Chapter 9: Hydrology, Hydrogeology and Soils

Creag Riabhach Wind Farm Extension

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9 Hydrology, Hydrogeology and Soils

9.1 Introduction

This chapter of the Environmental Impact Assessment (EIA) Report assesses the impacts on the hydrological, hydrogeological and soils environment at Creag Riabhach Wind Farm Extension (the proposed development), and the likely significant environmental effects resulting from the construction and operation of the proposed turbines, battery energy storage system (BESS) and associated infrastructure. The application site is the area within the site boundary illustrated in **Figure 3.1** of the EIA Report and is referred to as the 'site' within this chapter. The specific objectives of the chapter are to:

- Describe the current baseline;
- Describe the assessment methodology and significance criteria used in completing the impact assessment;
- Describe the potential effects, including direct, indirect and cumulative effects;
- Describe the mitigation measures proposed to address any potentially significant effects; and
- Assess the residual effects remaining following the implementation of mitigation measures.

The chapter is supported by the following technical appendices:

- **Technical Appendix 9.1: Outline Peat Management Plan**;
- **Technical Appendix 9.2: Peat Stability Risk Assessment**; and
- **Technical Appendix 9.3: CRWF Water Quality Management Plan**.

The assessment is supported by the following figures provided in Volume 3a of the EIA Report:

- **Figure 9.1: Hydrology Overview & GWDTE**;
- **Figure 9.2: Carbon and Peatland**;
- **Figure 9.3: Interpolated Peat Depth**;
- **Figure 9.4: Peat Stability**;
- **Figure 9.5: Slope Angle**;
- **Figure 9.6: Superficial Geology**; and
- **Figure 9.7: Bedrock Geology**

This assessment has been undertaken by Natural Power Consultants (Natural Power) on behalf of the ERG Group (the "applicant"). Natural Power has an established reputation in providing assessment of hydrological, geological and hydrogeological considerations discussed in this chapter.

9.2 Legislation, Policy and Guidance

9.2.1 Legislative and Policy Context

The assessment takes account of the requirements of the Water Framework Directive (2000/60/EC) (WFD). The WFD aims to protect and enhance the quality of surface freshwater (including lakes, rivers and streams), groundwater, groundwater dependent terrestrial ecosystems (GWDTE), estuaries and coastal waters. The key objectives of the WFD relevant to this assessment are:

- To prevent deterioration and enhance aquatic ecosystems; and
- To establish a framework of protection of surface freshwater and groundwater.

The WFD resulted in The Water Environment and Water Services (Scotland) Act 2003, which gave Scottish Ministers powers to introduce regulatory controls over water activities in order to protect, improve and promote sustainable use of Scotland's water environment. These regulatory controls in the form of The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR), made it an offence to undertake the following activities without a CAR authorisation:

- Discharges to all wetlands, surface waters and groundwaters (replacing the Control of Pollution Act 1974);
- Disposal to land (replacing the Groundwater Regulations 1998);
- Abstractions from all wetlands, surface waters and groundwaters;
- Impoundments (dams and weirs) of rivers, lochs, wetlands and transitional waters; and
- Engineering works in inland waters and wetlands.

Under the Water Environment (Miscellaneous) (Scotland) Regulations 2017, amendments were made to CAR and the proposed development would require a construction runoff permit (formerly known as a construction site license) for water management across the entirety of the site prior to any construction works taking place, including enabling works. No work would be able to commence on-site until a runoff permit has been agreed with the Scottish Environment Protection Agency (SEPA).

9.2.2 National Legislation and Policy

The assessment takes account of:

- The Water Environment and Water Services (Scotland) Act 2003;

- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended);
- The Water Environment (Miscellaneous) (Scotland) Regulations 2017;
- Flood Risk Management (Scotland) Act 2009;
- The Private Water Supplies (Scotland) Regulations 2006;
- Water Intended for Human Consumption (Private Water Supplies (Scotland) Regulations 2017;
- Part IIA of the Environment Protection Act 1990;
- Waste Management Licensing (Scotland) amendment Regulations 2016;
- Pollution Prevention and Control (Scotland) Regulations 2012;
- Scottish Planning Policy (SPP) 2014;
- National Planning Framework (NPF) 4 2023;
- SEPA Policy No. 19 Groundwater Protection Policy for Scotland 2009;
- SEPA Policy No. 41 Development at Risk of Flooding: Advice and Consultation 2016;
- SEPA Position Statement on Land Protection (Reference EP054); and
- SEPA Policy No. 61 Control of Priority & Dangerous Substances & Specific Pollutants in the Water Environment.

9.2.3 Local Policy

The assessment takes account of the following policy:

- The Highland-wide Local Development Plan (HwLDP)
  - Policy 55 – Peat and Soils;
  - Policy 63 – Water Environment;
  - Policy 64 – Flood Risk;
  - Policy 65 – Wastewater Treatment;
  - Policy 66 – Surface Water Drainage;
  - Policy 67 – Renewable Energy Development; and
  - Policy 72 – Pollution.

9.2.4 Other Guidance and Good Practice

Table 9.1 lists other key guidance and good practice documentation which has been considered as part of this assessment.

Table 9.1: Guidance and Good Practice

Topic	Source of Information
Scottish Government Planning Advice Notes (PAN's)	• PAN 50 (1996) Controlling the Environmental Effects of Surface Mineral Workings • PAN 51 Planning (revised 2006), Environmental Protection and Regulation • PAN 1/2013 Environmental Impact Assessment • PAN 61 (2001) Planning and Sustainable Urban Drainage Systems • PAN 79 (2006) Water and Drainage
(SEPA Guidance for Pollution Prevention (GPPs) and Pollution Prevention Guidelines (PPGs)	• GPP 1 (2020): Understanding your Environmental Responsibilities - Good Environmental Practice • GPP 2 (2018): Above Ground Oil Storage Tanks • GPP 4 (2017): Treatment and Disposal of Wastewater Where there is no Connection to the Public Foul Sewer • GPP 5 (2018): Works and Maintenance in or Near Water • PPG 6 (2011): Working at Construction and Demolition Sites • GPP 8 (2017): Safe Storage and Disposal of Used Oils • GPP 13 (2017): Vehicle Washing and Cleaning • GPP 21 (2021): Pollution incident response planning • GPP 22 (2018): Dealing with Spills • GPP 26 (2019): Safe Storage - Drums and Intermediate Bulk Containers
SEPA Position Statements (Published)	• WAT-PS-06-02: SEPA (2015), Culverting of Watercourses, Version 2 • WAT-PS-07-02: SEPA (2012), Bank Protection, Version 2 • WAT-SG-23: SEPA (2008), Engineering in the Water Environment, Good Practice Guide - Bank Protection Rivers and Lochs, Version 1 • WAT-SG-25: SEPA (2010), Engineering in the Water Environment, Good Practice Guide, Construction of River Crossings, Version 2 • WAT-SG-26: SEPA (2010), Engineering in the Water Environment, Good Practice Guide, Sediment Management, Version 1 • WAT-SG-31: SEPA, (2006) Special Requirements for Civil Engineering Contracts for the Prevention of Pollution, Version 2 • WAT-SG- 78: SEPA (2012), Sediment Management Authorisation, Version 1

Topic	Source of Information
Construction Industry Research and Information Association (CIRIA)	• CIRIA C692 Environmental Good Practice on Site (fourth edition) (2015) • CIRIA C753 SuDS Manual (2015) • CIRIA C532 Control of Water Pollution from Construction Sites (2001) • CIRIA C648 Control of Water Pollution from Linear Construction Projects (2006) • CIRIA C786F Culvert, Screen and Outfall Manual (2019)
Other Guidelines	• SNH and Scottish Renewables Joint Publication, (2019) Good Practice During Wind Farm Construction Version 4 • FCE, SNH, (2010), Floating Roads on Peat • Scottish Renewables, Joint Publication (2012), Development of Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste • SEPA, The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), A Practical Guide, Version 9.2, December 2022 • River Crossings and Migratory Fish: Design Guidance, A Consultation Paper, The Scottish Executive • SEPA Land Use Planning Guidance CC1 (LUPS-CC1) (2022). Climate change allowances for flood risk assessment in land use planning. Version 2 • SEPA Land Use Planning Guidance Note 4 (2017): Planning Guidance on On-Shore Windfarm Developments, Version 9 • SEPA Land Use Planning Guidance Note 31 (2017): Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, Version 3

9.3 Stakeholder Consultation

The scoping responses relating to the hydrological, hydrogeological and soils environment are summarised in **Table 9.2**.

Table 9.2: Scoping responses relating to hydrology, hydrogeology and soils

Organisation	Relevant Response	How comments have been addressed in the EIA Report
SEPA	• We consider that the following key issues must be addressed in the Environmental Impact Assessment process: – Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems and buffers. Avoid sensitive or rare habitats. – Peat depth survey and table detailing re-use proposals. Avoid deep peat and minimise peat disturbance. • Map and site layout of borrow pits. • Schedule of mitigation including pollution prevention measures. • Decommissioning statement. • We are pleased to note the proposal will make use of the existing substation and area of the temporary construction compound for the adjacent Creag Riabhach Wind Farm. • We emphasise the need for good peat probing information in all areas where new infrastructure is proposed. We can see that some peat probing has been done here, however, this is not in a format that is very accessible to assess, and access tracks should be included. • We note that the peat probing for EXT-01 [proposed turbine 1] has largely avoided areas of deep peat, which we welcome. We note that an area of deep peat is immediately upslope of the infrastructure, and we would question whether this will affect stability of the surrounding peat. EXT-03 shows that an area of deep peat will be affected, and we would like to see this infrastructure pulled back to the south to avoid areas of deep peat. EXT-02 also looks like it could be moved away from areas of deep peat. We therefore request more detailed peat depth surveys to look at the access tracks, and we would welcome further discussion with the applicant to discuss re-location of the turbines to minimise impacts on peat and carbon. • There is an existing borrow pit adjacent to the Battery Storage Compound (Borrow Pit C in the current Creag Riabhach Wind Farm). We would not want to see a new borrow pit opened on-site and avoid a recently restored borrow pit opened so soon following reinstatement. Consideration should be made to how this might be managed going forward to minimise impacts to the environment and previous peatland reinstatement. • We note that proposed EXT-01 lies in close proximity to the River Vagastie. While this may be out with the 50m buffer, construction will be immediately up slope of this watercourse. We would expect	• **Figure 9.1** Hydrology Overview identifies the principle hydrological receptors including areas of potential groundwater dependency. • **Figure 9.3** Peat Depth Interpolation illustrates the distribution of survey locations and peat depths. Further details can be found in **Section 9.6.9** below that explains the peat depth survey results. • **Technical Appendix 9.1: Peat Management Plan** details information relating to the avoidance of peat through the design evolution, the layout of additional surveys, peat excavation volumes and peat re-use proposals. • **Chapter 3: Description of Development** presents the evolution to design and demonstrates how the proposed development would not require a dedicated borrow pit and would instead source site-won stone from cut excavations as part of the proposed track network. • Site specific mitigation can be found in **Table 9.12** along with Good Practice Mitigation in Volume 4 **Technical Appendix 3.1: Outline Construction and**

Organisation	Relevant Response	How comments have been addressed in the EIA Report
	site specific plans to be provided that demonstrate how surface water run-off will be managed from the construction site at this location to ensure protection of the water environment. • We would also welcome investigations which would seek to compensate for impacts to the site through compensatory measures, such as peatland restoration or other environmental management objectives on or adjacent to the application boundary.	**Environmental Management Plan (OCEMP).** • **Figure 9.1** demonstrates the likely arrangement of surface water pollution mitigation at EXT-01.
NatureScot (NS)	• The proposal lies close to the River Naver SAC, protected for its Atlantic salmon and freshwater pearl mussel. Given the proximity of the proposal, it will be very important to consider and assess any direct and indirect impacts to the SAC in context of the site's conservation objectives. In particular, a clear explanation of how the Applicant will ensure sediment does not enter any watercourses flowing into the SAC will be very helpful. • Part of the proposal appears to be in a Class 1 area on the Carbon and Peatland Map 2016: https://soils.environment.gov.scot/maps/thematic-maps/carbon-and-peatland-2016-map/. Class 1 areas are described as nationally important carbon-rich soils, deep peat and priority peatland habitat likely to be of high conservation value. These areas are afforded significant protection under Scottish Planning Policy. • The Applicant will therefore need to demonstrate clearly how any impacts to these interests will be avoided, mitigated and/or compensated. • NS also recommends the Applicant complete and include within any future application a summary table in relation to peatland of national importance. While not essential, this would be extremely helpful in facilitating the assessment of potential impacts on peat, peatland habitat and carbon-rich soils. • Where peat is present, specific peat surveys should be carried out in line with Scottish Government guidance: https://www.gov.scot/publications/peatland-survey-guidance. Further information for development on peat, peatland habitat and carbon-rich soils is also available within NatureScot guidance at: https://www.nature.scot/advising-carbon-rich-soils-deep-peat-and-priority-peatland-habitat-development-management.	• Baseline information for the hydrological receptors within or potentially connected to the proposed development including the River Vagastie, are presented in **Section 9.6** below. • The sensitivity of the hydrological receptors within or potentially connected to the proposed development are considered in **Section 9.9** below with embedded mitigation and good practice mitigation presented below in **Section 9.10**. An assessment of the likely construction affects is presented below in **Section 9.11**. • Details can be found below in **Section 9.6.9** that explains the peat depth survey results. • **Technical Appendix 9.1: Peat Management Plan and 9.2: Peat Slide Risk Assessment** details information relating to peat information and the re-use proposals.

Organisation	Relevant Response	How comments have been addressed in the EIA Report
Marine Scotland Science	• No development shall commence unless a Water Quality and Fish Monitoring Plan (WQFMP) has been submitted to and approved in writing by the Planning Authority in consultation with Marine Scotland Science and any such other advisors or organisations. • The WQFMP must take account of the Scottish Government's Marine Scotland Science's guidelines and standing advice and shall include: – water quality sampling should be carried out at least 12 months prior to construction commencing, during construction and for at least 12 months after construction is complete. The water quality monitoring plan should include key hydrochemical parameters, turbidity, and flow data, the identification of sampling locations (including control sites), frequency of sampling, sampling methodology, data analysis and reporting etc.; – the fish monitoring plan should include fully quantitative electrofishing surveys at sites potentially impacted and at control sites for at least 12 months before construction commences, during construction and for at least 12 months after construction is completed to detect any changes in fish populations; and – appropriate site specific mitigation measures detailed in the Environmental Impact Assessment and in agreement with the Planning Authority and Marine Scotland Science. • Thereafter, the WQFMP shall be implemented within the timescales set out to the satisfaction of the Planning Authority in consultation with Marine Scotland Science and the results of such monitoring shall be submitted to the Planning Authority on a 6 monthly basis or on request.	• Monitoring requirements, including the provision of a Water Quality and Fish Monitoring Plan (WQFMP) is detailed in **Section 9.10.2** below**.** • Additional information on the monitoring of aquatic ecology is presented in **Chapter 7: Freshwater Ecology**.
The Highland Council	• The EIA Report needs to address the nature of the hydrology and hydrogeology of the site, and of the potential impacts on water courses, water supplies including private supplies, water quality, water quantity and on aquatic flora and fauna. Impacts on watercourses, lochs, groundwater, other water features and sensitive receptors, such as water supplies, need to be assessed. Measures to prevent erosion, sedimentation or discolouration will be required, along with monitoring proposals and contingency plans. Assessment will need to recognise periods of high rainfall which will impact on any calculations of run-off, high flow in watercourses and hydrogeological matters. You are strongly advised at an early stage to consult Scottish Environment Protection Agency (SEPA) as the regulatory body responsible for the implementation of the Controlled Activities (Scotland) Regulations	• Assessment of hydrology and hydrogeology can be found below in **Section 9.6** that details the baseline conditions associated with the proposed development. • Details relating to the watercourse crossings can be found in **Section 9.9** below. • Mitigation by design the incorporation of sustainable

Organisation	Relevant Response	How comments have been addressed in the EIA Report
	2005 (CAR), to identify if a CAR license is necessary and the extent of the information required by SEPA to assess any license application. • If culverting should be proposed, either in relation to new or upgraded tracks, then it should be noted that SEPA has a general presumption against modification, diversion or culverting of watercourses. Schemes should be designed to avoid crossing watercourses, and to bridge watercourses where this cannot be avoided. The EIA Report will be expected to identify all water crossings and include a systematic table of watercourse crossings or channelising, with detailed justification for any such elements and design to minimise impact. The table should be accompanied by photography of each watercourse affected and include dimensions of the watercourse. It may be useful for the applicant to demonstrate choice of watercourse crossing by means of a decision tree, taking into account factors including catchment size (resultant flows), natural habitat and environmental concerns. Further guidance on the design and implementation of crossings can be found on SEPA's Construction of River Crossings Good Practice Guide. • The Council's Flood Risk Management Team had no comments to make at this stage. However, there are a number of watercourses and waterbodies on the site, therefore, the following applies: – A minimum of a 50m buffer of all watercourses / bodies, except water crossings is required; – Access tracks not acting as preferential pathways for runoff and efforts being made to retain existing natural drainage wherever possible; – Natural flood management techniques should be applied to reduce the rate of runoff where possible; use of SuDS to achieve pre-development runoff rates and to minimise erosion on existing watercourses; – Water crossings in the form of culverts or bridges, or upgrades to existing crossings must be designed to accommodate to 1 in 200 year flood event, plus climate change; – Land rising within any floodplain to be avoided; if ultimately required, compensatory storage must be provided; and – The EIA Report should be informed by the Council's Flood Risk and Drainage Impact Assessment SG. • The need for, and information on, abstractions of water supplies for concrete works or other operations should also be identified. The	drainage can be found in **Section 9.10** below. • Private Water Supplies are assessed in **Section 9.6.8** below. There are no Private Water Supply hydrologically connected to the proposed development.

Organisation	Relevant Response	How comments have been addressed in the EIA Report
	EIA Report should identify whether a public or private source is to be utilised. If a private source is to be utilised, full details on the source and details of abstraction need to be provided. • The applicant will be required to carry out an investigation to identify any private water supplies, including pipework, which may be adversely affected by the development and to submit details of the measures proposed to prevent contamination or physical disruption. Highland Council has some information on known supplies, but it is not definitive. An on-site survey will be required.	

In addition to the scoping consultation responses shown in **Table 9.2**, further communication with SEPA highlighted other information requirements that should be presented and considered within the EIA Report including:

- The need to minimise dewatering of peat upslope of the infrastructure and this should be addressed by specific mitigation (refer to **Section 0** below);
- Peat is to be stored within the footprint associated with the consented and operational Creag Riabhach Wind Farm (CRWF) alongside the BESS Compound. The design to preserve the peat as well creating connectivity to the hydrological system (refer to **Technical Appendix 9.1: Peat Management Plan**);
- The peat storage at the Battery Energy Storage Compound must be performed in a way that minimises peat handling and therefore, loss (refer to **Technical Appendix 9.1: Peat Management Plan**); and
- Specific mitigation relating to the drainage of the proposed development is required due to the proximity to the River Vagastie and the concerns related to the consented and operational CRWF (refer to **Section 9.10** below for outline of good practice mitigation and **Figure 9.1** for an outline drainage schematic).

9.4 Assessment Methodology and Significance Criteria

9.4.1 Effects to be Assessed

The greatest risk of the proposed development affecting the hydrological, geological and hydrogeological environment would occur during the construction phase, with effects reduced during the operational and decommissioning phases. Taking this into account, the following issues would be addressed during all phases of the proposed development:

- Changes to existing drainage patterns;
- Effects on baseflow;

- Effects on run-off rates;
- Effects on erosion and sedimentation;
- Effects on groundwater and surface water quality (including GWDTEs);
- Effects on groundwater levels;
- Effects on water resources (including private water supplies);
- Effects on impediments to flow;
- Flood risk;
- Pollution risk;
- Effects on local geology; and
- Effects on hydrological integrity of peat bodies.

9.4.2 Methodology

Overview

The assessment has involved the following:

- Detailed desk studies and site visits to establish baseline conditions of the proposed development and adjacent or downgradient areas that are hydrologically connected (study area);
- Evaluation of the environmental impacts of the proposed development and the likely significant effects that these could have on the current site conditions;
- Evaluation of the likely significant environmental effects with consideration of the potential embedded mitigation measures, taking account of the sensitivity of the baseline features the potential magnitude of these effects and the probability of these effects occurring; and
- The residual significance of the environmental effects following the consideration of additional mitigation measures.

Study Area

Within this chapter, the study area is considered to include the planning application boundary and a search area ~3 km from this boundary. The study area is illustrated in **Figure 9.1: Hydrology Overview & GWDTE.**

Baseline Assessment

A desktop survey to establish the baseline conditions has been undertaken in order to:

- Describe surface water hydrology, including watercourses, springs and waterbodies;
- Identify existing catchment pressures (e.g. point source and diffuse pollution issues);

- Identify all private drinking water abstractions and public water supplies within 3km of the site;
- Identify all flooding risks;
- Describe the hydromorphological conditions of watercourses;
- Collect information relating to recreational and fisheries resources;
- Collate hydrological flow and flooding information for the immediate area and main downstream watercourses;
- Collect soil, geological and hydrogeological information;
- Confirm surface water catchment areas and watersheds; and
- Confirm the extent and nature of peat deposits across the site.

Published information consulted for the baseline is outlined in **Table 9.3** below.

Table 9.3: Published Baseline information sources

Topic	Source of Information
Topography	10m contour data derived from Digital Terrain Model (DTM) data
Designated Nature and Conservation Sites	NatureScot, https://map.environment.gov.scot/sewebmap/
Solid and Superficial Geology	BGS Geology of Britain Viewer, http://mapapps.bgs.ac.uk/geologyofbritain3d/index.html
Soils and Peat	James Hutton Institute (JHI), Soil Information For Scottish Soils (SIFSS), http://sifss.hutton.ac.uk/ Scotland's Soils Interactive Map, Carbon and Peatland 2016 and National Soil Map of Scotland, http://soils.environment.gov.scot/
Climate	Met Office, https://www.metoffice.gov.uk/public/weather/climate/gcv3mcrf9 Flood Estimation Handbook (FEH): FEH Web Service, https://fehweb.ceh.ac.uk/ Flood Modeller Suite, https://www.floodmodeller.com/
Surface Water Hydrology	1:10,000 OS Raster Data 1:50,000 OS Raster Data Flood Estimation Handbook (FEH): FEH Web Service, https://fehweb.ceh.ac.uk/ Flood Modeller Suite, https://www.floodmodeller.com/
Flooding	Flood Risk Management Map (SEPA) http://map.sepa.org.uk/floodmap/map.htm
Water Quality	SEPA, WFD Classification, Web Mapping Application, SEPA, Water Classification Hub, https://www.sepa.org.uk/data-visualisation/water-classification-hub
Water Resources	Private water supply information provided by THC Abstraction and Discharge License information provided by SEPA

Topic	Source of Information
Hydrogeology	Scotland's Environment Web Interactive Map, https://map.environment.gov.scot/sewebmap/ BGS Geology of Britain Viewer, http://mapapps.bgs.ac.uk/geologyofbritain3d/index.html BGS Geoindex Onshore https://mapapps2.bgs.ac.uk/geoindex/home.html SEPA, River Basin Management Plans, Web Mapping Application, http://gis.sepa.org.uk/rbmp/

Additional information used to characterise the baseline environment has been obtained from published documents associated with the consented and operational CRWF. The various documents were available through the Highland Council planning portal / Energy Consents Unit website and references have been provided in the text where these have been used.

Effects Evaluation

The likely significant environmental effects of the proposed development have been defined by taking account of the two main factors; the sensitivity of the receiving environment and the potential magnitude of change should that identified impact occur. This approach is based on guidance contained within the joint NatureScot (formerly known as Scottish Natural Heritage, SNH) (SNH)/Historic Environment Scotland (HES) publication Environmental Impact Assessment Handbook v5 (SNH/HES, 2018).

The sensitivity of the receiving environment i.e., its baseline quality, as well as its ability to absorb the impact without perceptible change is defined in **Table 9.4** below.

Table 9.4: Definition of sensitivity of the receiving environment

Sensitivity	Definition
High	• SEPA Water Framework Directive Water Body Classification: High-Good or is close to the boundary of a classification Moderate to Good or Good to High • Receptor is of high ecological importance or national or international value (e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), habitat for protected species or Geological Conservation Review (GCR) sites) which may be dependent upon soil, geology or the hydrology of the development area; • Receptor is at high risk from flooding above 0.5% Annual Exceedance Probability (AEP) and / or water body acts as an active floodplain or flood defence; • Receptor is used for public and / or private water supply (including Drinking Water Protected Areas (DWPA); and

Sensitivity	Definition
	• Groundwater vulnerability is classified as high; and if a GWDTE is present and identified as being of high sensitivity.
Medium	• SEPA Water Framework Directive Water Body Classification Moderate or is close to the boundary of a classification Low to Moderate; • Receptor is at moderate risk from flooding (0.1% AEP to 0.5 % AEP), but does not act as an active floodplain or flood defence; and • Moderate classification of groundwater aquifer vulnerability.
Low	• SEPA Water Framework Directive Water Body Classification Poor or Bad; • Receptor is at low risk from flooding (less than 0.1% AEP); and • Receptor not used for water supplies (public or private).
Negligible	• Receptor would not be affected by the proposed development, e.g. within a separate and unconnected hydrological or hydrogeological catchment.
Professional judgement based on the baseline condition of the receptor should be used to determine a receptor's sensitivity	

The magnitude of change considers the timing, scale, size and duration of the impact. For the purpose of this assessment, the magnitude of change criteria are defined in **Table 9.5**.

Table 9.5: Magnitude of Change

Magnitude of Change	Criteria	Definition
Substantial	Total loss of or major/substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post development character/composition/attributes would be fundamentally changed.	Fundamental (long term or permanent) changes to geology, hydrology, water quality and hydrogeology.
Moderate	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of the baseline would be materially changed.	Material, but non-fundamental and short to medium term changes to the geology, hydrology, water quality and hydrogeology.
Slight	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition would be similar to the pre-development circumstances/situation.	Detectable, but non-material and transitory changes to the geology, hydrology, water quality and hydrogeology.

Magnitude of Change	Criteria	Definition
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.	No perceptible changes to the geology, hydrology, water quality and hydrogeology.

Assuming the successful implementation of good practice and design mitigation measures, the sensitivity of the receiving environment together with the magnitude of the change defines the significance of the effect as outlined in **Table 9.6**.

Table 9.6: Significance Matrix

		Magnitude of change			
		Substantial	Moderate	Slight	Negligible
Sensitivity	High	Major	Major/Moderate	Moderate	Moderate/Minor
	Medium	Major/Moderate	Moderate	Moderate/Minor	Minor
	Low	Moderate	Moderate/Minor	Minor	Minor/Negligible
	Negligible	Moderate/Minor	Minor	Minor/Negligible	Negligible

Potential effects are, therefore, concluded to be Major, Moderate, Minor or Negligible. Effects considered as being Major or Major/Moderate are considered significant.

9.5 Difficulties & Uncertainties

The fieldwork carried out was a standard reconnaissance level walkover survey covering the main hydrological features within the application site. Representative locations and features such as watercourses, peat bodies and geological information were assessed, and this information is interpreted for any areas not visited.

Private water supply information within 3km of the proposed development has been provided by The Highland Council (THC) and is as accurate as this information allows.

The information presented in this assessment is based on desk studies and site investigations on the proposed development layout. There is the potential that further constraints may be identified during the pre-construction detailed design stage. Should further constraints be identified, these would be assessed and appropriately mitigated prior to construction.

9.6 Baseline Conditions

This subsection presents the information gathered on the existing topographical, hydrological, hydrogeological and geological conditions within the site and the study area. The study area is defined in **Section 9.4.2.**

9.6.1 Application Site

The proposed development is located in the Highlands in the North of Scotland, approximately 8km south east of Altnaharra and 21km north of Lairg and would be an extension to the consented and operational CRWF. Further details can be found in **Chapter 3: Description of Development.**

The proposed development lies within the eastern extent of the consented and operational CRWF within the River Vagastie catchment at approximately 240m above sea level. The topography slopes gently to the east down to 190 m above sea level adjacent to the River Vagastie. The landcover is dominated by a combination of open moorland and very low density juvenile commercial forestry. There are multiple unnamed tributaries running west-east across the site all discharging into the River Vagastie.

The hydrological study area is larger in extent than the site and includes the lower reaches of watercourse catchments that are present within the site. The extent of the catchment is shown in **Figure 9.1,** which outlines the extent of the study area.

9.6.2 Site Investigations

The phase 1 peat depth and hydrology survey and the hydrological walkover were undertaken in February 2022. Weather conditions were described as heavy snowfall. The phase 2 peat depth and hydrology survey was carried out in October 2022 and again in January 2023 with weather conditions described on both occasions as being dry and overcast with the occasional light shower. A final visit to obtain a small number of additional peat depths was undertaken in June 2023 with weather conditions being dry.

9.6.3 Climate

The standard average annual rainfall (SAAR) for the site has been derived from the Flood Estimation Handbook (FEH) Web Service as approximately 1507mm. To put this into context, rainfall in Scotland varies from under 800mm a year on mainland eastern Scotland in areas such as Fife, to over 3000mm on the mainland Western Highlands.

The Met Office 1991-2020 annual rainfall total from the Altnaharra No 2 Climate Station (81m Above Ordnance Datum (AOD)) is 1186.4mm with 196.6 days of rainfall days ≥ 1mm recorded, compared to 1702.5mm and 208.7 days for the Scotland North region.

The Altnaharra No 2 Climate Station is positioned approximately 10km north-east of the site and at a lower elevation compared to the site. However, the comparison with the regional Met Office and FEH data provides a good indication of both rainfall totals and patterns expected at the site.

The highest rainfall totals as shown in Error! Reference source not found. are typically experienced during t he winter months through October to March. The lowest totals rainfall is typically recorded during the Spring months from April to July.

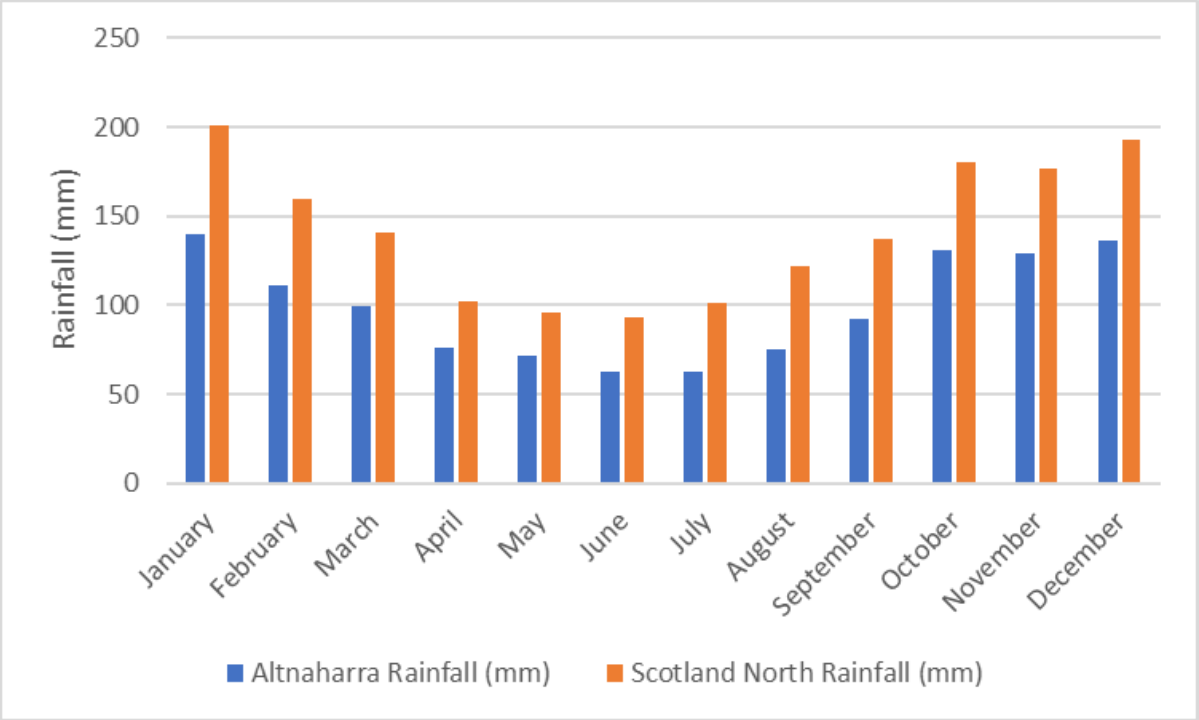

Figure 9.1: Average monthly rainfall data for climate period 1991 – 2020

9.6.4 Designated Sites

To the east of the site, the River Vagastie is hydrologically connected to the site and is designated as a Special Area of Conservation (SAC), due to the presence of Atlantic Salmon and Freshwater Pearl Mussel. The Caithness and Sutherland Peatland is classified as a SAC, as well as a Special Protection Area (SPA) and is located adjacent to the consented and operational CRWF and the site in the south-west. Additionally, this area is called Cnoc an Alaskie and is classified as a Site of Special Scientific Interest (SSSI). These classifications are related to the presence of peatland and blanket bog which are important upland habitat. To the north-west of the site, towards Ben Kilbreck, the 8732ha area is classified as a SSSI due protected habitats, such as blanket bog, and presence of Moine unit that holds a geological significance.

9.6.5 Surface Water Hydrology

Hydrologically, the site lies within the catchment of the River Vagastie that feeds into the Loch Naver approximately 10km to north-east. There are three unnamed minor watercourses that pass through the site from west to east, all of which discharge into the River Vagastie. The watershed for these watercourses are from higher ground west of the site containing the consented and operational CRWF. The River Vagastie is positioned on the eastern periphery of the site, with a small section within the site boundary close to the existing access bridge from the A836 to the consented and operation CRWF.

The unnamed channels are typical of upland and moorland catchments with channels often narrow and incised into the superficial geology with channel bedload including bedrock, peat and vegetation. Discharge rate is typically high with falls and plunge pools. These unnamed minor watercourses all discharge into the River Vagastie, which forms part of the wider River Naver catchment. Within the vicinity of the site, the River Vagastie is of boulder-bed morphology with a slight discharge angle. The channel contains pools and riffles as well as boulders, gravel bars and bedrock. See **Plate 9.1a** and **b** below for photographs taken by Natural Power surveyors illustrating the typical hydrology and geomorphology of the watercourses within the site.

Plate 9.1a: Photograph of the River Vagastie in November 2022 (BNGR NC 53270 27214)

Plate 9.1b: Photograph of an unnamed minor watercourse in November 2022 (BNGR NC 53236 27389)

Modified drainage networks also exist within the study area including historic land drainage features such as grips / ditches as well as some forestry drainage. There is also more recently installed drainage associated with consented and operational CRWF; however, these only exist within the study area in locations of planned shared access such as near the existing substation and proposed BESS.

According to the National River Flow Archive[1] the nearest river gauging station to the site is situated in the River Naver at Apigill (NGR NC 713 568). A review of the long-term flow archive for this gauging station (1977-

1 National River Flow Archive (2022), Naver at Apigill. Available at https://nrfa.ceh.ac.uk/data/station/info/77002 (accessed 18/01/2023)

2005) indicates a mean annual flow of 15.7 m^3/s and a Q10 flow of 30.7 m^3/s. Flow is generally highest during the winter months between November and February. The on-site catchment areas are generally *c*.1km^2 and are considerably smaller than the River Naver which has a total catchment extent above Apigill of ~477km^2; however, seasonal discharge patterns are likely to be similar.

According to the Flood Estimation Handbook website[2], the River Vagastie features a Base Flow Index (BFI) of 0.287 and a Standard Percentage Runoff (SPR) of 55.47%. To put this into context, the BFI is a measure of the proportion of a catchment's long-term runoff that derives from stored sources, with the BFI ranging from 0.1 in relatively impermeable clay catchments to 0.99 in highly permeable catchments. The SPR values represent the percentage of rainfall that is likely to contribute to runoff.

Based on the given BFI and SPR values, approximately a third of the catchment's long-term runoff is derived from stored sources with around half of the rainfall during a rainfall event contributing to runoff. This indicates that the site is located in a relatively impermeable catchment.

9.6.6 Flood Risk

The assessment has been carried out in accordance with Scottish Planning Policy (SPP, 2014). The document states that:

'Planning authorities must take the probability of flooding from all sources – (coastal, fluvial (watercourse), pluvial (surface water), groundwater, sewers and blocked culverts) and the risks involved into account when preparing development plans and determining planning application.' (SPP, page 58)

The Flood Risk Management (Scotland) Act 2009 sets in place a statutory framework for delivering a sustainable and risk-based approach to managing flooding. The main elements of flood risk management relevant to the proposed development is assessment of flood risk, as well as undertaking structural and non-structural flood management measures.

As highlighted in **Section** Error! Reference source not found. above, Policy 13 of NPF4 outlines the flood risk c onsiderations for developments. This includes the placement of development outside of the future functional flood plain and consideration for managing runoff.

As outlined in the following paragraphs, the relevant factors for assessing flood risk have been taken into account, measures to mitigate and sustainably manage the flood risk within the proposed development are provided in **Section 9.2.3** below.

As highlighted above, all potential sources of flooding must be considered for the proposed development. A summary of the potential sources of flooding is presented below.

[2] Flood Estimation Handbook website (2023), Available at https://fehweb.ceh.ac.uk/ (accessed 01/02/2023)

Fluvial Flood Risk

According to the SEPA Flood Risk Map (2019)[3], the River Vagastie has a high (10% / 1 in 10) likelihood of fluvial (watercourse) flooding in any given year. The risk areas are generally contained in the immediate river channel extent and is outside the site. As a result, there is no area identified within the site that is at risk of the fluvial flooding. In summary, the only areas of flood risk are downstream of the site associated with the River Vagastie and would be consistent with a typical upland catchment setting with Loch Naver located 10km downstream.

Pluvial Flood Risk

A review of SEPA Flood Risk Map indicates that there are no areas of surface water flood risk within or adjacent to the site.

Coastal Flood Risk

The site is located approximately 40km from the nearest coast and due to this distance, along with the topographical position of the proposed development turbines and infrastructure, approximately 220m AOD within the site, it would not be affected by tidal flooding.

Groundwater Flood Risk

The SEPA Flood Risk Map indicates that the site has no risk of groundwater flooding.

Infrastructure Flood Risk

The site features artificial ditches and furrows associated with the current or historic land use that may be affected by blockages and cause localised flooding. Whilst the density of these features has not been quantified, the likely wide spacing of drains and grips, and limited extent of former forestry drainage combined with the topographically sloping ground on which the site is positioned would infer that flood risk associated with existing networks is low.

9.6.7 Water Quality

Water Quality WFD Classification

Two waterbodies are classified under the Scottish Government's WFD (2000/60/EC) classification directions; The Scotland River Basin District (Standards) Directions 2014, and The Scotland River Basin District (Status) Directions 2014. The classified waterbodies are summarised in **Table 9.7** below. The WFD classifications discussed below are derived from SEPA's Water Classification Hub[4]

3 SEPA (2019), Flood Hazard and Flood Risk Information. Available at https://map.sepa.org.uk/floodmaps/FloodRisk/ (accessed 18/01/2023)

[4] SEPA (2015) Water Classification Hub. https://www.sepa.org.uk/data-visualisation/water-classification-hub/ (accessed 18/01/2023)

Table 9.7: RBMP Waterbodies within the vicinity of the proposed development

Waterbody	Waterbody ID	Current Overall Status (2020)	Overall Ecology (2020)	Overall Hydrology (2020)	Projected Overall Status (2027)	Predicted Overall Status (Long Term)
River Vagastie	20609	Moderate	Moderate	Good	Good	Good
Northern Highlands	150701	Good	n/a	n/a	Good	Good

WFD classified waterbodies are considered in the River Basin Management Plan (RBMP) for the Scotland River Basin District: 2015-2027[5]. The RBMPs are designed to protect and improve the water environment. The River Naver (Vagastie) watercourse has been designated as of moderate status on account of it being a heavily modified water body as a result of physical alterations. These cannot be addressed without a significant impact on water storage for hydroelectricity generation.

It should be noted that the River Naver catchment is an important fishery for salmon and freshwater pearl mussel. Further details are presented in **Chapter 7: Freshwater Ecology**.

The Northern Highlands is a groundwater body that has good status currently and is projected to remain in this status.

Water Quality Data

Water quality monitoring undertaken within the catchments for the consented and operational CRWF is presented to provide a local perspective on water quality. **Table 9.8** below presents the average values of selected parameters obtained during the water quality monitoring undertaken prior to the construction of the operational CRWF between October 2019 to March 2020.

Table 9.8: Local water quality data obtained from the River Vagastie and minor tributary watercourses within / adjacent to the site.

Watercourse	BNGR	Average Baseline Data				
		pH (Units)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	Turbidity (NTU)	Dissolved Organic Carbon (mg/L)
River Vagastie (main channel)	NC 53264 27208	6.27	13.43	0.070	0.62	5.85

[5] SEPA (2020) River Basin Management Planning https://www.sepa.org.uk/environment/water/river-basin-management-planning/ (accessed 18/01/2023)

Unnamed tributary to Vagastie	NC 53277 27404	4.96	12.74	0.050	0.28	6.48
Unnamed tributary to Vagastie	NC 53348 27982	6.48	13.62	0.060	0.42	5.33
Unnamed Tributary to Vagastie	NC 52174 29827	6.34	12.59	0.060	0.49	4.48

The results highlight that the watercourses draining the site are weakly humic, with generally low levels of mineralisation, healthy levels of dissolved oxygen and circumneutral to slightly acidic pH. This indicates that the watercourses are being fed by the percolation of rainwater over or through the peatland soils, which dominates the watersheds hereabouts (see **Section 9.6** below for further details). This is also reinforced by the concentration of Dissolved Organic Carbon, which exhibits a strong seasonal signal. Sediment export is generally low.

9.6.8 Water Resources

Public Water Supply

A review of the Scottish Government website does not indicate the site is located within the catchment of a surface Drinking Water Protected Area (DWPA)[6]. This conclusion was also confirmed by Scottish Water in their response to the EIA Scoping Report.

Private Water Supply

THC was contacted about the presence of Private Water Supplies (PWS) both within the site and within a 3km buffer zone of the site boundary. THC confirmed there are no registered within the site, or within the 3km search area.

No PWS were discovered during the course of the hydrology site investigations.

9.6.9 Soils and Peat

Information on the soils within the site has been obtained from Scotland's Environment Website[7] which brings together data from public organisations across Scotland including the British Geological Survey (BGS), James Hutton Institute (JHI), NatureScot and SEPA.

[6] Scottish Government (2014), Drinking water protected areas – Scotland rive basin district: maps Drinking water protected areas - Scotland river basin district: maps - gov.scot (www.gov.scot) (accessed: 18/01/2023).
[7] Scotland's Environment (2020), Scotland's environment map, https://map.environment.gov.scot/Soil_maps/?layer=1 (accessed 19/01/2023).

According to the National Soil Map of Scotland, the soil type expected to occur within the site are peaty gleys.

Peaty gleys are a result of particularly frequent waterlogging and are mapped across the entirety of the site.

The Carbon and Peatland 2016 map[8] provides information on the likely presence and nature of peat within the site. **Figure 9.2** shows that the site is dominated by Class 1 and Class 2 peat soils which are nationally important and have high conservation value. Notwithstanding, the presence of artificial ditches and moorland grips associated with historic land drainage and more recent commercial forestry infer that the peat present within the site is modified and unlikely to be fully representative of pristine peatland habitat.

Peat Survey Results

A programme of peat probing was completed in support of the proposed development (see **Technical Appendix 9.1: Peat Management Plan).**

The phase 1 (100m grid) peat depth walkover survey at the site was undertaken in February 2022 in line with Scottish Government guidance[9]. The detailed phase 2 detailed peat depth survey targeting proposed infrastructure was undertaken in October 2022. Additional probing was undertaken in January 2023 and June 2023 to provide further information relating to the proposed infrastructure. The interpolated peat depths are provided in Volume 3a **Figure 9.3: Peat Depth Interpolation**.

A breakdown of points in each category of peat depth is provided in **Table 9.9** below.

Table 9.9: Total number of peat depths surveyed within each category

Peat Depth Range (m)	Results	% of Points Surveyed
≤0.3	271	40.1
>0.3 – 0.5	106	15.7
>0.5 – 1.0	168	24.9
>1.0 – 2.0	108	16.0
>2.0	23	3.3
Total	645	**100.0**

The highest proportion (55.8%) of recorded peat depths were shallow (≤0.5m). Areas of deepest peat (greater than 2.0m deep) were located near to EXT-03 and EXT-02 which informed the design to relocate

[8] Scotland's Environment (2020) Carbon and Peatland 2016 Map, https://map.environment.gov.scot/Soil_maps/?layer=10 (accessed 19/01/2023).
[9] Scottish Government. 2017. Guidance on Developments on Peatland: Peatland Survey. Available at https://www.gov.scot/publications/peatland-survey-guidance/

these turbine locations to areas of shallower peat. Further information on the design evolution informed by peat probing is presented in **Technical Appendix 9.1: Peat Management Plan**.

9.6.10 Geology

According to the British Geological Survey (BGS) Solid Bedrock map sheet 108E (Loch Naver), the site is underlain by Altnaharra Psammite, a metasedimentary rock dating from the Neoproterozic Era. The Altnaharra Psammite is part of the Moine Supergroup and is described as feldspathic and micasceous, sometimes interbedded within minor semipelite and is massive to flaggy. The map indicates that identified exposure illustrate beds dipping gently to the south-east. No geological structural features were mapped within the site.

There are two nearby published borehole records obtained during intrusive site investigation of the adjacent consented and operational CRWF, both advanced to ~100m below ground level. However, no specific geological information was detailed.

9.6.11 Superficial Geology

According to the BGS 1:50,000 Superficial Geology map, the solid bedrock within the site is overlain by a combination of Quaternary sand, gravel and clay as both glacial till and more recent organic accumulations of peat. In addition to these, sand and gravel is also present in riparian corridors as alluvium associated with more recent fluvial deposition as well as some of glacio-fluvial origin.

9.6.12 Hydrogeology

The underlying metasedimentary rocks within the site are part of the Moine Supergroup and classified as a low productivity aquifer on account of a compact and crystalline structure. Limited transport and storage may occur within structural features or within near surface weather margins resulting in rare springs, or more likely, diffusely emerging seeps. Information on the hydraulic properties of the bedrock were obtained locally from the published borehole logs and indicated the completion of constant rate pump testing with corresponding yield values of 0.145m^3 hr and 5m^3 hr.

Alluvial or glacio-fluvial deposits with a high content of sand and gravel deposited by glacial meltwater rivers or post-glacial riverine processes will have the highest permeability and are likely to be situated closer to larger channels or valley basins, such as adjacent to the River Vagastie. Conversely, where these sediments are interbedded with finer grained, lower permeability deposits such as silts and clays, water transmission will be more limited resulting in more heterogenous flow conditions. Where present, the overlying peat may also host a shallow and potentially perched water table.

9.6.13 Groundwater Dependent Terrestrial Ecosystems

The methodology, survey data and assessment of potential GWDTE has been considered in full within **Chapter 6: Terrestrial Ecology**.

As presented in **Figure 9.1**, several areas were identified as potential GWDTEs. However, only one area is considered to be actually dependent on groundwater within the site. This area was classified as M10 and is located on the southern edge of the site; however, this is located across the River Vagastie on a slope that features no proposed infrastructure and so is not hydrologically connected to the site, nor is any infrastructure likely to be in the upgradient contribution zone.

Furthermore, and as presented in **Chapter 6: Terrestrial Ecology**, the remaining areas of potential GWDTE are sustained by surface water runoff / ponding and incident rainfall rather than by groundwater. It has been shown that the superficial and bedrock deposits have little potential to contain and allow groundwater movement. Accordingly, potential buffers to GWDTE specified in SEPA guidance (2017) need not apply.

Further details can be found within **Chapter 6: Terrestrial Ecology**.

9.7 Modifying Influences

Information regarding climate change was obtained from the UK Climate Projections (UKCP18) website[10] . The UKCP18 is a climate analysis tool which features comprehensive projections for different regions of the UK. General climate change trends projected over UK land for the 21st century show an increased chance of warmer, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of weather extremes. This is seen in the Probabilistic (25km), Global (60km), Regional (12km) and Local (2.2km) projections.

Warmer and wetter winters suggest less snow and more rain. This will create increased risk for flood events, and issues with water quality as less precipitation will be held in its frozen state during the winter season. If climate predictions are correct, summer months will become drier. This will create pressure on the needs of water abstractions and on sensitive water reliant ecosystems. Evidence also suggests that although the summer months will have an average decrease in rainfall, summer storms will be more frequent and intense. This may lead to more extreme flow values during and immediately following such events, with consequential flooding and water quality issues. This is of key importance for the hydrological environment during summer construction periods.

It is suggested that increased temperatures could also Increase evapotranspiration and potentially cause desiccation of peat. The desiccation could result in the peat being more susceptible to erosion due to increased intensity in summer storms and increased rainfall during the winter months. As peat and peat

[10] Met Office, UK Climate Projections (UKCP), https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index

dominant soils are composed of vegetation remains, they contain a high proportion of carbon compared to other soils.

9.8 Identification and Evaluation Of Effects

9.8.1 Proposed Development Interactions

The proposed development would introduce physical changes which have the potential to alter the hydrological characteristics within the site. During the construction phase, and to a lesser extent during the operational phase, potential sources of pollution would be present. Hydrological surveys have been undertaken to establish the existing on-site baseline conditions and associated areas downstream to assess the likely significant environmental effects of the proposed development on the identified receptors, the significance of these effects on the receptors and the potential for mitigation to reduce the significance of the identified effects.

9.8.2 Evaluation of Effects

Basis of Assessment

The proposed development would consist of the erection, up to 40-year operation, and subsequent decommissioning of up to three wind turbines, with tip heights of 149.9m. The proposed development includes a BESS compound and associated turbine foundations and transformers, hardstanding areas for erecting cranes at each turbine location, a series of on-site tracks connecting each turbine, and underground cables linking the turbines to the existing grid connection. Further details are provided in **Chapter 3: Description of Development**, of the EIA Report.

The existing CRWF temporary construction compound would be used for the additional turbine construction works and then the temporary construction compound would be removed in full or in part and the rest of the BESS completed *in situ*. As the infrastructure has already been assessed and consented, the construction effects will not be considered within this EIA. However, any impacts associated with the operation of the temporary construction compound during of the construction of the proposed development will be considered within the EIA Report.

Typically, the construction phase would involve a period of earthworks inclusive of track construction and excavations for forming turbine bases. Following this, the turbine bases and infrastructure would be installed and finally the turbines will be transported to the site and erected.

Mitigation by Design

A summary of the hydrological influences on the proposed development layout are given below with full details of the proposed development's design in **Chapter 3: Description of Development**. Due to the nature of the environment occupied by the site, it is important that the design and infrastructure helps maintain or even improve the local hydrology. Poor design of development infrastructure can result in significant implications to the hydrological environment, soils and ecology. The design has incorporated the consented

and operational CRWF access infrastructure, which will further reduce the impact of the Proposed Development.

The findings of the peat depth survey (**Section 9.6.9** above and **Figure 9.3**) show that the infrastructure has, as far as possible, taken into account other constraints and have been sited outside areas of deep peat (>1.0m). The depths within the site are shown to be in a shallower range when considering the discrete turbine and access track areas.

A 50m set-back (buffer) distances has been adopted to help reduce effects of the proposed development on the hydrological environment.

Table 9.10 confirms that all turbines and infrastructure associated with the proposed development are located outside the buffer limits. Distances were calculated using the functionalities provided with the Quantum Geographic Information System (QGIS) package. Watercourses are linear features that were identified from the OS 1:10,000 raster data.

Table 9.10: Distance from turbine to nearest watercourse

Turbine ID	Turbine distance from watercourse (inclusive of 50m buffer)
EXT-01	122
EXT-02	163
EXT-03	83

The areas of land take for the proposed development infrastructure will be very minor, with the Vagastie catchment area upstream of the existing and operational CRWF being 11.97 km^2. The combined temporary and permanent land take from the proposed development is <0.1 km^2 and there <1% of the catchment area.

Sediment management measures and pollution prevention would be utilised at all infrastructure locations and further details on these are presented in **Section 9.10** below. For EXT-01, additional details on the likely drainage arrangements have been provided in **Figure 9.1** as requested in the EIA Scoping Response from SEPA.

Other embedded mitigation integrated as part of the design of the proposed development is as follows:

- The rock required to construct the tracks and crane pads would be sourced from the battery energy storage area or other cut earthworks on track footprints within the site avoiding the need for a dedicated temporary quarry / borrow pit area. This reduced the overall footprint of the proposed development and minimises potential impacts on peat and carbon rich soils and other hydrological receptors;

- The proposed development access would utilise the existing access and the existing grid connection associated with the consented and operational CRWF, again reducing the overall footprint and minimises potential impacts on peat and carbon rich soils and other hydrological receptors; and
- The proposed development would require three watercourse crossings that are located on each of the unnamed tributaries to the River Vagastie located between the main access track, EXT-03, and EXT-02. Mitigation embedded within the design of these crossings is presented below in **Section 9.10**.

Watercourse Crossings

There are three watercourse crossing locations that correspond to the three unnamed tributaries featured within the site. It should be noted that a fourth, existing crossing is present on the River Vagastie as part of the consented and operational CRWF and has not been reproduced here, since no upgrade or other works are planned.

The three watercourses at the new crossing locations feature channel widths of <1.5m and drain towards the River Vagastie to the east. The gradient associated with the watercourses are gentle with water depths of ≤0.2m during the day of the survey in February 2022. Details can be found below in **Table 9.11**.

Table 9.11: Watercourse Crossings

Watercourse crossing	Easting	Northing	Width (m)	Anticipated CAR Authorisation	Photo
1	253074	928057	0.7	Registration	
2	253024	927766	1.2	Registration	

Watercourse crossing	Easting	Northing	Width (m)	Anticipated CAR Authorisation	Photo
3	252946	927525	1.2	Registration	

The weather conditions were recorded as featuring snowy weather and temperatures of approximately 0°C.

The rationale and design requirements include the need for appropriate sizing to manage flood risk (1 in 200 + uplift for climate change) and allow safe passage for wildlife such as fish or riparian mammals, the need for an engineering solution where the invert can be sunk into the watercourse bed allowing riverine substrate to stabilise in the crossing structure as well as not presenting a barrier by creating a step or hydraulic drop at the culvert inlet or outlet. Further design consideration and an overview of the relevant guidance is presented in **Chapter 3**.

As the crossings are an engineering activity in the water environment, the structures would require authorisation under the Water Environment (Controlled Activities) (Scotland) Regulations 2011.

9.9 Receptor Baseline Sensitivity

On the basis of the baseline surveys and available information, **Table 9.4** identifies the criteria for assigning the sensitivity of receptors as outlined in **Table 9.12**below with justification for their categorisation.

Table 9.12: Receptor Sensitivity

Receptor	Sensitivity	Comments
Surface Water		
River Vagastie	Medium	The River Vagastie is classified as moderate overall status (as of 2020) as part of SEPA's RBMP and a 2027 classification aim of good status. The unnamed tributaries to the River Vagastie are minor upland streams and do not have an RBMP Status. Medium sensitivity is also assigned to these due to the limited potential for attenuation prior to confluence with the River Vagastie.
Flood Risk		
The proposed development	Low	Very limited areas of the site fall within the flood inundation envelope with areas at risk of flooding being outside the site.

Receptor	Sensitivity	Comments
Flood Risk		
Downstream of the site	Low	The downstream catchment area is typical of an upland and uninhabited catchment setting with Loch Naver located approximately 10km downstream. The site occupies a comparatively small proportion of the total catchment area that would influence flood risk in these downstream areas. Therefore, there is low risk of flooding associated with the proposed development.
Soils & Peat		
Site soils and peat <0.5m depth	Low	56.8% of the recorded peat depths are less than 0.5m deep and therefore classified as peaty soils according to SPP.
Site soils and peat >0.5m depth	High	Areas of deep peat have been avoided as part of the design of the proposed development. 43.2% of the recorded peat depths are greater than 0.5m deep and therefore, classed as peat. The site consists of Class 1 & 2 peatland; however, extensive artificial drainage associated with historic land-use and drainage is likely to have resulted in peat not being fully representative of pristine peatland habitat.
Geology		
Geology	Low	Geology is typical of wider area with no designated site affected by the proposed development. The Ben Kilbreck SSSI is not connected to the proposed development.
Hydrogeology		
Underlying groundwater	Low	Bedrock and superficial aquifers are mapped as low productivity and are unlikely to supply significant volumes of groundwater except for areas on fractures or fault lines. Notwithstanding, bedrock groundwater is characterised as good quality status.
GWDTE	Low	GWDTE habitats are sustained by incident rainfall and surface water runoff / ponding rather than by groundwater. One area was identified as being GWDTE; however, it is not hydrologically connected to the proposed development.

9.10 Mitigation Measures

A number of planning, design and construction proposals have been identified during the assessment. Full details of the industry good practice construction management and mitigation measures would be provided in a Construction Environmental Management Plan (CEMP) which would be prepared post consent as part of

a planning condition. In order to indicate the likely contents of the CEMP a draft version has been provided in **Technical Appendix 3.1: Outline CEMP**.

A summary of the measures included within the Outline CEMP are described in **Section 9.10** below and have been assumed to be part of the proposals when the residual effects and their significance are reported. Any additional mitigation, specific to the proposed development, but still considered good practice is also provided in further detail in **Section 9.10** below.

A number of the mitigation measures described in the following paragraphs could also be adopted during the operational phase of the proposed development.

9.10.1 Good Practice Mitigation & Embedded Mitigation

The site-specific CEMP would provide details on industry good practice measures to be put in place to manage activities in such a manner as to prevent or minimise effects on the surface and groundwater environment. It is expected that the following would be included within the CEMP and would ensure the works are undertaken in accordance with good practice guidance;

- The development of a site-specific Pollution Prevention Plan which would inform the design and layout of sustainable drainage to be implemented for temporary drainage during the construction and permanent drainage during the operational phase of the proposed development. The Pollution Prevention Plan would also detail contingency measures in the event of unexpected pollution. Measures would ensure that pre-development runoff rates are maintained and that rates of runoff to watercourses are not increased. Where possible, Natural Flood Management measures would also be integrated into the drainage design with feasibility investigated post-consent;
- Heavy plant and machinery would be required and as a result it is appropriate to adopt best working practices and measures to protect the water environment, including those set out in Pollution Prevention Guidance (GPP1);
- In accordance with GPP2, any above ground on-site fuel and chemical storage would be bunded;
- Emergency spill response kits would be maintained during the construction works (GGP21 & GPP22);
- A vehicle management system would be put in place wherever possible to reduce the potential conflicts between vehicles and thereby reduce the risk of collision (GPP21);
- Suitable access routes would be chosen which minimise the potential requirement for either new temporary access tracks or for tracking across open land which could contribute to the generation of suspended solids and / or degradation of soil;

- Bog matting and / or low load bearing machinery would be used when access is required over adjacent peatland or GWDTEs, where unavoidable. Demarcation of sensitive habitats, prior to any works, would also be undertaken;
- A speed limit would be used to reduce the likelihood and significance of any collisions;
- Drip trays would be placed under stationary vehicles which could potentially leak fuel / oils; any temporary construction / storage compounds required would be located remote from any sensitive surface water receptors and would be constructed to manage surface water run-off in accordance with best practice;
- Any water contaminated with silt or chemicals would not be discharged directly or indirectly to a watercourse without prior treatment;
- Site waste management details, including for site waste, residual forestry material, soil and peat management good practice. Any excavated peat will be appropriately managed and re-used. This is detailed further in **Technical Appendix 9.1 Peat Management Plan**;
- Water for temporary site welfare facilities would be brought to site, and foul water would be collected in a tank and collected for offsite disposal at an appropriately licensed facility; and
- Water quality monitoring requirements for sensitive receptors downstream of work areas.

The CEMP would be accompanied by a Schedule of Mitigation, which would detail all the environmental mitigation requirements to protect hydrology, hydrogeology and soils receptors outlined in the EIA Report.

The implementation of the CEMP would be managed on-site by a suitably qualified and experienced Environmental Clerk of Works (ECoW), with support from other environmental professionals as required. The ECoW would have authority to stop any works that are or have potential to impair soils, geology or the water environment.

During the operational phase, an Operational Environmental Management Plan (EMP) would be implemented and shall outline permanent pollution prevention controls and emergency response measures.

Further information is provided in **Technical Appendix 3.1: Outline CEMP**.

9.10.2 Site-Specific Good Practice Mitigation

The site has been identified as containing peat and carbon rich soils. Extensive peat surveys have been completed as part of this assessment with the results detailed in **Technical Appendix 9.1: Peat Management Plan** along with a stability assessment presented in **Technical Appendix 9.2: Peat Slide Risk Assessment**. The Peat Management Plan also provides details on:

- The investigations undertaken used to inform the layout of the proposed development and how areas of deep peat (>1.0m) have been avoided as far as possible;

- The anticipated excavation volumes for acrotelmic and catotelmic peat required as part of the construction of the proposed development;
- Demonstration of the anticipated re-use balance of volumes of acrotelmic and catotelmic peat as part of the reinstatement of construction works associated with the proposed development;
- Presentation of good practice handling methods for construction, temporary storage and reinstatement that would be deployed in order to safeguard peat and to maximise the functionality of reinstated peat; and
- Presentation of compensatory peatland habitat restoration to be implemented as part of habitat management proposals.

The Peat Management Plan is a working document that would be updated as the project progresses through detailed design, construction and operation. Peat habitats are considered to be of **High** sensitivity. Loss and degradation of peat can result in the release of carbon dioxide and result in habitat loss. The Peat Management Plan would seek to ensure that any impacts on peat and carbon rich soils are reduced to a **Low** or **Negligible** magnitude, particularly with regard to any areas of deep peat, such that no significant effects are predicted.

In order to minimise the effects of dewatering of adjacent peatland habitats and impacts on the River Vagastie, additional site-specific good practice mitigation measures would be implemented during the construction phase with full details on how they would be developed and deployed presented in the outline CEMP. These measures include;

- The production of a conceptual drainage layout plan for EXT-01 to inform the likely arrangement of the drainage network to minimise potential adverse effects on the River Vagastie. The conceptual drainage layout is presented in **Figure 9.1**; and
- Covering upgradient side batter slopes with turves / vegetation to provide a 'seal' and minimise upgradient dewatering of peatlands. Further design consideration and an overview of the relevant guidance is presented in **Chapter 3**.

Monitoring

A programme of surface water quality and freshwater fish monitoring would be finalised post consent, prior to construction. A breakdown of the proposed monitoring methodologies has been provided to take into account sensitivities of the on-site and downstream environments. The details of any required monitoring should be discussed and agreed with SEPA, Marine Science Scotland (MSS), and THC prior to commencement. The extent and the frequency of the monitoring would be proportionate to the level of activity on the site during the construction, operation and decommissioning of the proposed development. Appropriate monitoring is important to:

- Provide reassurance that established in-place mitigation measures are effective and that the proposed development is not having any significant adverse impact upon the environment;
- Indicate whether further investigation is required and, where pollution is identified, the need for additional mitigation measures to prevent, reduce or remove any impacts on the water environment; and
- Understand the long-term effects of the proposed development on the natural environment.

A baseline surface water and freshwater fish monitoring programme would be undertaken prior to the commencement of construction works and is likely to reflect the existing monitoring plan for the existing and operational CRWF. A copy of this is provided with the EIA Report in **Technical Appendix 9.3**. The establishment of a baseline is very important as it provides a suite of parameters against which to compare samples taken during the proposed development's lifetime, and with which to assess any impacts and the requirement for any appropriate remedial measures. However, due to the variance in climatic conditions, recording like for like water quality prior to and during construction is likely to be unusual. Therefore, it is also recommended that control sites, situated outside the area affected by the proposed development infrastructure, are also established at the time.

It is also recommended that a suitably qualified water monitoring consultant is employed throughout the construction of the proposed development. The appointed consultant can provide advice to the contractors about how environmental effects can be minimised, and what methods can be employed to reduce effects on water quality, soils and associated habitats.

Monitoring should be undertaken throughout construction of the proposed development.

The monitoring would help to identify areas where infrastructure is having a negative effect on peaty soils and utilise the appropriate methods to prevent further deterioration. It is also recommended that all construction management and water management techniques are agreed prior to construction. The techniques would be agreed following consultation with SEPA, and the THC.

In conjunction with this, there should be a programme of visual monitoring to ensure that the designed drainage system is compliant with the requirements under CAR with respect to General Binding Rule (GBR) 10 and in particular clauses d, g and h.

9.11 Potential Construction Effects

The potential for significant environmental effects on the hydrological environment is greatest during the construction phase, due to the high levels of activity on-site and when there is greatest change to the existing environment.

The following potential environmental effects that could arise have been presented in full:

- Pollution Incidents;
- Erosion and Sedimentation;
- Increase in Runoff;
- Modification of Surface Drainage Patterns;
- Impediments to Surface Water Flow;
- Modification of Groundwater Flows and Levels; and
- Impacts on Peat and Carbon Rich Soils.

9.12 Assessment of Construction Effects

Table 9.13 identifies the significance of the likely construction effects on the identified receptors, assuming the successful implementation of the good practice and mitigation measures proposed in **Section 9.11** above. The assessment is based on the criteria outlined in **Section 9.4** above.

Table 9.13: Assessment of Construction Effects

Receptor	Sensitivity	Description of Potential Change	Mitigation Measure	Magnitude of Change	Significance of Effect
Surface Waters					
River Vagastie	Medium	• Pollution incidents; • Erosion and sedimentation; • Changes in water quality; • Increase in runoff; • Modifications to surface drainage patterns; and • Impediments to surface water flow.	General and site-specific good practice mitigation outlined in **Section 9.00** above including the development of a CEMP, surface water management measures and pollution prevention planning**.** Performance would be measured through water monitoring and inspection by the ECoW.	Slight	Moderate/Minor (Not Significant)
Flood Risk					
The proposed development	Low	• Increase in runoff; • Modifications to surface drainage patterns; • Impediments to surface water flow; and • Impacts on peat and carbon rich soils.	General and site-specific good practice mitigation outlined in **Section 9.00** above including the development of a CEMP and associated surface water management measures**.** Existing runoff patterns shall be maintained.	Negligible	Minor/Negligible (Not Significant)
Watercourse downstream of the proposed development	Medium			Slight	Moderate/Minor (Not Significant)
Water Resources					
River Naver	High	• Pollution incidents; • Erosion and sedimentation; • Changes in water quality; • Increase in runoff; • Modifications to surface drainage patterns; • Impediments to surface water flow; • Modification of groundwater flows and levels; and • Associated impacts on peat and carbon rich soils.	General and site-specific good practice mitigation outlined in **Section 9.00** above including the development of a CEMP, surface water management measures and pollution prevention planning**.** Performance would be measured through water monitoring and inspection by the ECoW.	Slight	Moderate (Not Significant)

Receptor	Sensitivity	Description of Potential Change	Mitigation Measure	Magnitude of Change	Significance of Effect
Peat & Carbon Rich Soils					
Site soils and peat < 0.5m depth	Low	• Pollution incidents; • Modifications to surface drainage patterns; • Modification of groundwater flows and levels; and • Associated impacts on peat and carbon rich soils.	General and site-specific good practice mitigation outline in **Section 9.00** above including site-specific measures to avoid upslope dewatering**.** **Technical Appendices 9.1: Peat Management Plan and 9.2: Peat Slide Risk Assessment** provides further details relating the protection of peat and carbon rich soils.	Negligible	Minor / Negligible (Not Significant)
Site soils and peat > 0.5m depth	High			Negligible	Moderate/Minor (Not Significant)
Geology					
On-site Geology	Low	• Excavation and removal required for construction.	General and site-specific good practice mitigation outline in **Section 9.00** above**.**	Negligible	Minor / Negligible (Not Significant)
Hydrogeology					
Hydrogeology and Groundwater	Low	• Pollution incidents; • Modification of groundwater flows and levels; and • Associated impacts on peat and carbon rich soils.	Resource potential for on-site groundwater is low. No actual GWDTEs are identified as in hydrological connectivity with the proposed development. Notwithstanding, general and site-specific good practice mitigation is outlined in **Section 9.00** above and include pollution prevention planning and the measures to avoid upslope dewatering**.**	Negligible	Minor / Negligible (Not Significant)
GWDTE	Low			Negligible	Minor / Negligible (Not Significant)

With the embedded mitigation measures described in **Section 9.10** and summarized in **Table 9.14**, including buffers, following good practice construction and site drainage management guidance from relevant bodies (e.g. SEPA, CIRIA and Scottish Renewables), the magnitude of the change of increased sediment/silt runoff causing a deterioration in surface water quality in waterbodies and watercourses within and downstream of the site during construction is considered to be moderate to moderate/minor. Embedded mitigation measures to minimize the risk of pollution and accidental spillage will minimise the likelihood and severity of such incidents happening, however, there is still a residual risk. Notwithstanding, it is highlighted that such risks will be highly transient, being of short duration, and may be reversible.

9.13 Potential Operational Effects

The effects of the proposed development are expected to be substantially lower during the operational phase.

Following construction of the proposed development, all infrastructure will be left in situ to permit maintenance.

The potential operational effects of the proposed development are associated with the permanent site infrastructure, including the access tracks, turbine bases, hardstanding areas and any required maintenance work during operation.

The assessment of operational effects considers that the pollution prevention controls, and permanent drainage installed during construction will remain in place during operation and would be safe guarded through the provision of an Operational EMP.

During operation, the increase in hardstanding areas (turbine bases, substation and tracks) could result in a slight increase in the rate and volume of surface water runoff, leading to an increase in flood risk downstream. However, permanent SuDS drainage measures will be part of the design and the size of the areas of hardstanding compared to the catchment areas of the downstream watercourses are very minor.

There is not expected to be any long-term effect on sub-surface flows during operation following the installations of permanent mitigation measures described in Section **9.10.1** and **9.10.2**.

9.14 Assessment of Predicted Operational Effects

Table 9.14 below identifies the likely operational effects on the identified receptors and their significance, assuming the successful implementation of the good practice and mitigation measures proposed in **Section 9.10** above. The assessment is based on the criteria outlined in **Section 9.4** above.

Table 9.14: Assessment of Operational Effects

Receptor	Sensitivity	Description of Potential Change	Mitigation Measure	Magnitude of Change	Significance of Effect
Surface Waters					
River Vagastie	Medium	• Pollution incidents; • Changes in water quality; • Increase in runoff; • Modifications to surface drainage patterns; and • Impediments to surface water flow;	General and site-specific good practice mitigation outlined in **Section 9.00** above, including the development of an operational EMP, permanent surface water management measures and pollution prevention planning.	Negligible	Minor (Not Significant)
Flood Risk					
The proposed development	Low	• Increase in runoff; • Modifications to surface drainage patterns; • Impediments to surface water flow; and • Impacts on peat and carbon rich soils.	General and site-specific good practice mitigation outlined in **Section 9.10** above, including the development of an operational EMP and associated surface water management measures. Existing runoff patterns shall be maintained.	Negligible	Minor/Negligible (Not Significant)
Watercourse downstream of the proposed development	Medium			Negligible	Minor/Negligible (Not Significant)
Water Resources					
River Naver	High	• Pollution incidents; • Erosion and sedimentation; • Changes in water quality; • Increase in runoff; • Modifications to surface drainage patterns; • Impediments to surface water flow; • Modification of groundwater flows and levels; and • Associated impacts on peat and carbon rich soils.	General and site-specific good practice mitigation outlined in **Section 9.10** above, including the development of an operational EMP, permanent surface water management measures and pollution prevention planning.	Negligible	Moderate/Minor (Not Significant)
Peat & Carbon Rich Soils					

Receptor	Sensitivity	Description of Potential Change	Mitigation Measure	Magnitude of Change	Significance of Effect
Site soils and peat < 0.5m depth	Low	• Pollution incidents; • Modification of groundwater flows and levels; • Modifications to surface drainage patterns; • Modification of groundwater flows and levels; and • Associated impacts on peat and carbon rich soils.	General and site-specific good practice mitigation outlined in **Section 9.00** above and **Technical Appendix 9.1 Peat Management Plan**, including the monitoring of peat reinstatement. Compensatory peatland habitat restoration proposals would also provide enhancement of off-site peatlands.	Negligible	Minor/Negligible (Not Significant)
Site soils and peat > 0.5m depth	High			Negligible	Moderate/Minor (Not Significant)
Geology					
On-site Geology	Low	• Excavation and removal required for construction.	-	Negligible	Minor / Negligible (Not Significant)
Hydrogeology					
Hydrogeology and Groundwater	Low	• Pollution incidents; • Modification of groundwater flows and levels; and • Associated impacts on peat and carbon rich soils.	Resource potential for on-site groundwater is low. No actual GWDTEs are identified as in hydrological connectivity with the proposed development. Embedded mitigation would minimise effects of dewatering of shallow groundwater.	Negligible	Minor / Negligible (Not Significant)
GWDTE	Low			Negligible	Minor / Negligible (Not Significant)

9.15 Cumulative Effects and Interaction of Effects

The adjacent consented and operational CRWF is the only other scheme with potential to cumulatively affect the water quality, flooding and fisheries interests associated with the River Vagastie catchment.

The good practice mitigation measures described in **Section 9.10** above would significantly reduce the likelihood of pollutants, including suspended solids, being discharged to nearby watercourses (including River Vagastie/Naver SAC). Furthermore, the implementation of embedded mitigation such as appropriate watercourse crossing structure sizing, good practice on peat and soil handling / reinstatement as well as suitably designed permanent drainage would not contribute to any existing pressures within the River Vagstie / Naver SAC. Monitoring would also be undertaken to demonstrate the effectiveness of these mitigation measures. Therefore, it is expected that any cumulative effects would be **Minor** and **Not Significant**.

9.16 Licencing Requirements

SEPA amended the requirements under CAR brought in by the Water Environment (Miscellaneous) (Scotland) Regulations 2017 to impose the need for individual sites to require a site-specific licence relating to surface water drainage, rather than individual activities required to adhere to the Regulations. This requirement is linked to specific criteria for a construction site, including access tracks, of >4ha, or >5km or which includes any area >1ha or >500m on ground with slope >25º.

It is acknowledged that to support the licence application, further information on the drainage and environmental management requirements are likely to be required. It should be acknowledged within this chapter that the information relating to good practice has been provided, but that the level of detail required to support a CAR licence application is not required to support the planning application.

9.17 Summary of Residual Effects

The residual effects represent the overall likely significant effect of the proposed development on the environment, taking account of practical and available mitigation measures.

The assessment has identified that following the implementation of embedded mitigation as well as general and site-specific good practice mitigation there would be no significant environmental effects from the proposed development on the hydrological, hydrogeological and geological environment.

9.18 Decommissioning

During decommissioning of the proposed development, potential impacts on the hydrological, hydrogeological and geological environment are expected to be less than those encountered during the construction phase and therefore, “not significant”. No specific mitigation measures are therefore identified. The decommissioning of the proposed development would adhere to the latest legislative and guidance requirements at the time.

9.19 Future Baseline

Without the proposed development, the main change to the future baseline would be as a result of climate change, as described above. Increased rainfall will result in higher peak flows in the watercourses in the future. In addition, there may be more drought periods in the summer months, with drier, hotter conditions predicted resulting in lower flows during the summer months.

9.20 Summary

An assessment has been carried out of the likely significant effects of the proposed development on the hydrological, hydrogeological and geological environment. The assessment has considered the site preparation, construction, operation and decommissioning of the proposed development.

The potential effects on the hydrological, geological and hydrogeological environment have considered:

- Pollution Incidents;
- Erosion and Sedimentation;
- Increase in Runoff;
- Modification of Surface Drainage Patterns;
- Impediments to Surface Water Flow;
- Modification of Groundwater Flows and Levels; and
- Impacts on Peat and Carbon Rich Soils.

Following the identification and assessment of the key receptors, taking into account the potential effects listed above, a comprehensive suite of mitigation and good practice measures has been incorporated into the design, including extensive buffer areas. In addition, a site-specific CEMP, Operational EMP, as well as detailed design of infrastructure and associated mitigation would be implemented to protect the groundwater and surface water resources from pollution and minimise changes to the hydrological environment.

The impact assessment has taken into account the hydrological regime, highlighting that the principal effects would occur during the construction. Assuming the successful design and implementation of mitigation measures the significance of construction effects on all identified receptors is considered to be of moderate to minor/negligible significance. The assessment of predicted operational effects has also determined that the significance of effects on all receptors to be of moderate/minor to minor/negligible significance.

Good practice design and construction of the proposed development delivered through a skilled team of competent workers, with mitigation and compliance monitored in collaboration with SEPA, THC and other engaged stakeholders, would result in no significant effects to the hydrological, hydrogeological and soils environment.

9.21 References

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Other references, guidance and good practice are presented in Table 9.4.