ASSI	The Glarryford area is of importance in understanding the recent glacial history of Northern Ireland containing a deglacial landform assemblage developed in an unusual environment.	6.5 km south-west	Yes: The designated site is hydrologically connected to the Proposed Development site.
Runkerry	ASSI	Runkerry ASSI is a beach system of international importance demonstrating beach states from dissipative to reflective.	27 km north-west	Yes: The designated site is hydrologically connected to the Proposed Development site.
Lough Neagh	ASSI	The area is of special scientific interest because it is a large shallow eutrophic lake occupying a down warp in Tertiary basalt with its associated physical, chemical and biological characteristics.	29 km south-west	Yes: The designated site is hydrologically connected to the Proposed Development site.
Lough Neagh & Lough Beg	Ramsar	The site qualifies under Criterion 1 of the Ramsar convention by being the largest freshwater lake in the United Kingdom.	29 km south-west	Yes: The designated site is hydrologically connected to the Proposed Development site.

Baseline Summary and Receptor Sensitivities

10.157. The baseline assessment identified the receptors which have the potential to demonstrate a sensitivity to the Proposed Development; the receptors and their scale / sensitivity value are summarised in Table 10.13. Sensitivity is based on the baseline assessment and determined in accordance with the rationale previously described in Table 10.4.

Table 10.13: Receptor Sensitivity

Type	Receptor	Scale / Sensitivity	Rational
Geological	Soils / Drift Deposits	Local / Low	Site with little geological value or of widespread local abundance. Loss of the land on the Site would not be considered significant in the context of the region.

Type	Receptor	Scale / Sensitivity	Rational
Hydrological	On-site significant watercourses (Aghanageeragh River / Cloghmills Water)	National / High	Cloghmills Water (including Aghanageeragh River) has a WFD status of 'Good'. It is also denoted as a designated salmonid river. The fisheries assessment highlights the river as having trout present. Fluvial flooding is predicted on Aghanageeragh River with FMNI flood extents indicating it an active floodplain area along its reaches within the Preliminary Site Boundary.
	On-site significant watercourses (Tributaries of Aghanageeragh River)	Local / Low	Within the Preliminary Site Boundary, several tributaries of Aghanageeragh River, and Killagan Eastern Tributary, are considered significant in terms of the contributing catchment areas. However, the current physico-chemical conditions of these water features (within the survey boundary) results in limited / negligible fisheries potential.
	On-site Minor Drainage	Local / Low	All other on-site watercourses are generally characterised by vegetated overgrown field drains / cut peat drainage / trackside drainage and have low fisheries and other ecological potential and have no other use of significant value.
	Off-site significant watercourses Bush River (Altnahinch)	National / High	The watercourse feeds a public water supply abstraction point located approximately 1.5 km downstream of the Site. Its headwaters are located in the eastern section of the Site.
	Off-site designated sites (Glarryford ASSI and Runkerry ASSI)	National / High	Designated sites with national and internal importance are hydrologically connected to the Proposed Development Site.
	Off-site designated sites (Lough Neagh & Lough Beg Ramsar / SPA)	International / Very High	
	Hydro-Geological	Private Water Supply	Local / Low
Bedrock Groundwater / Aquifers		Local / Low	Aquifer with limited productivity and no significant abstractions. Potential for discrete local supply sources.
Shallow Groundwater / potential superficial Aquifers		Local / Low	No substantial superficial aquifers present at the site.

Type	Receptor	Scale / Sensitivity	Rational
Terrestrial	The Development	Local / Low	Proposed infrastructure prone to damage including potential for water damage of electrical infrastructure in a flood event; potential for structural damage of access infrastructure in the event of hydraulic incapacity.
	Buildings	Local / Low	The Site is shown to be within the radon affected area. Any buildings located within this area would be subject to inclusion of protection measures.

Predicted Environmental Effects

Preamble

10.158. This section outlines and describes the potential likely effects of the Proposed Development on hydrological patterns and water quality on the Site, and in the downstream environment, that have the potential to arise in the absence of mitigation. The following phases of the Proposed Development are considered;

- Windfarm construction;
- Windfarm operation and maintenance;
- Wind farm decommissioning

10.159. During each phase some of the activities undertaken have the potential to modify hydrological regimes and affect water quality on the site and the downstream environment. Due to the nature of the Site and work undertaken, the hazards and associated effects will be similar for each phase, with an increased likelihood during the construction phase.

Components Contributing to Predicted Environmental Effects

Activities Associated with Construction, Operation and Decommissioning

10.160. During construction, the Proposed Development comprises construction of infrastructure which would be likely to cause change to local hydrology and water quality, comprising earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with construction of temporary compounds, turbine foundations, building foundations, access tracks, and cable trenches.

10.161. The operational phase of the Proposed Development (the designed operating life estimated to be 35 years) would cause runoff from access tracks, turbine bases and hard standings via drainage features, would require onsite welfare facilities with associated waste, includes the provision of battery energy storage systems (BESS) (i.e., 22 no. lithium ion battery energy storage containers), and potentially

necessitate storage and use of oils, fuels and lubricants on-site, each with the potential to cause adverse effects on the environment without adequate avoidance, design, or mitigation measures.

- 10.162. Activities associated with the decommissioning phase at the end of the operating design life are generally as per those for the construction phase i.e., earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with removal of turbines, buildings, hard standing areas, and buried structures followed by reinstatement and restoration of ground cover.

Likely Significant Effects

- 10.163. The likely effects of the Proposed Development on the surface and ground water environment prior to any avoidance, careful design, or additional mitigation are summarised in the following sections.

Changes in Runoff and Flow Patterns

- 10.164. New temporary and permanent impermeable surfaces, as well as temporary compaction of soils due to construction phase plant and site traffic movements, may cause increased rate and volume of surface water runoff due to the reduced permeable area on the Site through which rainfall can infiltrate. Impermeable surfaces will cause an increased “flashy” response to rainfall events, with increased water velocities in new and existing drainage features. As a consequence, the effect would be likely to cause temporary or permanent increases in surface water runoff rates and volumes, leading to increased flood risk and increased effects of erosion and scour in downstream watercourses. Similarly, loss of permeable areas is likely to cause reduced potential for groundwater recharge affecting aquifers.
- 10.165. Significant excavations, in particular linear works such as access tracks, drainage ditches and cable trenches, are likely to act as barriers to runoff resulting in ponding, or development of preferential flow routes, diverting surface water away from its current route. Consequently, temporarily or permanently redirected surface water flows may starve areas where water currently flows, or cause flooding of areas where water currently does not flow.
- 10.166. Works to existing surface watercourses (such as installation of culverts or bridges) have the potential to cause an obstruction to flows and may alter conveyance capacities, potentially causing temporary or permanent restrictions in watercourse channels, affecting upstream water levels and increasing flood risk.

Changes to Water Quality

Sediment / Suspended Pollution

- 10.167. Temporary activities required to construct windfarm infrastructure would require excavations, ground disturbance (due to excavations and plant and vehicle movements), stripping and excavation of peat and soils, and temporary spoil

deposition. Exposed soils have potential to release fine sediments in surface water runoff or where excavations come in contact with surface watercourses.

- 10.168. Construction of hardstanding areas and access tracks would require importing, handling and placement of aggregate; which would have the potential to release fine sediments into surface water runoff. The proximity of such works to surface watercourse will increase the risk of pollution to the wider water environment.
- 10.169. Temporary surface water or shallow groundwater gathering in significant excavations has the potential to be significantly polluted due to contact with excavated surfaces and aggregates. Discharge of intercepted contaminated groundwater during passive or active dewatering has the potential to pollute the wider water environment if not disposed of correctly.
- 10.170. Silt and suspended sediments and debris entering watercourses would have the potential to adversely modify stream morphologies, smother habitats and harm aquatic flora and fauna.

Chemical Pollution of Surface Water and Groundwater

- 10.171. Temporary storage and use onsite use of chemicals, fuels and oils associated with construction activities, and use of wet concrete and other cementitious material, may result in potentially harmful substances entering the water environment. Possible pathways to hydrological receptors may include; accidental spillages, improper transport and refuelling, or inappropriate storage and disposal procedures, by gradual leakage or single failure of storage tanks or refuelling mechanisms. Temporary presence of alum-based flocculants (used to remove suspended solids from surface water) has the potential to enter surface waters if unregulated.
- 10.172. During the operational phase of the Proposed Development, the permanent presence of oils and lubricants associated with turbine maintenance has a similar potential to enter and pollution the water environment.
- 10.173. Wastewater effluent from temporary construction phase welfare facilities and permanent substation building welfare facilities has the potential to enter surface water or shallow groundwater.
- 10.174. During the operational phase of the Proposed Development, accidental fire at the BESS facility on site may potentially risk contamination to land and water from release and fallout of gases and particulates.
- 10.175. As a consequence, chemical pollutants from construction activities, storage of materials, or from coliforms from wastewater entering watercourses have the potential to adversely affect water quality, with associated effects to potable supplies, fish and aquatic ecology.

Design Evolution: Constraints and Avoidance Measures

- 10.176. The magnitude and significance of those effects determined as being likely to be a consequence of the Proposed Development can be substantially reduced or eliminated through a proactive design approach to avoid identified baseline receptors, with particular emphasis in relation to fishery habitats.
- 10.177. This section identifies the avoidance measures imposed and outlines the resulting magnitude and significance of residual effects. Additional mitigation is then specified to further reduce or eliminate remaining residual effects.
- 10.178. Detail of the design evolution highlighting considerations made with regards to hydrology and water quality management is presented in **Chapter 3: Design Evolution & Alternatives**.
- 10.179. The Proposed Development layout has evolved so that the design avoids conflict with the water and geology environment, as demonstrated in the following sections.

Water Features

- 10.180. As a precautionary measure and in accordance with the guidance previously advocated by NIEA Natural Environment Division, buffer (exclusion) zones to valuable water features are adopted as constraints to built development, and for incorporation as a construction buffer in relation to permissible land uses in proximity to watercourses.
- 10.181. Impact avoidance and design of mitigation have been developed in accordance with legislation and best practice guidance outlined in **Table 10.1** and paragraphs 10.35 and 10.36, respectively. Mitigation for all water features aims to preserve existing water quality ratings as a minimum.
- 10.182. Establishment of intact vegetated buffer zones between infrastructure and water features allows:
- Protection of water quality by filtering runoff within riparian vegetation before it enters the watercourse;
 - Space for natural fluvial processes such as channel shape and planform adjustment which help restore and maintain the natural dynamic balance of river systems and associated habitats;
 - Establishment of vegetation to stabilise banks and reduce soil erosion;
 - Access for the maintenance and inspection of watercourses and for dealing with any residual risk of pollution incidents; and
 - Habitat for plants and animals to form part of a habitat network.
- 10.183. The sensitivity of the water feature and the associated degree of protection it is therefore afforded, is primarily dependent on:
- Environmental designations on the water feature or downstream environment;

- Fisheries or ecological potential in the water feature or in the downstream environment;
- Water feature morphology (natural substrate or artificial channel, soil/ground type);
- Water feature size, capacity to convey water and hydrological potential (flows) - proportionate to the size of the catchment drained by the water feature;
- Nature and topography of the surrounding land, i.e. wet, poorly drained soils and steep slopes (>10°) would require greater protection;
- Sensitivity of the water feature to particular types of pollution, i.e. silts / nutrient enrichment / chemical pollution.

10.184. The rationale adopted in relation to water feature buffers is informed by NIEA Natural Environment Division guidance, which has typically, in response to similar development, advised no infill, disturbance, construction activity or storage of materials within 50 m of natural watercourses. NIEA has indicated that justification for buffer zones applied is the responsibility on the Applicant, while any rationale for reducing the scale of the buffer zone must be demonstrated requiring the submission of detailed information using a number of additional factors e.g. soil typology, topography, size of watercourse and climatic conditions.

10.185. NIEA, in Practice Guide to EIA and Planning Considerations, outlines buffer zones for water features as per the below table;

Table 10.14: NIEA Buffer Zones for Water Features

Width of Watercourse	Width of Buffer Strip
Surface Watercourse	10 m (minimum detailed in GGP 5)
Water Feature (surface watercourse, spring, well, borehole used for Drinking Water - public or private)	250 m
Water Feature (surface watercourse, spring, well, borehole not used for water supply - but could provide preferential flow pathway)	50 m
Designated Wetland	250 m

10.186. Additional industry guidance relevant and similar in nature to the construction and operational activities for the Development has been reviewed and taken into account:

- Guidance for Pollution Prevention (GPPs): GGP5-Works and Maintenance in or near water;
- Pollution Prevention Guidance (PPGs);

- Best practice in relation to forestry works (in particular on upland and peat sites) recommends riparian buffer reflecting stream size, with buffers from 5 -20 m;
- Best practice in management of sediments and runoff from exposed ground in relation to agriculture recommends buffers of up to 10 m in order to protect surface waters from pollution by suspended solids, and nutrient enrichment by organic/inorganic fertilisers.

10.187. Water features considered significant for the purposes of the Proposed Development are shown on Figure 10.1 and drainage drawings within Technical Appendix 10.1: Surface Water Management Plan.

10.188. Significance has been determined following desktop studies and verified by site walkovers, with all streamlines subject to catchment and flow analysis by GIS -flow-raster accumulation analysis.



Significant watercourses

10.189. Significant watercourses identified and requiring application of a buffer to the proposed turbines and infrastructure are largely as per OS close scale vector mapping and were subject to ground truthing on Site.

10.190. A 50 m buffer has been applied to the significant watercourses identified in the baseline assessment, i.e., significant where catchment within Site is >0.25 km².

10.191. Examples of the significant watercourses on the site are shown on the following Plate 10-9.

Plate 10-9: Significant Watercourse Examples

Location	Lower catchment of Aghanageeragh River (within context of survey boundary)	Upper catchment of Aghanageeragh River (within context of survey boundary)
Grid Ref.	311244,419931	312420,421110
Photo Ref.	IMG_20190307_121918	IMG_20190307_144558
		

Minor Watercourses

- 10.192. Minor watercourses were given buffers of 10 m based on SEPA and NatureScot (previously SNH) guidance and represent tributary channels on the Site where the catchment area was less than 0.25 km². Many are the sources / upper reaches of the more identifiable downstream channels and appear as grass / heather-covered depressions in the land. They are distinct and easily identifiable on aerial imagery but often harder to differentiate from the surrounding land at ground level during dry conditions. Others are more defined channels cut into peat.
- 10.193. Minor watercourses will either be protected on their present alignment, or where works or diversions are required then this shall be as enabling work adhering to strict procedures for working in or near water (described later in this assessment) with the proposed alignment then protected from the development.
- 10.194. Examples of minor watercourses on the site are shown on the following Plate 10-10.

Plate 10-10: Minor Watercourse Examples

Location	Minor watercourse draining from the existing track towards the valley floor	Minor watercourse draining the south-west section of the survey boundary.
Grid Ref.	312751,421196	311841,419411
Photo Ref.	IMG_20190226_100454	IMG_20190226_121820
		

Other Drainage Features

- 10.195. All other minor drainage features (mapped or otherwise) comprising; dry or partially dry agricultural ditches, ephemeral drains, dry track drainage, grips, peat cuttings or other drainage features, are considered insignificant in the context of site hydrology and habitat potential.
- 10.196. Such features would be managed during and following construction by means of diversion and/or temporary blocking (with prior settlement features upstream of and outwith the drainage channel), using filtration check dams or similar, in order to prevent residual indirect potential pollution downstream caused by connectivity to downstream waterways.

Adopted Watercourse Buffers

- 10.197. The significance of watercourses is shown on Figure 10.1: Site Hydrology. Conservative minimum hydrological buffer zones are adopted and implemented as shown in Table 10.15. The buffer widths adopted exceed those recommended in industry guidance; the allowance provided gives due consideration to the nature of peat soil conditions on the Site, antecedent weather, moisture and base flow and

a significantly increased factor of safety in all instances given the significance of fishery interests within downstream catchments.

Table 10.15: Minimum Adopted Hydrological Buffer Zones

Water Features	Minimum Width of Buffer Strip
Significant Watercourses (catchment >0.25 km ²)	50 m
Minor Watercourses (catchment <0.25 km ²)	10 m
Other Drainage Features	Managed on-site by diversion / temporary blocking in accordance with GGP's and PPG's.

- 10.198. The buffer widths adopted meet the criteria as recommended in industry guidance. Discretion has been adopted where applying buffers to 'other drainage features' based on observed site conditions and using professional judgement. Given the number and insignificance of ephemeral features, peat drains, and artificial drainage features (in the context of site hydrology and habitat potential), it is not practical to apply buffers to all 'surface water drains' (as per GPP5). Protection of other drainage features would be implemented via observational design at the time of implementing the development to suit site conditions and would include appropriate buffer strips or other appropriate temporary measures. Such an approach is routine and well understood and managed by the onshore wind development sector.
- 10.199. Buffers are indicated on Surface Water Management drawings included at Technical Appendix 10.1.
- 10.200. New infrastructure is designed to lie outwith the 50 m hydrological buffer zones for significant watercourses in all instances. This includes those elements of the works associated with significant earthworks and greatest potential for spillage or leakage of chemical pollutants, i.e.:
- All turbine bases, crane pads and associated working areas;
 - Temporary and permanent spoil storage areas;
 - Enabling works compound, substation and construction compound, fuel and chemical storage areas and any other platforms;
 - Spoil movements and earthworks (placement of donor turves and contour ploughing) associated with proposed habitat enhancement and ecological mitigation.
- 10.201. New permanent access tracks are to lie outside of buffer zones; with the exception of unavoidable crossings of water features. Careful consideration has been given to the routing of access tracks in order to avoid / limit crossing of watercourses. Where crossings are proposed, appropriate design measures shall be incorporated

to control or reduce the potential effect of the Proposed Development on the receiving environment (refer to paras. 9.217 to 9.224).

- 10.202. For areas of proposed road widening on existing roads surrounding the Proposed Development, potential risk to water will be managed by complying with GPP5 and the principles for construction in or adjacent to water outlined in the site SWMP (Technical Appendix 10.1).
- 10.203. Temporary track infrastructure (such as temporary widening and turning heads) that may encroach into buffers shall be managed through the use of additional surface water management measures, discussed in paragraphs 9.233 through 9.243.

Abstractions

- 10.204. The proposed infrastructure layout within the Site is such that no development (tracks, turbines or other significant infrastructure) is sited within 250m of any known or potential potable water abstraction identified in the previous screening assessment. No further constraint is required.

Floodplains

- 10.205. All development, other than the access track at watercourse crossing to turbine T7, are located beyond the extents of the 1 % AEP indicative fluvial floodplain based on refined site-specific river modelling and flood mapping.
- 10.206. Pluvial flood extents noted along watercourses on-site (shown on **Figure 10.1: Site Hydrology**) generally coincide with the headwaters of watercourses. Surface water flooding coinciding with watercourses is more appropriately assessed as fluvial and would not pose an additional constraint.
- 10.207. Infrastructure is designed to ensure that conveyance of watercourse and surface water flooding is not impeded by means of providing drainage culverts / under track crossings where necessary.
- 10.208. Electrical infrastructure that would be susceptible to damage by floodwater is designed such that it does not have potential to be affected by fluvial (watercourse) or surface water flooding.
- 10.209. Areas of isolated surface water flooding generally coincide with source areas of on-site water features or isolated low points. Site drainage and culverts shall allow passage of local surface flooding as considered within **Technical Appendix 10.1: Surface Water Management Plan**, **Technical Appendix 10.2 Flood Risk & Drainage Assessment**, and accompanying drainage management drawings.

Designed Measures

- 10.210. Normal design measures associated with development of the type proposed are not considered "mitigation" in EIA terms, but are important in their effect of controlling or reducing the potential effect of the Proposed Development on the receiving environment. Such measures are outlined in the following sections.

Site Drainage Management and SuDS Design

- 10.211. The Proposed Development will adopt a surface water management plan / site drainage design using the principles of Sustainable Drainage, promoting the principles of onsite retention of flows and use of buffers and other silt removal techniques. All drainage related mitigation measures proposed will be encompassed by a robust and proven Sustainable Drainage System (SuDS) design which will be used to control drainage and silt management on the site.
- 10.212. Onsite drainage design will minimise modification and disruption of the existing natural hydrology by:
- Maintaining existing overland flow routes and channels. Existing natural flow paths lateral to access roads will be maintained through the use of piped crossings under road alignments at natural depressions and at regular intermediate intervals. The spacing of cross drains will be specified at detailed design stage;
 - Avoiding transporting rainfall runoff in long linear drainage swales by providing regular channel “breakouts”, whereby water is encouraged to flow overland, thus maintaining existing natural hydrological patterns;
 - Reducing surface water flow rates and volumes by attenuating runoff from tracks and hard standings “at source” by providing check-dams in swales, whereby the flow velocity and rate of discharge is artificially reduced to mimic natural properties;
 - Providing settlement ponds at turbine hard standing areas and other main surface water discharge locations, where runoff from significant new impermeable areas is treated and attenuated before being released overland;
 - All swales, crossings and other hydraulic features will be engineered to ensure that dimensions are suitable to convey predicted flows and so prevent build-up of surface water and / or flooding.
- 10.213. Drainage design will reduce chemical, silt and other suspended pollutant transport by providing a “treatment train” of two to three stages of pollutant removal to all surface water runoff, nominally by:
- Ensuring that drainage swales are designed to convey flows at a low velocity by using a wide, flat bottomed drain;
 - Providing settlement and filtration features in all linear drainage swales (check dams, filtration dams) to reduce flow velocity and encourage settlement;
 - Encouraging appropriate vegetation growth in the base of all linear drainage to provide additional filtration to flows;

- Providing settlement ponds at turbine hard standing areas and other key discharge locations in order to provide treatment to contaminated runoff prior to discharge;
- Discharging surface water runoff over undisturbed vegetated ground, hence allowing any remaining silts and other pollutants to drop out of flows before entering the watercourse (having the effect of polishing the runoff);
- Preventing the discharge of surface water runoff flows directly to existing watercourses or drainage. All discharges shall seek to be via SuDS and buffer zones which will act as a filter strip, allowing deposition of suspended solids and other pollutants;
- Providing settlement features in water channels downstream of areas of peat infilling and ditch blocking area proposed as part of habitat management and enhancement planning. Refer to **Technical Appendix 6.2** for full Habitat Management Plan (HMP) measures. Areas of ditch blocking are shown on Surface Water Management drawings included in **Technical Appendix 10.1: Surface Water Management Plan**.

10.214. Consideration specific to the proposed infrastructure elements are documented in the detailed site-specific drainage management / SuDS design - see Appendix 10.1: Surface Water Management Plan and accompanying drainage drawings.

Drainage at Upgraded Tracks

10.215. The infrastructure design includes the upgrading of sections of existing access track associated with the existing Gruig wind farm. As such, the proposed upgrade works (maintenance of existing running surface and associated drainage) will encounter the current track drainage which is locally significant in terms of drainage function.

10.216. In these instances, additional mitigation measures shall be deployed where necessary, including placement of temporary silt barriers (e.g., check dams) within retained and replacement drains. Additional mitigation is discussed further in paragraphs 10.249 through 10.252.

Watercourse Crossings

10.217. As noted previously, the number of watercourse and drainage crossings has been minimised through the principle of avoidance at the layout design stage. Proposals submitted in conjunction with this assessment indicate:

- 2 No. crossing of a significant watercourses.
- 11 No. crossings of minor watercourses.

10.218. Culverts will be designed to accommodate track crossings and minimise length of affected channel in order to comply with Revised PPS15 policy FLD4.

10.219. Hydraulic design of crossings will be undertaken as per the guidance and requirements provided in CIRIA C786 "Culverts, Screen and Outfall Manual" (or other standard as may be required by DfI Rivers in post-consent consultation), with primary parameters likely to include:

- Width of the culvert will be greater than the width of the active drainage channel;
 - Alignment of the culvert will suit the alignment of the drainage channel, i.e. preserve the existing direction of flow;
 - The slope of the culvert will not exceed the slope of the bed of the existing drainage channel.
 - Detailed design of crossings will assume a hydraulic capacity requirement of 1% Annual Equivalent Probability flow including factor for climate change as required by DfI Rivers Technical Flood Risk Guidance in relation to Allowances for Climate Change in Northern Ireland as a conservative measure. Detailed hydraulic design of culverts and similar structures post permission is normal and accepted practice for wind farms in Northern Ireland.
 - Fisheries shall be protected by adopting the guidance stated in Guidelines for Fisheries Protection during Development Works as published by Loughs Agency.
- 10.220. Culvert form is informed by the site-specific fisheries assessment (Chapter 9: Fisheries). In instances where fish passage is a requirement (which is limited to Aghanageeragh River (x1)), culverts will be designed to ensure that the channel bed and banks remain intact in order to preserve fisheries habitats and allow continued fish passage; i.e. the structure will be a bottomless culvert. Elsewhere culverts shall be of a closed conduit type.
- 10.221. Typical design drawings for a bottomless culvert and closed culvert have been provided as part of the planning application and are included as part of the Drainage Management Drawings within **Technical Appendix 10.1: Surface Water Management Plan**.
- 10.222. Consultation and approval will be sought from all relevant parties as required by the DAERA Surface Waters Alteration Handbook (November 2017), including and DfI Rivers in particular, at the pre-construction detailed design stage for all works in and affecting watercourses and drains, as per the requirements of Schedule 6 of the Drainage (Northern Ireland) Order 1973 and subsequent amendments.
- 10.223. While detailed design of minor watercourse crossings (comprising simple closed culverts) can satisfactorily be deferred post-consent of any planning application, a design of the crossing over the Aghanageeragh River has been undertaken to inform the **Flood Risk & Drainage Assessment (Technical Appendix 10.2)** as the crossing would otherwise have potential to impede a floodplain.
- 10.224. The resultant structures comprise clear span crossings of the significant watercourses, which have been demonstrated to ensure that the effect on flood conveyance is satisfactorily managed and would have no significant adverse effect on flood levels and flood extent within the Site and no adverse effect elsewhere.

Preliminary DfI Rivers approval has been sought for the significant watercourse crossings.

Radon

10.225. The Site is within an area of lowest elevated radon potential, where less than 1% buildings are above the action level. Radon protection measures are advised to be implemented for the permanent control building or as may be directed by the local Building Control office suitable to the nature of the proposed enclosed space.

BESS

10.226. The battery energy storage systems (BESS) comprise 22 no. lithium-ion battery energy storage containers. The storage containers are designed such that the batteries are within sealed units to ensure that a single cell thermal runaway will not propagate and result in multiple cell thermal runaways. This has been tested and confirmed in the UL9540A test (refer to Appendix 1.3). Therefore, the amount of potential pollutants will be limited to the gas vented from one cell but will be contained within the sealed unit limiting any potential impact to the wider environment (i.e., via fallout to land or surface waters and thereafter to groundwater).

Effect of the Proposed Development

10.227. Magnitude and likelihood of the potential environmental effects have been determined based on criteria outlined within paragraphs 10.46 to 10.52 taking into account the effect of avoidance measures and normal designed-in measures proposed and described in preceding sections.

10.228. The associated impact significance of these effects on the receptors affected (following the implementation of avoidance and design measures proposed) has been determined in accordance with the rationale described previously and the results are presented in summary **Table 10.16**.

Table 10.16: Potential Magnitude and Significance of Impacts to Receptors - Including Effect of Avoidance & Design

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
Soils / Drift Deposits (Local / Low)	Ground Movement / Instability	Low	Negligible	Unlikely	Not Significant	The Quantitative Risk Assessment within the Peat Slide Risk Assessment has concluded that peat slide risk is not significant.
On-site significant watercourses - (Aghanageeragh River / Cloghmills Water) (National / High)	Changes in runoff and flow patterns	Low	Moderate	Unlikely	Minor	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of significant watercourses within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	High	High	Likely	Major	Temporary short-term construction activities within watercourses would be likely to cause a significant but temporary fundamental change in water quality in watercourses on the Site.
	Chemical pollution of surface waters	High	High	Likely	Major	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in watercourses on the Site.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
On-site Minor Drainage (Local / Low)	Changes in runoff and flow patterns	Low	Negligible	Unlikely	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of minor watercourses within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	Medium	Low	Likely	Minor	Temporary short-term construction activities within watercourses would be likely to cause a significant but temporary fundamental change in water quality in watercourses on the Site.
	Chemical pollution of surface waters	Medium	Low	Likely	Minor	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in watercourses on the Site.
Off-site Cloghmills Water, Killagan Water, Bush River (Ballyhoe), and Bush River (Altnahinch)	Changes in runoff and flow patterns	Low	Moderate	Unlikely	Minor	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. The Site as a proportion of the waterbody catchments is not significant. The drainage strategy adopted ensures that natural catchments are mirrored and ensures that water is not lost from the catchment that would result in a loss of available water for abstraction.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
(Including NI Water abstraction) (National / High)	Silt / suspended solid pollution of surface waters	Medium	Moderate	Unlikely	Minor	Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the Site to have no effect exceeding normal seasonal or pre-existing fluctuations. Temporary short-term construction activities within upstream watercourses would be likely to cause a detectable but temporary change in water quality in the immediate downstream environment that would have an effect on water quality affecting the water resource, including the NI Water raw water offtake.
	Chemical pollution of the watercourse	High	High	Likely	Major	Spillage of oils, chemicals, or cementitious material associated with temporary construction, particularly at works adjacent to or within watercourses, and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in the downstream environment that would have an effect on water quality affecting the water resource, including the NI Water raw water offtake.
Off-site Designated Site - Glarryford ASSI (National / High)	Changes in runoff and flow patterns	Low	Moderate	Unlikely	Minor	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of minor watercourses within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Silt / suspended solid pollution of surface waters	Medium	Moderate	Unlikely	Minor	Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the Site to have no effect exceeding normal seasonal or pre-existing fluctuations. Temporary short-term construction activities within upstream watercourses would be likely to cause a detectable but temporary change in water quality in the immediate downstream environment that would have an effect on water quality.
	Chemical pollution of the watercourse	High	High	Likely	Major	Spillage of oils, chemicals, or cementitious material associated with temporary construction, particularly at works adjacent to or within watercourses, and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in the downstream environment that would have an effect on water quality.
Off-site Designated Site- Runkerry ASSI (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. The survey boundary as a proportion of the waterbody catchment hydrologically shared with the designated site is not significant (i.e., c. 0.07%). Given this, and the distance between the Site and the ASSI (c. 40 km downstream), it is unlikely the designated site could feasibly be affected by works associated with the Proposed Development.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	<p>Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the Site to have no effect exceeding normal seasonal or pre-existing fluctuations.</p> <p>Temporary short-term construction activities within upstream watercourses would be likely to cause a detectable but temporary change in water quality in the immediate downstream environment that would have an effect on water quality.</p> <p>However, the survey boundary as a proportion of the waterbody catchment hydrologically shared with the designated site is not significant (i.e., c. 0.07%). Given this, and the distance between the Site and the ASSI (c. 40 km downstream), it is unlikely the designated site could feasibly be affected by works associated with the Proposed Development.</p>

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Chemical pollution of the watercourse	Negligible	Low	Rare	Not Significant	<p>Spillage of oils, chemicals, or cementitious material associated with temporary construction, particularly at works adjacent to or within watercourses, and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in the downstream environment that would have an effect on water quality.</p> <p>However, the survey boundary as a proportion of the waterbody catchment hydrologically shared with the designated site is not significant (i.e., c. 0.07%). Given this, and the distance between the Site and the ASSI (c. 40 km downstream), it is unlikely the designated site could feasibly be affected by works associated with the Proposed Development.</p>
Off-site Designated Site - Lough Neagh Ramsar Site (International / Very High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	<p>Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated.</p> <p>The survey boundary as a proportion of the waterbody catchment hydrologically shared with the designated site is not significant (i.e., c. 0.53%). Given this, and the distance between the Site and the ASSI (c. 42 km downstream), it is unlikely the designated site could feasibly be affected by works associated with the Proposed Development.</p>

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	<p>Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the Site to have no effect exceeding normal seasonal or pre-existing fluctuations.</p> <p>Temporary short-term construction activities within upstream watercourses would be likely to cause a detectable but temporary change in water quality in the immediate downstream environment that would have an effect on water quality.</p> <p>However, the survey boundary as a proportion of the waterbody catchment hydrologically shared with the designated site is not significant (c. 0.53%). Given this, and the distance between the Site and the ASSI (c. 42 km downstream), it is unlikely the designated site could feasibly be affected by works associated with the Proposed Development.</p>

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Chemical pollution of the watercourse	Negligible	Low	Rare	Not Significant	Spillage of oils, chemicals, or cementitious material associated with temporary construction, particularly at works adjacent to or within watercourses, and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in the downstream environment that would have an effect on water quality. However, the survey boundary as a proportion of the waterbody catchment hydrologically shared with the designated site is not significant (c. 0.53%). Given this, and the distance between the Site and the ASSI (c. 42 km downstream), it is unlikely the designated site could feasibly be affected by works associated with the Proposed Development.
Bedrock Groundwater / Aquifers (Local / Low)	Alteration of Groundwater	Low	Negligible	Unlikely	Not Significant	No significant excavations within the bedrock are expected. Significant dewatering with the potential for affecting groundwater levels is not anticipated.
	Chemical pollution of groundwater	Low	Negligible	Likely	Minor	Bedrock is expected to be shallow in several areas, with limited thickness of Superficial Deposits however depth to groundwater is anticipated to be significant and dominated by fracture flow.
Private water supplies (Local / Low)	Disruption to quantity or quality of supply	Negligible	Negligible	Unlikely	Not Significant	No infrastructure is proposed within 250m of any known or potential abstraction location and as such no supply would be affected.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
Tracks, turbines and associated buildings. (Local / Low)	Risk to occupants and infrastructure due to identified potential risk of flooding.	Low	Negligible	Unlikely	Not Significant	The Proposed Development has been designed to avoid areas potentially susceptible to pluvial ponding.
	Risk to occupants due to presence of Radon	Low	Negligible	Unlikely	Not Significant	Proposed buildings will be designed to incorporate appropriate radon / gas protection measures.
Watercourses, Groundwater and Land / Soils - (Varies up to National / High)	Risk of contamination due to accidental fire at BESS facility.	Negligible	Low	Rare	Not Significant	Battery storage containers are sealed to ensure that any potential single cell thermal runaway is contained. Therefore, the amount of potential pollutants will be limited to the gas vented from one cell but will be contained within the sealed unit limiting any potential impact to the wider environment.

Additional Mitigation Measures - Construction Phase

10.229. Additional mitigating measures, over and above the avoidance and buffer zones previously detailed, are intended to reduce or prevent the residual significant hazards which may not be fully mitigated by the design evolution and avoidance.

Water Quality Monitoring

10.230. A water quality monitoring program will be implemented to monitor effects on the surface water quality regime during the infrastructure construction, operational and decommissioning phases of the Proposed Development, in order to;

- Demonstrate that the mitigation measures and surface water management is performing as designed;
- Provide validation that the in-place mitigation measures are not having an adverse effect upon the environment;
- Indicate the need for additional mitigation measures to prevent, reduce or remove any effects on the water environment, such as additional temporary settlement or filtration structures or short-term flocculant dosing to suit observed site conditions.

10.231. The monitoring would be informed by existing water quality baseline data presented in paragraphs 10.131 through 10.134 of this assessment and baseline monitoring rounds undertaken prior to the commencement of the construction phase.

10.232. It is intended that the water monitoring extent, duration and frequency will be agreed with the Department of Infrastructure or the relevant regulating body (nominally NIEA WMU) post consent and will nominally consist of physicochemical and biological monitoring. The extent, duration and frequency of the monitoring will be proportionate to the level of activity during each phase of the Proposed Development and the associated perceived risks.

Pollution Prevention

Pollution Prevention Plan

10.233. A detailed Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of the Construction Environmental Management Plan for the project, to be submitted post-consent following detailed site investigations and agreed with the local planning authority. Although this will be of particular importance during construction, it will apply to potentially polluting activities during all phases of the Proposed Development.

10.234. The detailed PPP will be produced following consultation and agreement with NIEA, and all appropriate personnel working on the Proposed Development will be trained in its use. As a minimum, the PPP will comply with Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidelines (in particular GPP 21: Pollution Incident Response Planning) and best practice as advocated by CIRIA. The

PPP will identify site-specific measures and incorporate a Pollution Incident Plan, which will include emergency contact details, details of spill kits on the Proposed Development and instructions on actions in case of spillage / emergency.

10.235. Measures to be incorporated within the PPP are identified in the following sections.

Pollution Prevention Measures

10.236. During all phases the site manager will ensure that mitigation measures as identified within this assessment are fully implemented and that activities are carried out in such a manner as to prevent or reduce effects. The following construction and decommissioning phase-specific measures will be implemented. The following sections should be read in conjunction with the construction management information provided within **Chapter 1: Introduction & Proposed Development**.

10.237. To ensure best practice on site and to help avoid pollution release to watercourses and groundwater, the following NIEA Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidance (PPGs) will be adhered to:

- GPP 1 Understanding Your Environmental Responsibilities - Good Environmental Practices
- GPP 2 Above Ground Oil Storage Tanks
- GPP 3 Use and Design of Oil Separators in Surface Water Drainage Systems
- GPP 4 Treatment and disposal of Wastewater where there is no connection to the public foul sewer
- GPP 5 Works and Maintenance in or near Water
- GPP 8 Safe Storage and Disposal of Used Oils
- GPP 20 Dewatering Underground Ducts and Chambers
- GPP 21 Pollution Incident Response Planning
- GPP 22 Dealing with Spills
- GPP 26 Safe Storage of Drums and Intermediate Bulk Containers
- PPG 6 Working at Construction and Demolition Sites
- PPG 7 Safe Storage - The Safe Operation of Refuelling Facilities
- PPG 18: Managing Fire Water and Major Spillages

10.238. Key requirements for control of chemical pollution risk are identified in the above guidance and will include the following:

Storage

10.239. All equipment, materials and chemicals on the Proposed Development will be stored away from any watercourse (i.e. outwith previously stated buffer zones). Chemical, fuel and oil stores will be sited on impervious bases in accordance with

GPP2 and within a secured bund of 110% of the storage capacity, within the temporary storage compound

Vehicles and Refuelling

10.240. Standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Refuelling of vehicles and machinery will be carried out on an impermeable surface in designated areas, well away from any watercourse or drainage ditches (i.e. outwith previously stated buffer zones) and will adhere to best practice as detailed in PPG 7.

Maintenance

10.241. Onsite maintenance to construction plant will be avoided in all practicable instances, unless vehicles have broken down necessitating maintenance at the point of breakdown. Suitable measures in accordance with a Pollution Prevention Plan (PPP) will be put in place prior to commencement of maintenance in this instance.

Cement and concrete batching

10.242. Preference shall be given to construction techniques that do not require use of cementitious materials where suitable practicable alternatives exist. When concrete / cement is used, concrete batching will not be permitted on site. Wet concrete operations will not be carried out within watercourses or adjacent to watercourses. Measures to prevent discharge of alkaline wastewaters or contaminated storm water to watercourses will be outlined in a detailed PPP for the Proposed Development to be approved by NIEA before commencement of works. Wastewater spillage will be minimised by using settling tanks and recycling water.

Mess and welfare facilities

10.243. Mess and welfare facilities will be required during construction and decommissioning and will be located at the construction compound. Foul effluent disposal shall be via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on site).

Construction Best Practice

Construction in the vicinity of Watercourses

10.244. The following procedures apply to the general construction activities either within the watercourses or in defined watercourse buffer zones:

- Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works in order to ensure that in-channel works are undertaken during periods of predicted low flow and low rainfall in order to minimise contact with water.

- Ensure that roadside drains do not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation as denoted on design drawings.

Construction of Watercourse Crossings

10.245. Construction of watercourse crossings will be programmed to coincide with periods of predicted low flow in the affected channel (determined by rainfall and would generally coincide with summer months) and adhere to working period restrictions imposed. Construction will be strictly as per the design for each identified watercourse crossing and will fully implement all SuDS and additional mitigating measures proposed at the detailed design stage. For purposes of outline design, the proposed mitigation will include:

- Installation of silt fences parallel to the watercourse channel in the vicinity of the proposed crossing;
- Installation of small cut-off drains to prevent natural surface runoff entering area of construction activity;
- Installation of filtration or other silt entraining features within the watercourse channel immediately downstream of the works location;
- Use of over pumping where deemed appropriate.

Temporary SuDS

10.246. Temporary drainage and silt management features (SuDS) will be constructed prior to earthworks (including preliminary or enabling works) proceeding to construct any linear works (tracks / hardstanding areas / cable routes), turbine bases, and other infrastructure. Drainage will be provided to temporary works and reinstated to suit the final footprint of the completed development.

10.247. Temporary drainage measures in particular will be employed in enabling works to facilitate widening of existing tracks and diversion of minor watercourses where specifically proposed.

10.248. Temporary measures may include:

- Temporary silt fences erected in areas where risk of pollution to watercourses has been identified e.g. watercourse crossing locations and areas where tracks or other infrastructure lie within watercourse buffer zones.
- Placing temporary filtration silt fences within drainage channels where siltation is observed.
- Installing temporary constructed settlement features such as sumps or settlement ponds / lagoons where required.
- Upslope cut-off drainage channels approximately parallel to the proposed track alignment installed in advance of any excavated cuttings for the track or turbine hardstanding areas.

- Watercourses, drains, natural flow paths and cut-off drain outlet locations should be identified and charted, in order to ensure that piped crossings can be installed in advance of or adjacent to the track construction.
- Settlement ponds should be constructed in advance of commencing excavations for foundations and at any other locations identified as required at detailed design stage.
- Trackside drainage swales should be installed in parallel with track construction. Note that this may require that drainage swales are reformed on an ongoing basis as temporary track alignments are modified to their eventual finished design level.

10.249. Suitable prevention measures should be in place at all times to prevent the conveyance of silts to receiving watercourses.

Electrical Cable Laying

10.250. Due consideration will be given to the prevailing ground conditions and season when programming the execution of cable trench excavations in order to ensure works are undertaken during periods with low rainfall and elevated shallow groundwater levels in order to reduce the likelihood of runoff entering the excavations.

10.251. Excavation of cable trenches will be carried out over short distances, with frequent backfilling of trenches to minimise opportunity for the ingress of water into open trenches, temporary silt traps will be provided in longer trench runs and on steeper slopes and spoil will be stored in line with a spoil management plan, which will be produced as part of the CEMP at the pre-construction stage.

Excavations and Spoil Management

10.252. Soil and subsoil excavation and movement will be undertaken in accordance with best practice guidelines such as Good Practice Guide for Handling Soils (MAFF, 2000) in order to minimise potential for silt laden runoff from spoil and excavations. Areas of stockpiled spoil including stored peat:

- will not be permitted within previously identified watercourse buffer zones; and
- will not be permitted to obstruct the flow of overland surface water with specific drainage to spoil mounds to be provided.

10.253. Material produced from excavations on the Site will be reused where reasonably practicable in the reinstatement of the site. Excavated materials will be separated into rock material, subsoil, reusable peat and vegetated sod material and will be stored in the designated temporary stockpile zones, under the supervision of a geotechnical expert. These materials will be reused where possible to re-grade slopes, and to re-vegetate and stabilise the sides of access tracks and hard standing areas.

10.254. Spoil drainage will be designed on a bespoke basis for spoil storage areas to allow controlled dewatering and prevent washout of suspended solids to the receiving

water environment. As part of the detailed CEMP a spoil management strategy will be developed by the appointed competent contractor for the development. Outline designs for drainage arrangements for temporary spoil areas are shown on the Drainage Management Drawings within Appendix 10.1: Surface Water Management Plan.

Ditch Blocking and Earthworks for Habitat Enhancement

- 10.255. It is proposed that localised ditch blocking, permanent and seasonal, be carried out for the purposes of habitat enhancement / restoration. Details are provided in the **Outline Habitat Management Plan (OHMP) in Appendix 6.2.**
- 10.256. Ditch blocking downgradient of areas of earthworks will have an additional beneficial effect by providing settlement to reduced quality runoff from lands upgradient.

Dewatering of Excavations

- 10.257. The majority of the turbine base foundations will be on bedrock or other hard strata above bedrock (to be confirmed by detailed site investigation prior to detailed design); therefore, deep excavations within bedrock and the associated bedrock aquifer are not anticipated and dewatering below the bedrock aquifer groundwater table is therefore not anticipated.
- 10.258. Shallow groundwater (e.g. in areas of glacial sand and gravel) or rainfall runoff collected in excavations will be discharged via settlement ponds or filter strips prior to entry to the receiving water environment.
- 10.259. Any settlement lagoons or filter strips associated with dewatering will be regularly inspected, particularly after periods of heavy rainfall and prior to periods of forecast heavy rainfall. Maintenance (to clear blockages or remove silt) will be carried out in periods of dry weather where practicable. Maintenance requirements are further considered in Appendix 10.1: Surface Water Management Plan.

Dust Management

- 10.260. Loose track material generated during the use of access tracks and the construction compound will be prevented from reaching watercourses by maintenance to surface water drainage systems installed at aggregate based hard standing areas. In dry weather dust suppression methods such as by dust suppression bowser will be employed.

Borrow Pits

- 10.261. For the avoidance of doubt, no borrow pits are proposed at the Proposed Development, therefore associated pollution risks associated with rock extraction activities are not a consideration.

Maintenance of Pollution Prevention Measures

10.262. All SuDS and additional pollution prevention measures installed will be subject to a regular maintenance regime for the life of the construction phase in order to maintain functionality of all features. This will comprise:

- Unblocking of drains;
- Maintenance of access road and other hard standing surfaces;
- Replacement of filtration features;
- Removal of silt build-up from settlement and filtration features.

Mitigating Measures - Operational Phase

10.263. Mitigation of the effects of the Proposed Development will comprise the following:

- Ensure best practice is adhered to on the Site and avoid pollution release to watercourses by incorporating NIEA Pollution Prevention Guidance notes into management policy.
- In the event that permanent welfare facilities are installed as part of control building / substation facilities, foul effluent will be disposed of through the use of sealed cesspools or chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on the site).
- Cyclical maintenance of permanent SuDS drainage features installed during the construction phase, including unblocking of drains, maintenance of access road and other hard standing surfaces, and removal of silt build-up from settlement features. An outline maintenance programme is included in **Technical Appendix 10.1: Surface Water Management Plan**.

Mitigating Measures and Residual Effects

10.264. The following table details the assessed impact magnitude, likelihood and associated significance as a function of the matrix stated previously of all receptors identified as previously having an unmitigated impact significance greater than 'not significant'.

Table 10.17: Mitigated Effects

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
On-site significant watercourses - (Aghanageeragh River / Cloghmills Water) (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of significant watercourses on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
On-site Minor Drainage (Local / Low)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of minor watercourses on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Off-site Cloghmills Water, Killagan Water, Bush River (Ballyhoe) and Bush River (Altnahinch), (including NI Water abstraction) (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. The site as a proportion of the waterbody catchments is not significant.
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the site to have no effect exceeding normal seasonal or pre-existing fluctuations. Surface water management and pollution control in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Chemical pollution of the watercourse	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Off-site Designated Sites - Glarryford ASSI (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. The site as a proportion of the waterbody catchments is not significant.
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the site to have no effect exceeding normal seasonal or pre-existing fluctuations. Surface water management and pollution control in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Bedrock Groundwater / Aquifers	Alteration of Groundwater	Low	Negligible	Unlikely	Not Significant	No significant excavations within the bedrock are expected. Significant dewatering with the potential for affecting groundwater levels is not anticipated.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
(Local / Low)	Chemical pollution of groundwater	Low	Negligible	Unlikely	Not Significant	Bedrock is expected to be shallow in several areas, with limited thickness of Superficial Deposits however depth to groundwater is anticipated to be significant and dominated by fracture flow. Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.
Watercourses, Groundwater and Land / Soils - (Varies up to National / High)	Risk of contamination due to accidental fire at BESS facility.	Negligible	Low	Rare	Not Significant	A fire management response plan will be prepared in conjunction with the battery supplier and with the local Fire Service prior to construction. This will outline containment measures and chemical fire suppressant methods which will be implemented to mitigate risk of potential contamination to land or water environment. In the event of a fire all wastes will be dealt with appropriately through the procedures agreed within the site-specific Fire Management Plan to be prepared post-consent.

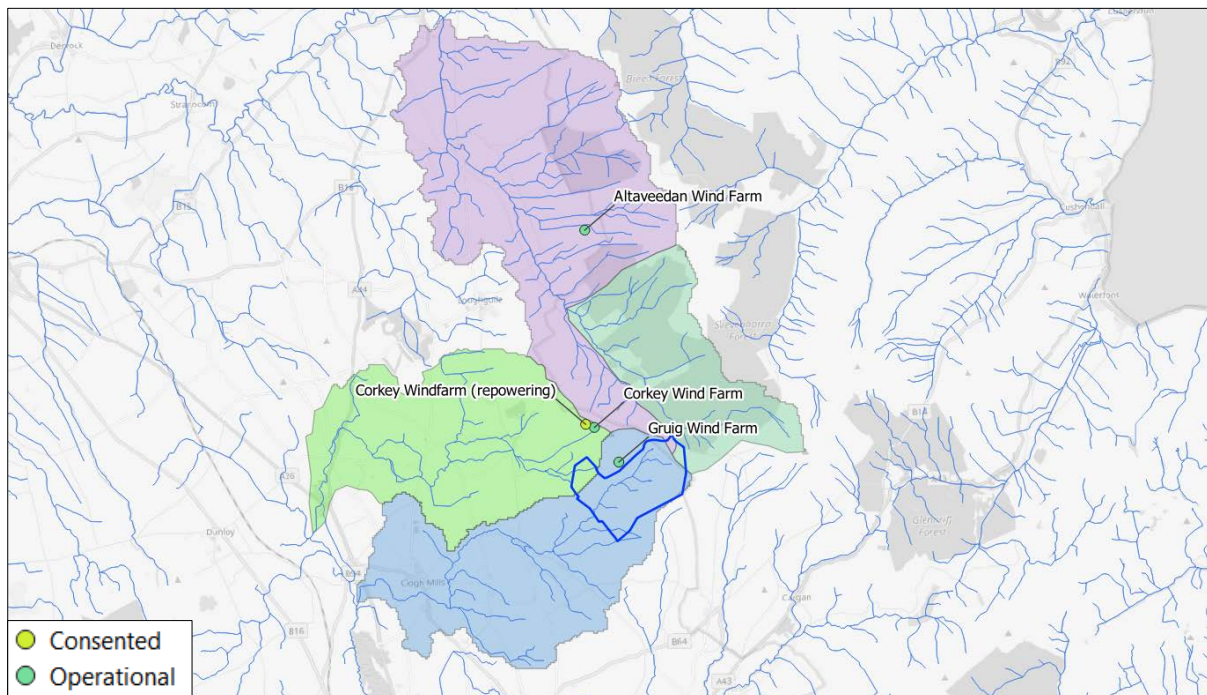
Cumulative Effects

- 10.265. An assessment has been undertaken of the cumulative effect on geology and the water environment of the Proposed Development in conjunction with other known wind farms and other significant developments in planning, construction or operation at the time of the application.
- 10.266. The assessment aims to determine potential for cumulative impact within the hydrological, hydrogeological and geological setting of the Proposed Development caused by an accumulation of similar developments.
- 10.267. The hydrological and hydrogeological setting of the site for the purposes of the assessment is the downstream Cloghmills Water, Killagan Water, and Bush River as identified on the NIEA Catchment Data Map Viewer and shown on Plate 10-11.
- 10.268. Windfarms identified within the setting are detailed within the table below:

Table 10.18: Cumulative Assessment

Wind Farm	Planning Reference	Number of turbines	Status
Gruig Wind Farm	D/2004/0790/F	10	Operational
Corkey Wind Farm	N/A	10	Operational
Corkey Wind Farm (Repowering)	LA01/2019/0772/F	5	Consented
Altaveedan Wind Farm	D/2010/0356/F	9	Operational

Plate 10-11: Cumulative Assessment Area & Hydrological Setting



- 10.269. As no likely significant residual water environment or geological effects are predicted arising from the current Proposed Development, there is no potential significant cumulative effect to water or the geological environment in conjunction with any other pre-existing or Proposed Development.
- 10.270. If considering a wider setting, then as no likely significant residual water environment or geological effects are predicted arising from the Proposed Development, there is no potential significant cumulative effect to water or the geological environment in conjunction with any other pre-existing or future development.

Summary and Conclusions

- 10.271. This assessment identifies the potential geological, hydrological, and hydrogeological impacts, including surface and groundwater quality of the Proposed Development. It summarises the relevant legislation and guidance and provides appropriate baseline information, enabling the potential effects to be identified.
- 10.272. Aspects of the design, construction and operation of the Proposed Development that may potentially impact on the receiving geological and water environment have been identified and the pathways for impacts assessed. It has been determined that without mitigation, the Proposed Development would be likely to cause adverse impacts of major significance primarily driven by the sensitivity of fisheries interests on and shortly downstream of the Site. As such, informed by the

baseline assessment and pathways identified, mitigation integrated as part of outline design and proposed during construction phase includes:

- Avoidance of water features based on baseline constraints mapping;
- Design of site elements to minimise impact on the geological and water environment;
- Implementation of a comprehensive surface water management plan comprising the use of SuDS (drainage) and silt management in order to prevent pathways for pollution;
- Construction phase pollution prevention procedures in accordance with NIEA requirements and guidance.

10.273. Monitoring of the effect of the Proposed Development on the water environment and fisheries habitat will be provided by the Applicant through physicochemical and biological water quality monitoring. Implementation of the mitigation proposed eliminates or reduces the potential significance to all receptors to “not significant”.

10.274. There is no likelihood of significant cumulative impacts over and above any pre-existing effect caused by existing or consented wind development.