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Chapter 9

Hydrology, Geology & Hydrogeology

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Glossary

Term	Definition
Abstraction	The process of and the location of the removal or diversion of water from the natural environment, by a variety of means including pumps, pipes, boreholes and wells
Aquifer	A geological formation, group of formations or part of a formation that can store and transmit water in significant quantities.
Acrotelm	The acrotelm is one of two distinct layers in undisturbed peat bogs. It overlies the catotelm.
Baseflow	The component of the river flow that is derived from groundwater sources rather than surface run-off. The Base Flow Index (BFI) value provided by the Flood Estimation Handbook (FEH) is a measure of the proportion of a catchments long-term runoff that derives from stored sources.
Buffer area	An area which protects the receptor such as watercourses from pollutants and sediment from the adjacent land.
Catotelm	The lower, water-saturated zone of a mire/peat bog.
Environmental Clerk of Works	The Environmental Clerk of Works will carry out pre-construction surveys during the construction of the proposed development and monitor construction compliance with agreed mitigation and management requirements
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of drawing together by the developer, in a systematic way, a description of the development and information relating to the likely significant environmental effects arising from a Proposed Development
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Regulation 5 .
Groundwater (GW)	Water located beneath the ground surface in soil pore spaces and in the fractures of rock formations.

Term	Definition
Headwaters	A tributary stream of a river close to or forming part of its source. Normally wet flushes, bogs or springs at the head of first-order streams.
Hydrological regime	The statistical pattern of a river's constantly varying flow rate.
Overland flow	Water passing rapidly over or through the surface layer of soil.
Peak flow	The maximum flow recorded during a high flow event.
Peat	A largely organic substrate formed of partially decomposed plant material.
Precipitation	Deposition of moisture including dew, hail, rain, sleet and snow.
Private water supply	Any water supply which is not provided by a water company and is not connected to mains supply. Most private water supplies are situated in more remote, rural parts of the country and may just serve one property or several properties through a network of pipes.
Return period	Is a measure of the rarity of an event: the longer the return period, the rarer the event.
Riparian zone	Land immediately adjoining the aquatic zone of a watercourse and influenced by it.
Runoff	Surface runoff is the flow of water over the surface that can result due to the surrounding soils lacking the capacity to infiltrate further water or due to the surface water flowing off infrastructure such as access tracks and hardstandings.
Sedimentation	The tendency for particles in suspension to settle out of the fluid in which they are entrained.
Standard Percentage Runoff	The percentage of rainfall that is likely to contribute to runoff. For example, an SPR value of 50 % would suggest that half of the rainfall during an event will contribute to runoff.
Surface water catchment	The area from which runoff would naturally discharge to a defined point of a river.
The Proposed Development	The proposed Scawd Law Wind Farm development
The Proposed Development Area/ The Site	The development area within the red line boundary (application area)
Topography	The physical features of a geographical area
Water resources	The supply of groundwater and surface water in a given area

List of Abbreviations

Abbreviation	Description
AOD	Above Ordnance Datum
AILs	Abnormal Invisible Loads
BFI	Base Flow Index
bgl	Below ground level
BGS	British Geological Society
BP	Borrow Pit
CAR	Water Environment (Controlled Activities) (Scotland) Regulations 2011
CC	Climate Change
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
CSL	Construction Site Licence
DTM	Digital Terrain Model
DWPA	Drinking Water Protection Area
ECoW	Environmental Clerk of Works
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FEH	Flood Estimation Handbook
GBR	General Binding Rule
GIS	Geographical Information System
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependent Terrestrial Ecosystems
GW	Groundwater
IoH	Institute of Hydrology
JHI	James Hutton Institute
LDP	Local Development Plan
LUPS-CC1	Land Use Planning Guidance CC1
Natural Power	Natural Power Consultants Limited
NGR	National Grid Reference
NPF	National Planning Framework
NVC	National Vegetation Classification
PAN	Planning Advice Note
PPG	Pollution Prevention Guidelines
PPP	Pollution Prevention Plan
PWS	Private Water Supply
PWSMP	Private Water Supply Monitoring Plan and Method Statement
QGIS	Quantum Geographic Information System
RBMP	River Basin Management Plan
SAAR	Standard Average Annual Rainfall
SAC	Special Area of Conservation
SBC	Scottish Borders Council
SEPA	Scottish Environment Protection Agency
SIFSS	Soil Information for Scottish Soils
SNH	Scottish Natural Heritage
SPP	Scottish Planning Policy
SPR	Standard Percentage Runoff

Abbreviation	Description
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
T	Turbine
TWI	Topographic Wetness Index
UKCP18	UK Climate Projections
WFD	Water Framework Directive
WTW	Water Treatment Works

9.1 STATEMENT OF COMPETENCE

9.1.1 The authors have collective 19 years of experience in consultancy dealing with many renewable energy projects throughout the UK. The authors provide expert hydrology and peat consultancy services throughout the lifecycle of a project with particular expertise in onshore wind. Both a suitably qualified experts in the field with collective qualifications as follows: BSc in Environment Science, MSc in Environmental Studies, MA in Environmental Science and Geography and PhD in Geography.

9.2 INTRODUCTION

9.2.1 This chapter of the Environmental Impact Assessment Report (EIAR) assesses the impacts on the hydrological, geological and hydrogeological environment at Scawd Law Wind Farm, the “Proposed Development”, and the likely significant environmental effects resulting from the construction and operation of the proposed turbines and associated infrastructure. The Proposed Development Area, as presented in Figure 1.2 in Volume 3a of the EIAR, is referred to as “the Site” within this chapter.

9.2.2 The assessment is supported by the following figures provided in Volume 3a of the EIAR:

- Figure 9.1: Hydrology Overview;
- Figure 9.2: Topographic Wetness Index (TWI);
- Figure 9.3: Flow Accumulation;
- Figure 9.4: Private Water Supplies;
- Figure 9.5: Predominant Soils;
- Figure 9.6: Carbon and Peatland;
- Figure 9.7: Interpolated Peat Depth;
- Figure 9.8: Superficial Geology;
- Figure 9.9: Bedrock Geology; and
- Figure 9.10: Ground Water Dependent Terrestrial Ecosystems (GWDTE).

9.2.3 The assessment is also supported by the following Appendices provided in Volume 4 of the EIAR:

- Appendix 9.1: Carbon Balance Assessment;
- Appendix 9.2: Private Water Supply Risk Assessment;
- Appendix 9.3: Ground Stability Report; and
- Appendix 9.4: Borrow Pit Assessment.

9.2.4 This assessment and associated Technical Appendices were undertaken by The Natural Power Consultants Limited (Natural Power). Natural Power has an established reputation in providing assessment of hydrological, geological and hydrogeological considerations discussed in this chapter. The Associate Technical Director (Environment) has led on the production of this chapter and has over 15 years’ experience in delivery of EIA for renewable energy developments.

9.3 LEGISLATION AND POLICY CONTEXT

Policy Context

9.3.1 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 (GW), 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 GW.

9.3.2 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) or CAR, made it an offence to undertake the following activities without a CAR authorisation:

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

9.3.3 Under the Water Environment (Miscellaneous) (Scotland) Regulations 2017 amendments were made to CAR and the Proposed Development will 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 will be able to commence on site until a runoff permit has been agreed with the Scottish Environment Protection Agency (SEPA).

National Legislation and Policy

9.3.4 The assessment takes account of the following legislation and policy:

- 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);
- SEPA Policy No. 19 GW Protection Policy for Scotland;
- SEPA Policy No. 22 Flood Risk Assessment Strategy;
- SEPA Policy No. 41 Development at Risk of Flooding: Advice and Consultation;
- SEPA Policy No. 54 Land Protection Policy; and
- SEPA Policy No. 61 Control of Priority & Dangerous Substances & Specific Pollutants in the Water Environment.

Draft NPF 4 Scotland 2045

9.3.5 The Scottish Government published the draft National Planning Framework (NPF) on the 10th November 2021 and laid it before Parliament at the same time to allow the consultation process and the Parliamentary process to run together. It is considered further in Chapter 2: Policy Context.

9.3.6 The draft National Planning Framework 4 (NPF4) will supersede National Planning Framework 3 (NPF3) and SPP and Part 3 – National Planning Policy will become part of the local statutory development plan.

9.3.7 The planning policy overview provided above is therefore subject to the adoption of the final NPF4 and the applicant proposes to update the policy position at the appropriate time as part of this application.

9.3.8 Policy 13 (Flood risk) and 33 (Soils) of NPF4 have been considered accordingly in the completion of the assessment.

Regional Policy

9.3.9 The assessment takes account of the following policy:

- Scottish Borders Council Local Development Plan (LDP) 2016;
- Scottish Borders Council Local Development Plan two (LDP2) (once adopted will replace LDP);
- Renewable Energy for the Scottish Borders Environmental Report; and
- Scottish Borders Council Supplementary Guidance Renewable Energy.

Other Guidance and Good Practice

9.3.10 Table 9.1 below 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 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 Planning and Sustainable Urban Drainage Systems • PAN 79 Water and Drainage
Scottish Environment Protection Agency (SEPA) Guidance for Pollution Prevention (GPPs) and Pollution Prevention Guidelines (PPGs)	• GPP 1: Understanding your Environmental Responsibilities - Good Environmental Practice • GPP 2: Above Ground Oil Storage Tanks • GPP 4: Treatment and Disposal of Wastewater Where there is no Connection to the Public Foul Sewer • GPP 5: Works and Maintenance in or Near Water • PPG 6: Working at Construction and Demolition Sites • PPG 7: Safe Storage - The Safe Operation of Refuelling Facilities • GPP 8: Safe Storage and Disposal of Used Oils • GPP 13: Vehicle Washing and Cleaning • GPP 21: Pollution incident response planning • GPP 22: Dealing with Spills • GPP 26: Safe Storage - Drums and Intermediate Bulk Containers

Topic	Source of information
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
Construction Industry Research and Information Association (CIRIA)	• CIRIA C692 Environmental Good Practice on Site (third edition) • CIRIA C753 SuDS Manual (2015) • CIRIA C532 Control of Water Pollution from Construction Sites • CIRIA C648 Control of Water Pollution from Linear Construction Projects • CIRIA C689 Culvert Design and Operation Guide
Other Guidelines	• Scottish Natural Heritage (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 8.5, July 2021 • River Crossings and Migratory Fish: Design Guidance, A Consultation Paper, The Scottish Executive • 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 GW Abstractions and GW Dependent Terrestrial Ecosystems, Version 3

9.4 STAKEHOLDER CONSULTATION

9.4.1 The scoping and consultation responses relating to the hydrological, hydrogeological and geological environment are summarised in Table 9.2.

Table 9.2: Consultation responses relating to hydrology, hydrogeology and geology

Organisation	Relevant Response	Comment
Scottish Borders Council (SBC)	• Impacts on the water environment, notably Gameshopeknowe burn, Seathope burn and their tributaries should be assessed within the EIA. This should also take into account the drift and solid geology and any hydrological impacts that may arise. The proposal site lies within the catchment of the River Tweed Special Area of Conservation (SAC)/Site of Special Scientific Interest (SSSI).	Assessment of effects presented in Sections 9.13 – 9.17
SEPA	• The following key issues must also be addressed: – a) Peat depth survey and table detailing re-use proposals – b) Map and assessment of all engineering activities in or impacting on the water environment including proposed buffers, details of any flood risk assessment and details of any related CAR applications. – c) Map and assessment of impacts upon GWDTE and buffers. – d) Map and assessment of impacts upon GW abstractions and buffers – e) Map and table detailing forest removal. – f) Map and site layout of borrow pits. <u>Detailed scoping requirements</u> 1. Site Layout 2. Engineering activities 3. Disturbance and re-use of excavated peat and other carbon rich soils 4. Disruption to GWDTE 5. Existing GW abstractions 6. Forestry removal and forest waste 7. Borrow pits 8. Pollution prevention and environmental management	Refer to: a) The results of peat depth surveys are presented in paragraphs 9.8.51 - 9.8.61 b) Figure 9.1 provides details of the site layout with further details on flood risk presented in paragraphs 9.8.30 to 9.8.42 c) Completion of GWDTE assessment is provided in paragraphs 9.8.68 to 9.8.76 d) Details on water resources are provided in paragraphs 9.8.43 to 9.8.49 e) No forestry clearance works are expected as part of the development f) Please refer to Appendix 9.4 further details on the borrow pit requirements. Detailed scoping requirements: 1. Site layout is provided in Figure 1.2 in Volume 3a of the EIAR. 2. Details on engineering requirements are provided in paragraphs Section 9.12. 3. Details on peat and peaty soil management are provided in paragraphs 9.8.54 to 9.8.62 and paragraphs 9.12.51 to 9.12.71 and Appendix 9.3 4. Details of GWDTE provided in paragraphs 9.8.69 to 9.8.76 and Table 9.13 5. Details on existing GW abstractions are provided in paragraphs 9.8.49 and Appendix 9.2 6. No forestry works will take place

Organisation	Relevant Response	Comment
		7. Borrow pit details are provided in Appendix 9.4 8. Pollution prevention and environmental management is provided in Section 9.12.
Scottish Water	• The proposed activity falls partly within a drinking water catchment where a Scottish Water abstraction is located. Stantling Craigs Reservoir and Caddon Water supplies Galashiels (Manse Street) Water Treatment Works (WTW) and it is essential that water quality and water quantity in the area are protected. It is a relatively large catchment and the activity is sufficient distance from the intake that it is likely to be low risk. Please note that site specific risks and mitigation measures will require to be assessed and implemented.	Please refer to Figure 9.1 which presents the site catchments. Baseline hydrological characteristics are presented in paragraphs 9.8.14 to 9.8.22 Mitigation measures are presented in 9.12 with the assessment of construction and operational effects presented in Sections 9.14 and 9.15, respectively
NatureScot	• River Tweed SAC and SSSI – Consideration needs to be given to the potential effects of construction, operation and decommissioning of the proposed development in relation to the qualifying interests of the SAC, including proposed access tracks. • Moorfoot Hills SAC/SSSI – Our concern is that the topography of this area may mean that there is hydrological connectivity between the blanket bog on the wind farm site and that of the SAC/SSSI. • Peat – indicate that impacts on peat ought not to be scoped out of the EIAR. Consideration of the potential for hydrological connectivity of peatlands on the site with the peatland interest of the Moorfoot Hills SAC/SSSI must be included in the EIAR.	Mitigation measures are presented in 9.12 with the assessment of construction and operational effects presented in Sections 9.14 and 9.15, respectively. The results of peat depth surveys are presented in paragraphs 9.8.51 - 9.8.61

9.5 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

Effects to be assessed

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

- Changes to existing drainage patterns;
- Effects on baseflow;
- Effects on run-off rates;
- Effects on erosion and sedimentation;
- Effects on GW and surface water quality (including GWDTEs);
- Effects on GW 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.

9.6 METHODOLOGY

Overview

9.6.1 The assessment has involved the following:

- Detailed desk studies and site visits to establish baseline conditions of the area;
- Evaluation of the environmental impacts of the Proposed Development and the likely significant effects that these could have on the current site conditions;
- Identification of embedded good practice measures to avoid and mitigate against any identified adverse effects resulting from the Proposed Development;
- Evaluation of the likely significant environmental effects with consideration of the potential embedded mitigation measures and risk assessment, 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.

Baseline Assessment

9.6.2 A desktop survey to establish the baseline conditions was 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 3 km 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 data 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.

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

Table 9.3: Baseline information sources

Topic	Sources of Information
Topography	10 m 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	British Geological Society (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 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 SBC
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/

Effects Evaluation

9.6.4 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 an identified impact occur. 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	National importance. Receptor with a high quality and rarity, local scale and limited potential for substitution/replacement or receptor with a medium quality and rarity, regional or national scale and limited potential for substitution / replacement.
Medium	Regional importance. Receptor with a medium quality and rarity, local scale and limited potential for substitution/replacement or receptor with a low quality and rarity, regional or national scale and limited potential for substitution / replacement.
Low	Local importance. Receptor with a low quality and rarity, local scale. Environmental equilibrium is stable and is resilient to changes that are greater than natural fluctuations, without detriment to its present character.

9.6.5 The magnitude of impact includes the timing, scale, size and duration of the likely significant environmental effects. For the purposes of this assessment the magnitude of impact criteria are defined in Table 9.5 below.

Table 9.5: Magnitude of Change

Magnitude	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 will 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 will 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 will be similar to the pre-development circumstances/situation.	Detectable but non-material and transitory changes to the geology, hydrology, water quality and hydrogeology.
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.

9.6.6 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

9.6.7 Potential effects are therefore concluded to be Major, Moderate, Minor or Negligible. Effects considered as being Major or Moderate/Major are considered significant in terms of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

9.7 DISCLAIMER

9.7.1 The fieldwork carried out was a standard reconnaissance level walkover survey covering the main hydrological features within the 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. Surveys have not been conducted at the 27 pinch points along the proposed abnormal delivery route.

9.7.2 Private water supply information within 3 km of the Site has been provided by SBC. Additional on-site private water supply sources were not encountered during the site investigations and are considered unlikely due to the remoteness of the Proposed Development. However, it is possible that there are non-potable supplies, such as for livestock, which were not identified in the SBC register.

9.7.3 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 will be assessed and appropriately mitigated prior to construction.

9.8 BASELINE CONDITIONS

9.8.1 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 Figure 9.1 provided in Volume 3a of the EIAR.

Site Area

9.8.2 The Proposed Development is located to the north-east of Innerleithen approximately 3 km to the east of the B709 and 4 km north of the A72 in Scottish Borders, Scotland. Habitat is considered typical of this area, comprising a mix of heather moorland and rough, semi-improved grassland.

9.8.3 The Proposed Development will consist of the erection, 35-year operation, and subsequent decommissioning of up to 8 wind turbines, with tip heights of up to 180 m. The Proposed Development includes associated turbine foundations and transformers, battery storage, hardstanding areas for erecting cranes at each turbine location, a series of on-site tracks connecting each turbine, underground cables linking the turbines to the grid connection, an on-site substation, a construction compound, a temporary borrow pit and a new access into the Site.

9.8.4 The Proposed Development lies along the ridge tops between 500 m and 640 m above sea level; with steep slopes to the south, leading down to small water courses that drain south towards the River Tweed.

9.8.5 The hydrological study area is larger in extent than the actual Site and includes the lower reaches of watercourse catchments that are present within the Site. The extent of the catchments are shown in Figure 9.1 in Volume 3a which outline the extent of the study area. Designated sites and relevant developments are considered from the perspective of assessing any potential hydrological linkages or cumulative effects.

Site Investigations

9.8.6 The phase 1 peat depth survey and hydrological walkover were undertaken in August 2019. Weather conditions were windy and occasionally showery. Further hydrological surveys including additional peat probing were undertaken in May 2021. Weather conditions were showery.

Climate

9.8.7 The standard average annual rainfall (SAAR) for the Site has been derived from the Flood Estimation Handbook (FEH) Web Service as ranging from 948 - 1009 mm based on the Site catchments. To put this into context, rainfall in Scotland varies from under 800 mm a year on mainland eastern Scotland in areas such as Fife to over 3000 mm on the mainland Western Highlands.

9.8.8 The Met Office 1981-2010 annual rainfall total from the Galashiels Climate Station (161 m Above Ordnance Datum (AOD)) is 808.9 mm with 139.5 days of rainfall days ≥ 1 mm recorded, compared to 1182.6 mm and 161.4 days for the Scotland East region.

9.8.9 The Galashiels Climate Station is positioned approximately 13 km east of the Proposed Development and at a lower elevation compared to the Proposed Development. 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.

9.8.10 The highest rainfall totals as shown in Image 9.1 (embedded in this chapter) are typically experienced during the winter months through October to January. The lowest totals rainfall is typically recorded during the Spring months from April to May.

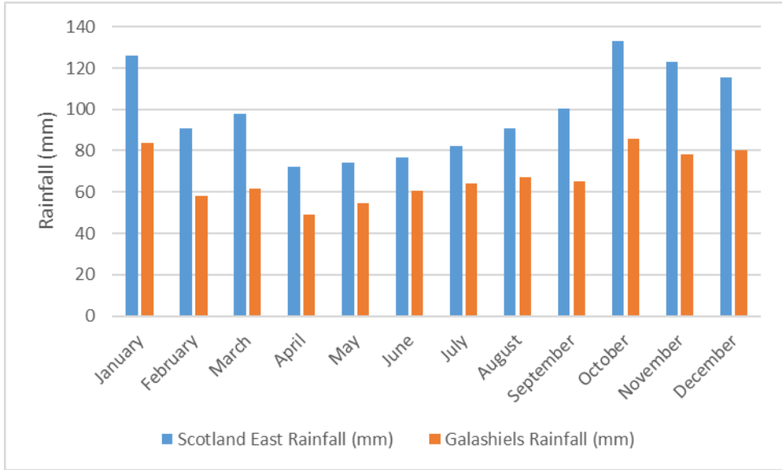

Image 9.1: Average monthly rainfall data for climate period 1981-2010

Designated Sites

9.8.11 To the south and hydrologically connected to the Site, the River Tweed is designated as a SAC and SSSI for supporting Atlantic Salmon, Otter, Sea Lamprey, River Lamprey and Brook Lamprey. To the north and east of the Site, the Moorfoot Hills is designated as a SAC and SSSI. Moorfoot Hills SSSI is designated, amongst other features of non-hydrological importance, for its blanket bog. The qualifying feature associated with the Moorfoot Hills SAC is blanket bog. An assessment for the access route requirements for the Abnormal Indivisible Loads (AILs) associated with the Proposed Development is presented in Appendix 12.1. Along the entire delivery route a total of 27 Pinch Points have been identified. A section of the route falls within the Moorfoot Hills SAC/SSSI where five Pinch Points have been identified within the SAC/SSSI.

9.8.12 In addition, within 5 km of the Site is Dundreich Plateau SSSI, Gladhouse Reservoir SAC and SSSI, Peeswit Moss SAC and SSSI, Williamhope SSSI, Thornylee Quarry SSSI and Plora Wood SSSI.

9.8.13 Habitat Regulations Assessment screening is presented in Chapter 7: Ecology.

Surface Water Hydrology

9.8.14 Hydrologically, the Site lies within the catchment of the River Tweed. The catchment of the River Tweed in the Scottish Borders is approximately 4,390 km^2 and flows east for approximately 156 km from its source at Tweeds Well. It flows through England for 3 km before discharging into the North Sea at Berwick-upon-Tweed at National Grid Reference (NGR) NU 00369 52367.

9.8.15 The Leithen Water is a river in the River Tweed catchment of the Solway Tweed River basin district. The main stem is approximately 17.3 km in length.

9.8.16 Figure 9.1: Hydrology Overview in Volume 3a shows distribution of hydrological features across and adjacent to the Proposed Development. There are several burns which supply these networks situated in and around the Site.

Gatehopeknowe Burn

9.8.17 The Caberston Grain and Seathope Burn converge at NGR NT 37565 40769 to form the Gatehopeknowe Burn which flows 4 km south, joining the River Tweed at the southern extent of the Site. The Gatehopeknowe Burn catchment is 10.5 km^2. The majority of the catchment is comprised of open moorland with the headwaters contained within the Site boundary extent.

9.8.18 A photograph of immediately downstream of the two headwater streams converging is shown in Photograph 9.1.

Source: Natural Power (29 Aug 2019)

Photograph 9.1: Gatehopeknowe Burn channel

Walker Burn

9.8.19 The West Grain and East Grain converge at NGR NT 36026 39905 to form the Priesthope Burn which becomes the Walker Burn, before discharging into the River Tweed at Walkerburn. The catchment area is approximately 7 km^2.

9.8.20 A photograph of the East Grain, an upland tributary of the Walker Burn is shown in Photograph 9.2. The catchment area is predominately used for rough grazing and rearing pheasant and partridge.

Source: Natural Power (29 Aug 2019)

Photograph 9.2: East Grain channel

Hope Burn

9.8.21 The Hope Burn upland catchment is sourced from Bareback Knowe (505 m AOD) and joins the Leithen Water discharging into the River Tweed south of Innerleithen. The catchment 2.6 km^2 and is comprised of open moorland.

Harpershiel Burn / Shaw Burn

9.8.22 The Harpershiel Burn and Shaw Burn converge at NGR NT 33667 40414, flowing 0.4 km west, joining the Leithen Water before discharging into the River Tweed south of Innerleithen. The catchment is 2 km^2 and is comprised of commercial forestry plantation.

Hydrological Regime

Flow Estimation

9.8.23 Peak flows have been estimated for the key catchments described above using the FEH Rainfall Runoff (FEH RR) and Institute of Hydrology Report 124 (IoH124) methodologies for a range of return periods, with the results presented in Table 9.7. Catchment descriptors were derived from the FEH Web Service and used for calculating peak flows for the identified catchments above.

9.8.24 The Q200+Climate Change (CC) is the 200-year return period flow plus a 20 % mark up for CC as per SEPA Land Use Planning Guidance CC1 (LUPS-CC1)[1]

Table 9.7: Estimated peak runoff for the Site catchments calculated using the methodology prescribed by the FEH RR and IoH Report No. 124.

Catchment	Area (km^2)	Method	Estimated peak runoff (m^3/s) for stated return periods							
			2	5	10	25	50	100	200	200 + CC
Gatehopeknowe Burn	10.53	FEH RR	4.40	6.49	7.84	9.80	11.52	13.17	15.83	19.00
		IHI24	2.58	3.15	4.03	5.14	6.16	7.47	9.03	10.83
Walker Burn	6.09	FEH RR	2.61	3.88	4.69	5.88	6.92	7.93	9.49	11.38

[1] SEPA (2019), LUPS-CC1, Land Use Planning System, Climate change allowances for flood risk assessment in land use planning

Catchment	Area (km^2)	Method	Estimated peak runoff (m^3/s) for stated return periods							
			2	5	10	25	50	100	200	200 + CC
		IHI24	1.28	1.56	1.00	2.54	3.05	3.70	4.71	5.37
Hope Burn	2.62	FEH RR	1.64	2.41	2.91	3.62	4.25	4.85	5.62	6.75
		IHI24	1.16	1.41	1.81	2.30	2.76	3.35	4.05	4.86
Harpershiel Burn / Shaw Burn	2.02	FEH RR	1.05	1.55	1.88	2.35	2.76	3.16	3.64	4.37
		IHI24	0.48	0.59	0.76	0.96	1.15	1.40	1.69	1.03

Catchment Characteristics

9.8.25 Base Flow Index (BFI) and Standard Percentage Runoff (SPR) data for the Site catchments was also taken from the FEH Web Service. 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.

9.8.26 The BFI for the Site catchments ranges from 0.455 to 0.582 indicating that around a half of the catchment's long-term runoff is derived from stored sources. The SPR for the site catchments ranges from 31.86 % to 42.07 % indicating that around a third of the rainfall during a rainfall event contributes to runoff. The BFI and SPR values show that the Site is located on moderately permeable catchments.

9.8.27 Figure 9.2 TWI provides information on how the topography influences the surface saturation of the peat and soils across the Site. The analysis of the DTM derived a TWI. The TWI is a dimensionless index, defined by the equation: In (a/tan b), where a is the area draining through a point from an upslope contributing area and tan b is the local slope angle. The index provides results on the hydrological similarity of peat. All points with the same value of the index are assumed to respond in a similar hydrological manner. High index values will tend to saturate first and will therefore indicate potential subsurface or high surface runoff areas.

9.8.28 Figure 9.3 Flow Accumulations provides information on the flow direction of the surface runoff within the Site. Flow accumulation is based on the 5 m resolution DTM of the area occupied by the Site. The flow accumulation represents the volume of water that would flow into each 5 m cell of the DTM, assuming that all water becomes runoff and there was no interception, evapotranspiration or infiltration. The volume of accumulation is represented in greyscale with higher flow accumulations being darker in shade to areas with lower flow accumulation. This figure illustrates the influence of topography on the accumulation and direction of surface water runoff across the Proposed Development.

9.8.29 As shown in Figure 9.2, the TWI for the Site has identified those areas where water will accumulate on site and result in saturation of the surrounding peat. The highest values (≥18) in the TWI form linear channels or where areas have a tendency to become saturated, are shown in blue and drier areas where there may be less tendency for the ground to saturate, are shown in yellow and orange. The dark blue represents areas such as linear channels or runoff pathways that are likely to occur throughout the year or during extreme rainfall events. The lighter blue represents areas of the Site where the topography allows the accumulation and saturation of peat and soils from subsurface or surface during prolonged and/or intense rainfall events. Whilst it is recognised that other areas of the Proposed Development are likely to become saturated, it is expected that any saturation will be dependent upon climatic conditions such as the intensity and duration of rainfall. Figure 9.3 suggests that away from the watercourses and riparian corridors, that the Site is generally quite dry with TWI at the lower end of the range.

Flood Risk

9.8.30 SPP 2014 states that:

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

9.8.31 The Flood Risk Management (Scotland) Act 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.

9.8.32 As highlighted in paragraphs 9.3.5 to 9.3.8, Policy 13 of NPF4 outlines the flood risk considerations for developments. This includes the placement of development outside of the future functional flood plain and consideration for managing runoff.

9.8.33 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 Site are provided in paragraph 9.12.1 to 9.12.69

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

Fluvial flooding sources

9.8.35 Downstream of the Caberston Grain and Seathope Burn confluence into the Gatehopeknowe Burn is at high 10% (1 in 10) likelihood of fluvial (watercourse) flooding in any given year. The risk areas are generally contained in the river channel extent.

9.8.36 Downstream of the West Grain and East Grain converge into the Walker Burn is at high 10% (1 in 10) likelihood of fluvial (watercourse) flooding in any given year. The risk areas are generally contained in the river channel extent.

9.8.37 The River Tweed is also at high 10% (1 in 10) likelihood of fluvial (watercourse) flooding in any given year, however the Hope Burn and Harpershiel Burn/ Shaw Burn are not indicated as at risk from flooding.

Pluvial flooding sources

9.8.38 A review of SEPA Flood Risk Management Map indicates that scattered small areas, contained to the Gatehopeknowe Burn, Walker Burn and Shaw Burn channel extent are at high – 10% (1 in 10) likelihood of pluvial (surface-water) flooding in any given year.

Coastal flooding sources

9.8.39 The Site is located approximately 60 km from the nearest coast and due to this distance along with the topographical position of site infrastructure, approximately 543 m AOD within the Site, it is presumed that it will not be affected by tidal flooding.

Groundwater flooding sources

9.8.40 Flooding can also result from high GW levels if the water table rises above the surface level. GW flooding can occur in a variety of geological settings including river valleys with thick deposits of alluvium and river gravels. GW flooding happens in response to a combination of already high GW levels (usually during mid or late winter) and intense or unusually lengthy storm events. Such flooding also often lasts much longer than flooding caused by a river over-flowing its banks.

9.8.41 GW flooding is difficult to predict as it rarely follows a consistent pattern. The response time between rainfall and GW flooding is also relatively long.

9.8.42 GW flooding is often associated with the shallow unconsolidated sedimentary aquifers that overlay non-aquifers. Such aquifers are susceptible to flooding as the storage capacity within these deposits is often limited and direct rainfall recharge can be relatively high, subsequently increasing the water levels within the GW and providing a good hydraulic connection with adjacent river networks. The SEPA Flood Risk Management Map indicates that the western extent of the Site is contained within a potentially vulnerable area (PVA:02/13/03) that is at risk of GW flooding and incorporates the Walker Burn. No other areas of the Site are indicated as at risk of GW flooding.

Water Quality

Water quality WFD Classification

9.8.43 Three surface 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 9.8 below. In addition to surface waterbodies, two additional GW bodies have also been identified and are also listed in Table 9.8. WFD classifications discussed below are derived from SEPA's Water Classification Hub.

Table 9.8: WFD classification of surface waterbodies within the vicinity of the Proposed Development

Water Body	Waterbody ID	Current Overall Status (2018)	Overall Ecology (2018)	Overall Hydrology (2018)	Projected Overall Status (2021)	Predicted Overall Status (2027)
Gatehopeknowe Burn	5300	Good	Good	High	Good	Good
River Tweed (Scotsmill to Ettrick Water confluence)	5203	Good	Good	Good	Good	Good
Leithen Water	5301	Moderate	Moderate	High	Moderate	Moderate
Peebles, Galashiels and Hawick (Bedrock)	150697	Good	-	-	Good	Good
Upper Tweeddale Sand and Gravel (Superficial)	150738	Good	-	-	Good	Good

9.8.44 WFD classified waterbodies are considered in the River Basin Management Plan (RBMP) for the Scotland River Basin District: 2015-2027. The RBMPs are designed to protect and improve the water environment.

Water Resources

Water Resources WFD Classification

9.8.45 The classified surface waterbody within the Site (Gatehopeknowe Burn) has a WFD classification of High for overall hydrology, indicating that there are no abstractions within the catchment, and flows within the watercourse are considered natural.

9.8.46 The Leithen Water has pressure from the North American signal crayfish which makes freedom from invasive species an impacted pressure which cannot be fully resolved resulting in a moderate overall and predicted status.

9.8.47 The underlying GW body (Peebles, Galashiels and Hawick) and Upper Tweeddale Sand and Gravel are classified under the RBMP as having "good" overall status.

Public Water Supply

9.8.48 Scottish Water confirmed the presence of an abstraction which is protected under Article 7 of the WFD. Stantling Craigs Reservoir and Caddon Water supplies Galashiels (Manse Street) WTW and it is essential that water quality and water quantity in the area are protected. Stantling Craig Reservoir is located within the catchment of Caddon Water. No activities associated with the Proposed Development are located within the catchment of the Caddon Water.

Private Water Supply

9.8.49 SBC were contacted about the presence of Private Water Supplies (PWS) both within the Proposed Development and within a 3 km buffer zone of the Site boundary. Further details are available in Appendix 9.2: Private Water Supply Risk Assessment.

Fisheries and Recreation

9.8.50 Watercourses draining from the Site are part of the River Tweed catchment. The River Tweed is considered a good salmon and trout fishery. Current impacts of concern to the Tweed Foundation on the River Tweed include the presence of American signal crayfish, which can obliterate fish stocks and destroy river banks.

Soils and Peat

9.8.51 The distribution of soils across the Site is dependent upon land use, geology, topography and hydrological regime of the area. Information on the Site soils has been obtained from Scotland's Environment Website which brings together data from public organisations across Scotland including the BGS, JHI, NatureScot and SEPA.

9.8.52 Figure 9.5 in Volume 3a shows the distribution of soils across the Site according to the National Soil Map of Scotland. Soil types expected to occur within the Site primarily include blanket peats, brown soils, peaty podzols and mineral podzols. Blanket peat is expected to the north of the site on the Windlestraw Law plateau. Brown soils are expected in the Gatehopeknowe Burn catchment dominating the central section of the Site. Podzol soils located to the east and west of the Site often have a thin iron-pan which restricts the flow of water deeper into the soil.

9.8.53 The Carbon and Peatland 2016 map provides information on the likely presence and nature of peat across the Site. As shown in Figure 9.6 in Volume 3a, much of the Site is mapped as Class 0 (mineral soils – no peatland vegetation). An area to the north of the Site at Bareback Knowe is mapped as Class 1 (nationally important) peat soil, with Class 3 (occasional peatland habitat) mapped along the ridges at Broomy Cleuch Ridge, Black Cleuch Ridge and the north west facing slopes of Glede Knowe. The ridge line summits are dominated by Class 5 peat soil (no peatland habitat).

9.8.54 Peat is a soft to very soft, highly compressible, highly porous organic material that can consist of up to 90 – 95% water, with 5 – 10% solid material. Peat deposits can exist in one of three forms:

- Fibrous – non-plastic with a firm structure and is only slightly altered by decomposition;
- Pseudo-fibrous – peat in this form still has a fibrous appearance but is much softer and more plastic than fibrous peat. The change is due to more prolonged sub-mergence in airless water rather than to decomposition; and
- Amorphous – decomposition has destroyed the original fibrous vegetation structure such that it has virtually become organic clay.

9.8.55 Peat deposits can also be characterised into two layers:

- The 'acrotelm' is the upper layer and has a relatively high hydraulic conductivity and therefore has variable water content. This layer comprises of a thin surface layer of active vegetation; and
- The 'catotelm' is the lower layer, permanently below the water table, which has a small hydraulic conductivity and is often at a higher state of humification and lower tensile capacity.

Peat Survey Results

9.8.56 The phase 1 (100 m grid) peat depth walkover survey at the Site was undertaken in August 2019 in line with Scottish Government guidance[2]). The survey, which also complies with Policy 33 of NPF4 in undertaking detailed site surveys, was undertaken on a 100 m grid spacing, within a 300 m buffer of proposed turbines. The buffer was created due to the steep topography of the Site in consideration of health and safety and the restrictions the steep topography constraining infrastructure placement. The proposed alternative track was surveyed at 100 m intervals with an offset survey point also taken at 50 m either side of the centre line. This was selected due to the exclusion of proposed infrastructure within the southern boundary and the topography placing restrictions on the available routing of the track. See Figure 1.2 in Volume 3a for a detailed Site Layout which shows the proposed access tracks.

9.8.57 The requirement for detailed Phase 2 peat depth survey across the entirety of the Proposed Development was scoped out due to the lack of peat encountered on Site. Due to design layout changes a further peat depth survey was carried out in May 2021. Additional peat depth surveying was undertaken at T6, T8 and the proposed construction compounds and substation to confirm infrastructure placement had avoided areas of peat and the 3.5 km of newly proposed access track to the west of the Site was also surveyed at 50 m intervals with 10 m offsets.

9.8.58 The interpolated peat depths are provided in Figure 9.7 in Volume 3a.

9.8.59 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
≤0.5	1128	93.1
>0.5 – ≤1.0	48	4.0
>1.0 – ≤1.5	30	2.5
>1.5 – ≤2.0	5	0.4
Total	**1211**	**100**

9.8.60 Table 9.9 indicates that the majority (93.1%) of the locations surveyed exhibited depths ≤0.5 m or less, with 4% between 0.5 – 1.0 m. Less than 3% of the surveyed locations recorded a depth greater than 1 m. The average recorded depth across the entire proposed development area was 0.25 m. Peat depths of less than 0.5 m have been categorised as peat soils with peat deposits being >0.5 m in depth[2 3]. Mean infrastructure peat/peaty soil depths are provided in Table 9.10.

Table 9.10: Recorded depths at infrastructure elements

Infrastructure Element	Mean Peat Depth* (m)
Turbines (T)	
T1	0.3
T2	0.2
T3	0.3
T4	0.3
T5	0.3
T6	0.7
T7	0.2
T8	0.3
Ancillary infrastructure	
BP1	0.2
Construction Compound (site entrance)	0.2
Construction Compound	0.2
Substation (including battery storage area)	0.3
Met Mast	0.2
Access track segments	
Site entrance to T3	0.1
T3 to T2	0.2
T2 to T1	0.3
T3 to T6	0.7
T6 to T7	0.5
T7 to T8	0.3
Junction between T6 and T7 to BP1	0.2
BP1 to T4	0.2
T4 to T5	0.3

**Mean peat depth within a 75 m buffer*

9.8.61 Cores were collected and analysed at T6 and at the access track between T3 and T6. Cores were logged in accordance with the Von Post Scale of Humification and the results are presented in Table 9.11. The results demonstrate that the peat deposits at the proposed development are generally characterised as soft, dark brown fibrous, pseuofibrous with increasing levels of plasticity at greater depth plastic, with Von Post classification codes ranging from H3 to H7.

Table 9.11: Von Post Classification of peat cores

Core location	Mean Peat Depth	Von Post Classification	Description
T6	0.7 m	H3 (0.0 – 0.35 m) H4 (0.35 – 0.5 m) H5 (0.5 – 0.7 m) H6 (0.7 – 0.9 m) H7 (0.9 – 1.0 m)	H3 – Very slightly decomposed peat H4 – Slightly decomposed peat H5 – Moderately decomposed peat H6 – Moderately highly decomposed peat with a very indistinct plant structure H7 – highly decomposed peat
Track between	0.7 m	H5 (0.0 - 0.5 m)	H5 – Moderately decomposed peat

[2] Scottish Government, Scottish Natural Heritage, SEPA (2017), Peatland Survey, *Guidance on Developments on Peatland.* On-line version only

[3] JNCC Report 445 (2011), Towards an assessment of the state of UK Peatlands, Accessed 01/10/2021

Core location	Mean Peat Depth	Von Post Classification	Description
T3 and T6			

9.8.62 Further information on the carbon balance findings and peat slide risk assessment for the Proposed Development are available in Technical Appendices 9.1: Carbon Balance Assessment and 9.3: Ground Stability Report, respectively.

Geology

9.8.63 The following information regarding the underlying geology of the Site has been obtained from digital data available from the BGS online geology mapping.

9.8.64 As shown in Figure 9.8 in Volume 3a, the majority of the Site is mapped with no superficial deposits. Within the areas where no superficial deposits are mapped, including higher elevations and summits, it is expected that there will be a layer of weathered bedrock overlain by poorly developed montane / organic soil.

9.8.65 The bedrock in the Gatehopeknowe Burn and Walker Burn river valleys are mapped as being overlain by alluvium – silt, sand and gravel and till, Devensian – Diamicton. The alluvium sedimentary deposits are fluvial in origin and range from coarse-to-fine-grained. The quaternary till formations are sedimentary in origin and were deposited through the action of meltwater and ice. The headwaters of the West Grain and East Grain are comprised of hummocky (moundy) glacial deposits – Diamicton, sand and gravel.

9.8.66 The bedrock geology of the Site as provided in Figure 9.9 in Volume 3a is primarily underlain by Gala Unit 7 – Wacke. The sedimentary rocks are of marine origin and are detrital and are identified as vertically dipping, with bedding striking north east to south west. Small and scattered areas are mapped as unnamed igneous intrusions of late Silurian to early Devonian – microgranite. There is also a fault line running through the central section of the Site, striking north east to south west. A strike-slip fault line orientated north to south is also mapped in the west of the Site.

Hydrogeology

9.8.67 The following information was obtained from digital data available from the British Geological Survey GeoIndex Onshore 1:625,000 scale online mapping. The Site is mapped as a low productivity aquifer where flow is primarily all through fractures and other discontinuities. There may also be shallow GW storage within sand and gravel deposits in valley basins, however productivity will be limited by the small lateral and vertical extent.

9.8.68 It is expected that GW within the Site flows from high to low elevation, with the water table predominantly below ground level, and reflecting the shape of the topography. Where topography is relatively flat and overlain by peat deposits, piping may be present where water flows through eroded conduits at the interface between peat and weathered bedrock. Some notable GW flow may be present within a weathered bedrock zone at the interface of the soil/peat and solid bedrock.

Groundwater Dependent Terrestrial Ecosystems

9.8.69 A review and assessment of GWDTE of the Proposed Development has been undertaken with details provided in the following sections.

9.8.70 A buffer search distance of 250 m from all proposed new Site infrastructure was adopted for all elements deemed to require excavations >1 m bgl (below ground level); this was applied to turbine foundations and the borrow pit. A 100 m buffer was applied to all access tracks, including existing tracks which may be subject to local widening and typically may require excavations <1 m bgl. National Vegetation Classification (NVC) habitat data (refer to Chapter 7: Ecology) and SEPA's list of potential GW dependent communities was used to identify potential GWTDE within the Proposed Development. For a habitat to be designated as a GWDTE there is the requirement for hydraulic connectivity between the GW body and the habitat.

9.8.71 Review of the NVC data highlighted a number of potential GWDTEs using the list of communities identified in the SEPA guidance document LUPS-GU 31[4]. It is acknowledged in this document that the listed communities 'may be considered GWDTEs only in certain hydrogeological settings'. The identified potentially GW dependent NVC communities are summarised as follows in Table 9.12 below.

Table 9.12: NVC communities and potential GW dependency (within 250 m and 100 m buffer zones)

NVC Community	Potential Level of GW Dependency
M23 - *Juncus effusus/acutiflorus* - *Galium palustre* rush-pasture	High
M25 - *Molinia caerulea* - *Potentilla erecta* mire	Moderate
M32 - *Philonotis fontana* - *Saxifraga stellaris* spring	High
U6 - *Juncus squarrosus* - *Festuca ovina* grassland	Moderate

9.8.72 An assessment of the GW dependency of the identified habitats has been undertaken based on the following sources of information: topography, soils, geology, hydrogeology and hydrology findings from the desk study and site survey.

9.8.73 The composition of the underlying geology likely determines the GW throughflow (i.e. intergranular or fracture flow mechanism), which will influence the water supply to the GWDTE habitat communities. Within low permeability bedrock, GW flow is typically limited to fault lines, fractures and/or the weathered bedrock zone and will therefore only be present where these features exist. Porous bedrock or superficial deposits demonstrating small interconnected pore spaces are likely to support intergranular GW flows.

9.8.74 For this assessment the determination of habitats within the buffers identified to be overlaying and/or in the immediate vicinity of permeable or highly faulted geological features or where it cannot be ruled out that a habitat is subject to a degree of GW contribution have been considered as GW dependent habitats and assigned either Moderate Dependency or High Dependency. Where available evidence indicates that a habitat is most likely ombrotrophic (rain fed) with no significant GW recharge, these habitats have been assigned Low Dependency.

9.8.75 The aquifer properties of the identified solid bedrock is likely to be of low productivity and unlikely to support any significant volumes of GW with spring rises noted as rare. The GWDTE clusters have been defined as set out in Table 9.13 and shown in Figure 9.10 of Volume 3a. The potential GWDTE have been grouped (clustered) based on their potential GW dependency, location and underlying geology.

Table 9.13: GWDTE Screening Assessment

GWDTE Cluster ID	Potential GWDTE habitats as per LUPS-GU31	Bedrock Geology	Superficial Geology	Hydrogeology	Potential GW Dependency (as per LUPS-GU31)	Actual GW Dependency
1	M23b/MG9	Gala Unit 7 - Wacke	Till, Devensian - Diamicton	Bedrock: Low Productivity Aquifer	High	Moderate

[4] SEPA (2017), Land Use Planning System, Guidance Note 31, *Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems*

2	M23	Gala Unit 7 - Wacke	Till, Devensian - Diamicton	Bedrock: Low productivity aquifer	High	Moderate
3	M23	Gala Unit 7 - Wacke	No mapped deposits	Bedrock: Low productivity aquifer	High	Low
4	M23/M6	Gala Unit 7 - Wacke	No mapped deposits	Bedrock: Low productivity aquifer	High	Moderate
5	M25	Gala Unit 7 - Wacke	No mapped deposits	Bedrock: Low productivity aquifer	Moderate	Low
6	MG9.M23	Gala Unit 7 - Wacke	Glacial Deposits – Diamicton, Sand and Gravel	Bedrock: Low productivity aquifer	Moderate	Moderate
7	U6	Gala Unit 7 - Wacke	Glacial Deposits – Diamicton, Sand and Gravel	Bedrock: Low productivity aquifer	Moderate	Moderate
8	M25	Gala Unit 7 - Wacke	No mapped deposits	Bedrock: Low productivity aquifer	Moderate	Low
9	U6	Gala Unit 7 - Wacke	Peat	Bedrock: Low productivity aquifer	Moderate	Moderate
10	U6	Gala Unit 7 - Wacke	Peat and No mapped deposits	Bedrock: Low productivity aquifer	Moderate	Low
11	M23	Gala Unit 7 - Wacke	Peat and No mapped deposits	Bedrock: Low productivity aquifer	High	Moderate

9.8.76 The habitats are characterised as follows:

- Ombrotrophic Surface Wetlands – including areas of M23 (Clusters 2, 3 and 4) and M25 (Clusters 5 and 8). These areas have been assessed as most likely non-GWDTE due to absence of evidence for underlying highly permeable deposits, which are likely to impede drainage and encourage standing water. Water tables are likely maintained by direct rainfall inputs and surface water runoff from adjacent areas. As such, these habitats have been assigned as having a likely "Low" actual GW dependency in Table 9.13.
- Upland grassland - areas of primarily U6 are found on hillslopes including within Clusters 7 and 9. Generally these habitats are likely to be of "Low" actual GW dependency due to an absence of productive underlying strata. Where there is an absence of evidence of deep peat and acidic environments, particularly on steeper hillslopes, it cannot be ruled out that these U6 habitats may be subject to a degree of base-rich GW inflow via weathered bedrock. Within these hillslope conditions, actual GW dependency is assessed to be no greater than "Moderate" in Table 9.13.
- Mire hillslope communities – areas of U6 and M23 on hillslopes (Cluster 10) are generally likely to be of "Low" GW dependence due to low permeability underlying bedrock. However, some diffuse GW emergence via weathered bedrock cannot be discounted, and these areas are not associated with acidic deep peat (non-GWDTE) environments. These communities are therefore considered to have actual GW dependency of no greater than "Moderate" in Table 9.12.
- Riparian corridors and valleys –an area of M23 mire habitat (Cluster 1 and 6), has been identified. This area is situated at a break in slope underlain by potentially highly permeable sand and gravel superficial deposits. Therefore actual GW dependency of these clusters is considered no lower than "Moderate", and possibly "High".

9.9 MODIFYING INFLUENCES

9.9.1 Information regarding climate change was obtained from the UK Climate Projections (UKCP18) website[5]. 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 (25 km), Global (60 km), Regional (12 km) and Local (2.2 km) projections.

9.9.2 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.

9.9.3 It is suggested that increased temperatures in the summer 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 dominant soils are composed of vegetation remains, they contain a high proportion of carbon compared to other soils.

9.10 IDENTIFICATION AND EVALUATION OF EFFECTS

Proposed Development Interactions

9.10.1 The Proposed Development will 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 will 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.

9.10.2 Overview of Construction Phase the Proposed Development will consist of the erection, 35-year operation, and subsequent decommissioning of up to 8 wind turbines, with tip heights of up to 180 m. The Proposed Development includes associated turbine foundations and transformers, battery storage, hardstanding areas for erecting cranes at each turbine location, a series of on-site tracks connecting each turbine, underground cables linking the turbines to the grid connection, an on-site substation, a construction compound, temporary borrow pits, a permanent anemometry mast and a new access into the Site.

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

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

Mitigation by Design

9.10.4 A summary of the hydrological influences on the Proposed Development layout are given below with full details of the Proposed Development's design provided in Chapter 4: Site Selection and Design Evolution. Due to the nature of the environment occupied by the Proposed Development 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.

9.10.5 The findings of the peat depth survey (paragraph 9.8.51 - 9.8.61 and Figure 9.7 in Volume 3a) show that the infrastructure has, as far as possible, taken into account other constraints and have been sited outside areas of deeper peat. The depths within the Site are predominantly shown to be in a shallow range (≤0.5 m) when considering the discrete turbine and access track areas.

9.10.6 The hydrological desktop study and site visits have identified a typical upland hydrological environment which include hydrological pathways and features associated with it. A series of set-back (buffer) distances have been adopted to help reduce effects of the Proposed Development on the hydrological environment. Whilst a 50 m buffer was implemented for all identified natural hydrological features, the infrastructure, apart from the single watercourse crossing, has been placed at greater distances away from these features due to engineering constraints. This increased distance provides additional protection to the hydrological receptors. With the exception of the construction compound at the site entrance, no infrastructure will breach this 50 m buffer should consideration for micositing within the 75 m allowance be required. The construction compound at the site entrance will not move closer to the watercourse due to its location on the opposite side of the existing B709.

9.10.7 Table 9.14 confirms that all turbines and infrastructure associated with the Proposed Development are located outside the buffer limits. Distances were calculated using the functionalities provided within the Quantum Geographic Information System (QGIS) package. Watercourses are linear features that were identified from the OS 1:10,000 raster data.

Table 9.14: Infrastructure distance to nearest watercourse

Infrastructure	Distance from watercourse (inclusive of 50 m buffer)
Turbines	
1	352
2	254
3	185
4	295
5	279
6	241
7	279
8	519
Ancillary Infrastructure	
BP1	204
Construction Compound (site entrance)	60
Construction Compound	151
Substation (including battery storage area)	215
Met Mast	195

9.10.8 Other embedded mitigation integrated as part of the design of the Proposed Development is as follows:

- A borrow pit and search area associated with the Proposed Development, was located towards the centre of the site to minimise transportation movements of stone. The borrow pit is located close to the proposed infrastructure and will be restored after use. The proposed borrow pit and search area are located out with the 50 m buffer of mapped watercourses. Further details are provided in Appendix 9.4: Borrow Pit Assessment;
- The layout of new tracks has been designed to minimise impacts on the hydrological environment and as far as possible avoid sensitive receptors such as watercourses and potential GWDTE;
- The design of linear infrastructure elements will be done so to avoid modifying surface water and GW flow pathways. This includes the use of permeable materials for track construction, adoption of a site-wide drainage strategy integrating the use of regular cross drains and soakaways, and the use of regular clay plugs within buried structures such as cable trenches; and
- A single watercourse crossing, between T3 and T6 (located at NGR NT 36029 41717 and presented in Figure 9.1 of Volume 3a of the EIAR), will be required for the Proposed Development. As shown in Photograph 9.3, the crossing is located on headwater channel of the East Grain. There is a poorly defined channel but at the time of survey no flow was observed, and it is likely that the channel is ephemeral. The crossing will be designed to maintain flows up to the 1 in 200 year plus climate change event. As the crossing is considered to be an engineering activity in the water environment, the structure will require authorisation under the Water Environment (Controlled Activities) (Scotland) Regulations 2011.

Photograph 9.3: Watercourse crossing location

9.10.9 If the need for the creation of further new or upgraded crossings is required, crossings should be constructed in a manner that minimises the impact of hydrological disturbance on the Site and allows free passage of aquatic species.

9.11 RECEPTOR BASELINE SENSITIVITY

9.11.1 On the basis of the baseline surveys and available information, Table 9.4 above identifies the criteria for assigning the sensitivity of receptors as outlined in Table 9.15 below with justification for their categorisation.

Table 9.15: Receptor Sensitivity

Receptor	Sensitivity	Comment
Surface Water		
Gatehopeknowe Burn	High	The Gatehopeknowe Burn is classified as having good overall status (as of 2018) as part of SEPA's RBMP and a 2027 classification aim of Good status.
Walker Burn	Low	Not designated as part of SEPA's RBMP.
Hope Burn	Low	Not designated as part of SEPA's RBMP.
Harpershiel Burn / Shaw Burn	Low	Not designated as part of SEPA's RBMP.
River Tweed	High	All onsite watercourses are tributaries of the River Tweed. The River Tweed is classified as having a good overall status (as of 2018) and a 2027 classification aim of Good. The River Tweed is designated as a SAC and SSSI.
Flood Risk		
The Proposed Development	Low	Very limited areas of the Proposed Development fall within the flood inundation envelope with areas at risk contained to the river channel extent. Proposed infrastructure is placed along ridge line tops.
Downstream of the Proposed Development	Medium	Downstream watercourses are at potential risk of flooding given the steep topography of the proposed infrastructure and design techniques required for construction and any changes to the hydrological environmental that results in additional flow could exacerbate the likelihood of flooding.
Water Resources		
PWS	High	PWS are of low regional importance, but high in a local context from the perspective of the user.
River Tweed SAC	High	The River Tweed is a designated SAC and is fished for salmon, trout, grayling and brown trout which are dependent upon good water quality which has the potential to be impacted by the Proposed Development. The Leithen Water has pressure from the North American signal crayfish which can obliterate fish stocks and destroy river banks.
Soils Geology & Hydrogeology		
Moorfoot Hills SAC	High	Moorfoot Hills SAC is a designated SAC for its blanket bog habitat.
Site soils and peat < 0.5 m depth	Low	The majority of soils (93.1% of probed locations) are less than 0.5 m deep and therefore classified as peaty soil.
Site soils and peat > 0.5 m depth	High	There is a small area identified as consisting of Class 1 soils which are considered to be of national importance.
Geology	Low	Geology is typical of wider area with no designated sites of geological interest located within the study area.
Hydrogeology and GW	High	Bedrock and superficial aquifers are not likely to be of high productivity and are unlikely to supply significant volumes of GW except for areas on fractures or fault lines. Notwithstanding, bedrock GW characterised as good quality status. Mooroot Hills SSSI is designated for supporting blanket bog habitat that is sensitive to changes in water quality and quantity.
GWDTE	Medium	Available information does not suggest a strong GW component associated with identified possible GWDTE within the Site. Notwithstanding, localised hydrogeological conditions may partially nourish some of the identified habitats in combination with surface waters. Whilst not of national or regional importance, such habitats are still protected under the WFD.

9.12 MITIGATION MEASURES

9.12.1 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 will be provided in a Construction Environmental Management Plan (CEMP) which would be prepared post consent as part of a planning condition. A summary of the measures included within the CEMP are described below and have been assumed to be part of the proposals, including works associated with upgrades at the pinch points along the route of the AIL, 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 paragraph 9.12.3 to 9.12.49.

9.12.2 A number of the mitigation measures described in the following paragraphs can also be adopted during the operational phase of the Proposed Development. To avoid duplication of text, the reference to what stage the measures can be adopted is provided.

Outline Construction and Environment Management Procedures

9.12.3 A site-specific CEMP will 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 GW environment. The CEMP will be prepared prior to commencement of construction but will include information as follows:

- Drainage – all runoff derived from construction activities and site infrastructure will not be allowed to directly enter the natural drainage network. All runoff will be adequately treated via a suitably designed drainage scheme with appropriate sediment and pollution management measures. The Proposed Development is situated in an upland hydrological area and it is imperative that the drainage infrastructure is designed to accommodate storm flows based on a 1 in 200-year event (plus climate change) to help maintain the existing hydrological regime;
- Storage – all soil/peat stockpiles as well as equipment, materials and chemicals will be stored well away from any watercourses. Chemical, fuel and oil stores will be sited on impervious bases with a secured bund;
- Vehicles and Refuelling – standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Where practicable, refuelling of vehicles and machinery will be carried out in designated areas, on an impermeable surface, and well away from any watercourse;
- Maintenance – only emergency maintenance to construction plant will be carried out within the Site, in designated areas, on an impermeable surface well away from any watercourse or drainage, unless vehicles have broken down necessitating maintenance at the point of breakdown, where special precautions will be taken;
- Welfare Facilities – on-site welfare facilities will be adequately designed and maintained to allow for sewage to be disposed of appropriately. Given the low permeability of the underlying bedrock and limited extent of soils, its likely such waste would be tankered off-site and treated elsewhere under Duty of Care;

- Cement and Concrete – fresh concrete and cement are very alkaline and corrosive and can be lethal to aquatic life. The use of wet concrete in and around watercourses will be avoided and carefully controlled;
- Monitoring Plan – to provide environmental compliance, activities undertaken as part of the Proposed Development will be monitored throughout the construction phase. Water quality monitoring will also occur throughout each phase of the Proposed Development and will help to maximise the effectiveness of mitigation measures whilst monitoring effects on the hydrological environment. Full details on the monitoring requirements will be agreed with SEPA, SBC and Marine Scotland Science;
- Contingency Plans – plans will provide information on emergency equipment and where it is available on the Site i.e. spill kits and absorbent materials, advice on action to be taken and who should be informed in the event of a pollution incident; and
- Training – All relevant staff personnel will be trained in both normal operating and emergency procedures and be made aware of highly sensitive areas on the Site.

9.12.4 Further details regarding the pollution prevention and mitigation measures that will be adopted during the construction and operation of the Proposed Development are detailed in the following paragraphs.

Runoff and Sediment Management

9.12.5 The following measures will be adopted to appropriately attenuate and treat runoff during construction and operation of the Proposed Development.

9.12.6 The Site drainage system will convey water away from construction activities as well as the Proposed Development infrastructure. However, due to the nature of the works on the Site and the negligible infiltration and storage capacity of the underlying peat and bedrock there is significant potential for sediment and other pollutants to become entrained in the surface runoff.

9.12.7 To reduce this potential, prior to the commencement of work and during construction, plans showing the Site drainage and hydrologically sensitive areas should be regularly checked to review potential for runoff and ponding of water within the Site to make sure that runoff patterns are well known.

9.12.8 The drainage systems installed within the Site will also have sediment management measures incorporated into their design to help reduce or wholly mitigate effects on the hydrological environment. The type of sediment management will depend on the volume of construction activities occurring in particular areas within the Site. For all of the suggested control measures regular inspection and maintenance is necessary, particularly after prolonged heavy rainfall.

9.12.9 Silt traps will be installed within the Site drainage system. Silt traps could take the form of terram fences or clean stone. However, the ability of the silt traps to successfully treat runoff will be dependent upon the permeability of the terram geotextile material and the size and source of the clean stone.

9.12.10 The ability of the silt traps to effectively treat runoff will depend upon the volume of runoff within the drainage channel, the type of material used and the frequency of monitoring and replacement of the measures.

9.12.11 If required, flocculents could also be used to treat runoff. Flocculents are very effective at removing suspended sediment from water but they can also have effects on water chemistry. As such, SEPA will be consulted prior to the use of flocculents and only considered as a last resort. If their use is proposed, SEPA will be consulted and a method statement agreed prior to use. This method statement must detail the type of floc, how dosing is controlled, record keeping (dates used, location, volume/weight used etc) and how the precipitated silt will be disposed of.

9.12.12 Access tracks crossing slopes will disrupt surface flow that consequently will collect in drains constructed upslope of the tracks. Cross-drains will be constructed at regular intervals to conduct this surface flow below or across the track where it will be discharged back into the drainage system, although all efforts will be made to segregate this runoff from more silty runoff originating from track surfaces and other exposed construction areas, thus reducing the silt load and volume discharging to all silt treatment areas. Regular discharge points will limit the concentration of surface runoff and the diversion of flows between catchments. Such cross drains need to be strong enough to withstand the expected traffic loadings.

9.12.13 During storm events there is likely to be some ponding on the uphill side of tracks, as percolation alone is unlikely to be able to accommodate surface flows. To minimise this ponding, small diameter cross drains or perforated pipes (similar to plastic pipe field drains) would be incorporated into the track base at regular intervals to allow more flow to pass through the track and maintain the current flow regime. It is recommended that such pipes are surrounded by free draining material that is wrapped in a separator geotextile. The number of pipes and associated dimensions will be dependent upon the width of the flush/boggy area and the hydrological regime.

9.12.14 Prior to track construction, site operatives and the Environmental Clerk of Works (ECoW) will identify flush areas, depressions or zones which may concentrate water flow. These sections will be spanned with plastic pipes to help maintain hydraulic conductivity under the road and reduce water flow over the road surface during heavy precipitation.

9.12.15 The constructed drainage system will not discharge directly to any natural watercourse, but will discharge to buffer strips, trenches or Sustainable Drainage System (SuDS) measures, preferably on flatter, lower lying ground. These buffers will act as filters and will minimise sediment transport, attenuate flows prior to discharge and maximise infiltration back into the soils and peat.

9.12.16 Drainage from the construction compound, welfare facilities, borrow pit and concrete wash out areas will be collected and treated separately from the Site drainage, as the runoff from these areas is more likely to be contaminated and therefore will require treatment. Appropriate treatment, such as oil interceptors and treatment for high alkalinity, will be installed.

Pumping and Dewatering of Excavations

9.12.17 All pumping operations e.g. removal of water from turbine base excavations, will be carried out in line with good practice and where necessary in line with the requirements of The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) prior to the works being undertaken. Suitable measures to minimise the impact of the pumped water on the hydrological environment shall be taken. These measures shall include, but are not limited to, the following techniques:

9.12.18 Due to the expected low permeability of the Site soils it is expected that the potential for GW ingress would be low. The ingress of surface water into the excavations will be minimised through the use of upgradient drainage measures e.g. cut-off ditches. It is recognised that water can still enter the excavation and would need to be removed. This can be achieved by allowing the water to gravity drain to a designated area before being pumped from the excavation to a predesigned settlement lagoon or other suitable silt treatment area. The settlement lagoons would attenuate and treat runoff before discharging back into the natural drainage network.

9.12.19 Due to peaty soils on Site the throughput rate of runoff within the settlement treatment areas would be reduced to give longer settlement time within the excavations and settlement tanks. If required, a series of settlement lagoons or other silt treatment measures can be deployed to allow maximum settlement of sediment during the construction period.

9.12.20 The treated water from the settlement lagoons or other silt treatment measures will not be discharged directly into watercourses but directed onto vegetated surfaces where appropriate. Any sediment within the treated water will be deposited amongst the rough surface vegetation, away from sensitive habitats or watercourses.

9.12.21 To reduce the likelihood of erosion channels being formed by the discharge from the sediment treatment outfalls it is recommended that the water is discharged at a slow rate or spread evenly across a surface. For discharge onto rough vegetation to be effective the discharge must be spread efficiently, and the vegetation, soils and topography be carefully considered to determine an appropriate discharge location.

9.12.22 To maximise the efficiency of the settlement measures or other holding lagoons or tanks, the sediment sludge that collects at the base will be removed as required.

Storage of Fuels/Chemicals and Bunding Arrangements

9.12.23 Throughout the construction and to a lesser extent during the operational phase of the Proposed Development a number of oils and chemicals will be used. Such materials will be used and stored in a safe manner to so that the surface and GW environment is not adversely affected.

9.12.24 The following measures will be adopted to protect the surface and GW environment from the inappropriate storage and use of substances hazardous to the environment:

- All equipment, materials and chemicals to be stored away from any watercourses. Chemicals, fuel and oil will be stored in tanks of sufficient strength and structural integrity to minimise the likelihood of bursts or leak in ordinary use. They will also be sited on impervious bases within a secured bund of 110 % of the storage capacity;
- Where oil is stored in a bunded area, oil residue can build up. This residue build up will reduce the storage capacity of the bund and will be removed regularly. The residue will be disposed of by a specialist contractor;
- Locks shall be fitted to all fuel storage tanks or containers and there shall be a nominated trained person to oversee the refuelling and delivery to prevent spillages; and
- Standing machinery to have drip trays placed underneath to prevent oil and fuel leaks causing pollution.

9.12.25 No storage of fuels/chemicals will be permitted within the catchment of the Walker Burn DWPA and sub-catchments of PWS.

Refuelling

9.12.26 A fuel bowser will be used for refuelling on the access tracks or hardstanding. The bowser driver shall be responsible for ensuring that refuelling of mobile plant does not take place within 50 m of a watercourse. The bowser driver will receive extra training on spill prevention and response.

9.12.27 The refuelling bowser shall be equipped with a mobile spillage control kit containing oil absorbent booms and mats. All site personnel will be trained in their use as part of the Site induction training or toolbox talks. Special attention will be paid to spillage control at watercourses.

Vehicle Maintenance and Management

9.12.28 All plant used during the construction of the Proposed Development will be in suitable condition and fit for purpose to carry out the works and will be maintained as per manufacturers guidelines.

9.12.29 Maintenance of construction plant to be carried out in designated areas, on an impermeable surface away from any watercourse or drainage. Only if vehicles have broken down will maintenance be permitted out with a designated area, and this would only be carried out after implementing special precautions. Such precautions include, but are not limited to:

- Drip trays will be placed underneath vehicles during maintenance;
- As a precautionary measure, measures such as silt fencing or entrapment matting can be placed downstream of the maintenance area;
- All heavy construction plant will be inspected daily by the operating personnel and any defects or issues resolved immediately prior to starting works. All heavy construction plant shall be issued with spill-kits. Should a spillage occur, larger spill kits shall also be positioned at various areas within the Site which will be highlighted to all operatives during the Site induction; and
- Standing machinery and plant will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Where practicable refuelling of vehicles and machinery will be carried out at a central designated area, on an impermeable surface, which will be located at least 50 m away from any watercourses.

Concrete Works

9.12.30 Concrete would be required for the construction of the wind turbine foundations. The following section provides good practice measures that are required to be implemented to prevent detrimental effects to the hydrological environment.

9.12.31 Care will be taken during the transportation of concrete to the turbine and building foundations using good practice measures. Freshly mixed concrete and/or dry cement powder will not be allowed to enter any watercourse. This will be implemented by:

- Locating turbines, concrete batching (if considered) or wash out areas at least 50 m from watercourses;
- Concrete wagons will only be permitted to wash-out into specifically designed wash-out areas and predetermined at agreed locations Site wide;
- The drivers will be informed at their Site induction of the location of the designated wash-out areas and issued with a location map;
- Loads will be managed and assessed with regards to the size of vehicle and ground conditions whilst keeping at appropriate speed limits to avoid spillage;
- Tools and equipment will not be cleaned in watercourses. Should it be necessary to clean tools and equipment on the Site, this will be done in the predetermined wash-out areas;
- A designated concrete wash out will be constructed within the Site at a location agreed with the relevant consultees to protect the watercourses. The design and construction of these wash out areas will be agreed with SEPA; and
- Wash out areas will be continually monitored, and findings recorded to prevent a rise in effluent levels and avoid a spill over into the environment.

Welfare Facilities/Foul Water

9.12.32 The following measures will be adopted for the design of the foul water drainage system:

- Any sewage associated with the temporary construction compound and welfare facilities will be collected in appropriately sized interceptor tanks and shall be located at the construction compound. All wash basins, toilets and shower areas shall also be connected to an interceptor tank; and
- The interceptor tanks and the tanks within any Site portable toilets, which shall be situated not less than 50 m from any watercourse, will be emptied regularly by a suitably licensed contractor. Sewerage from these facilities will be disposed offsite in accordance with waste management legislation.

Site Drainage

9.12.33 The following section discusses the conventional Site drainage measures that can be installed during the construction and operation of the Proposed Development.

9.12.34 Surface drainage ditches will be installed alongside tracks only where necessary. The length, depth and gradient of individual drains will be minimised to avoid intercepting large volumes of diffuse overland flow and generating high velocity flows during storm events. Sediment traps, settlement ponds and buffer strips will be incorporated into the drainage system as necessary and will serve the dual purpose of attenuating peak flows, by slowing the flow of runoff through the drainage system and allowing sediment to settle before water is discharged from the drainage system.

9.12.35 As well as utilising sediment traps, structures such as v-notched weirs and/or check dams will be installed within the drainage channels. Such structures will throttle the flow within the channel, thus reducing erosive potential of any runoff and allowing sediment and/or pollutants to settle.

9.12.36 To reduce the impact of the Proposed Development on the natural hydrological regime, the Site drainage will mimic greenfield runoff response through the use of sustainable drainage practices.

9.12.37 SuDS will be taken into consideration as part of the water management and details of the proposed SuDS regime would be included in the CEMP that will be produced post-consent to discharge planning conditions and the Pollution Prevention Plan (PPP).

9.12.38 SuDS are used to attenuate rates of runoff from development sites and can also have water purification benefits. The implementation of SuDS as opposed to conventional drainage systems provides several benefits by:

- Reducing peak flows to watercourses and potentially reducing risk of flooding downstream;
- Reducing the volumes and frequency of water flowing directly to watercourses;
- Improving water quality by removing pollutants;
- Reducing potable water demand through rainwater harvesting; and
- Replicating natural drainage patterns, including the recharge of GW so that base flows are maintained.

9.12.39 Whilst it is understood that the scope for SuDS measures is limited as a result of the hydrological environment, it is recommended that the installed drainage measures adopt the principles highlighted above.

9.12.40 Access tracks crossing slopes will disrupt surface flow that consequently will collect in drains constructed upslope of the tracks. Cross-drains and/or water bars will be constructed at regular intervals to conduct this surface flow below or across the track where it will be discharged back into the drainage system, although all efforts will be made to segregate this runoff from more-silty runoff originating from track surfaces and other exposed construction areas, thus reducing the silt load and volume discharging to all silt treatment areas. Regular discharge points will limit the concentration of surface runoff and the diversion of flows between catchments. Such cross drains need to be strong enough to withstand the expected traffic loadings.

9.12.41 During storm events there is likely to be some ponding on the uphill side of tracks, as percolation alone is unlikely to be able to accommodate surface flows. To minimise this ponding, small diameter cross drains or perforated pipes (similar to plastic pipe field drains) would be incorporated into the track base at regular intervals to allow more flow to pass through the track and maintain the current flow regime. It is recommended that such pipes are surrounded by free draining material that is wrapped in a separator geotextile. The number of pipes and associated dimensions will be dependent upon the width of the flush/boggy area, proximity to GWDTE and the hydrological regime.

9.12.42 Prior to track construction, site operatives will identify flush areas, depressions or zones which may concentrate water flow. These sections will be spanned with plastic pipes to help maintain hydraulic conductivity under the road and reduce water flow over the road surface during heavy precipitation.

9.12.43 Due to the poor permeability of the surrounding peat, peaty soils and bedrock, it is also recommended that drains and/or cut-off drains are installed on the upstream/upgradient sides of the turbine foundations, crane hardstands, and other excavations required across the Proposed Development. The purpose of this will be to help reduce the volume of surface water runoff entering the excavations and minimise any subsequent contamination.

9.12.44 The constructed drainage system will not discharge directly to any natural watercourse, but will discharge to buffer strips, trenches or SuDS measures, preferably on flatter, lower lying ground. These buffers will act as filters and will minimise sediment transport, attenuate flows prior to discharge and maximise infiltration of water back into the soils and peat.

9.12.45 Drainage from the construction compounds, welfare facilities, borrow pits and concrete wash out areas will be collected and treated separately from the main Site drainage, as the runoff from these areas is more likely to be contaminated and therefore will require treatment. Appropriate treatment, such as oil interceptors and treatment for high alkalinity, will be installed.

9.12.46 Mitigation will follow industry good practice. All mitigation and drainage will be subject to detailed design and approved by SEPA prior to construction with the ECoW ensuring compliance. The Proposed Development will also be subject to a construction runoff permit. Further suggested measures include ensuring the detailed design includes buffer areas indicating “no construction zones” whereby the micrositing of infrastructure is not permitted. This will also include construction activities, stockpile storage areas, refuelling areas to ensure these are not located within buffers of watercourses or the catchments of PWS.

9.12.47 Watercourse crossings will be appropriately designed so that they do not alter the natural drainage, hinder the passage of aquatic fauna and can accommodate flow for a 1:200 year plus climate change event. All watercourse crossings will be designed with edge upstands or bunds e.g. sandbags or silt fences to prevent sediment laden runoff from construction plant movement from directly entering watercourses. Relevant CAR Authorisation from SEPA will be sought for construction of the crossings that are required over watercourses that are displayed on the 1:50,000 OS Landranger maps.

Emergency Water Management Measures

9.12.48 A large volume of oils and chemicals will be stored on Site during the construction phase and to a lesser extent the operational phase. Site traffic will also be present in significant numbers during the construction phase of the Proposed Development, with traffic volumes significantly reduced during Wind Farm operation.

9.12.49 The appropriate storage of oils, chemicals and maintenance of Site plant has been discussed above. However, despite these measures, accidents can happen, and these can have significant impacts upon the quality of the surface and GW environment. The following emergency procedures can be implemented to allow protection of the surface and GW environment during the construction and operation of the Proposed Development:

- All relevant on-site staff to be trained in both normal operating and emergency procedures and be made aware of highly sensitive areas on Site. The staff training and implementation of Site procedures will be overseen by the Infrastructure Contractor. These measures should be carried out effectively to minimise the risk of a pollution incident;
- Contingency plans should provide information on where emergency equipment is available on site (i.e. spill kits and absorbent materials), and that provide advice on actions to be taken and who would be informed, in the event of a pollution incident;
- Contingency planning procedures must be regularly reviewed to include changes to site operations that were not foreseen during design;
- The procedures set out in Site contingency plans need to be prepared in conjunction with the assessment of the risk of a pollution incident occurring and the measures to be taken to minimise pollution. The location of the procedures will be publicised, and it is essential that they are set out clearly so that they can easily be understood and acted upon; and
- The emergency procedures can include the following:
  - Containment measures;
  - Emergency discharge routes;
  - List of appropriate equipment and clean-up materials;
  - Maintenance schedule for equipment;
  - Details of trained staff, location, and provision for 24-hour cover;
  - Details of staff responsibilities;

- Notification procedures to inform the relevant environment protection authority;
- Audit and review schedule;
- Telephone numbers of statutory and local water company; and
- List of specialist pollution clean-up companies and their telephone numbers.

Peat/Soil Handling and Storage

9.12.50 The construction of roads, turbine foundations and crane hardstanding areas as well as the establishment of the borrow pit will require the stripping of surface soils / peat soils and its temporary storage. The following paragraphs present the mitigation measures required to minimise impact on underlying soils/peat and peaty soils. A peat slide risk assessment is provided in Appendix 9.3: Ground Stability Report.

9.12.51 Topsoil will be stripped keeping some intact. Turves will be stripped and handled with care and kept vegetation side up such that damage to the living vegetation mat is prevented or minimised as far as possible

9.12.52 This material will be stored upright adjacent to the working area but sited away from watercourses and drains, as far as is practicable. Surface water would ideally be directed away from construction activity to avoid silty run off entering watercourses or ecologically sensitive areas. The stored mounds will be limited in height to 1.5 m to minimise the risk of instability and compaction of lower layers. Subsoil and peaty soil that is stripped and stored will be kept separate from the topsoil.

9.12.53 The excavation of soils is to be undertaken in such a manner as to avoid cross contamination between distinct horizons. The different soil horizons will be kept and stored separately for use at a later date.

9.12.54 During and after excavation, the storage, haulage and reuse of excavated material will planned in advance to minimise material movement around the site. Immediate reuse is preferred to temporary storage (where possible). Further details are provided in the following paragraphs.

9.12.55 Turves will be stripped and handled with care and kept vegetation side up such that damage to the living vegetation mat is prevented or minimised as far as possible

9.12.56 The following will also be considered in the handling and storage of excavated soils:

- Sediment Discharges – implementation of a buffer zone to minimise impacts to watercourses and water supplies, undertaking of water quality monitoring particularly after heavy rainfall, and insurance that culverts or bridging of watercourses are of sufficient size and spacing with appropriate erosion mitigation measures; and
- Contaminant discharges – follow Pollution Prevention Guidance (PPGs), refuel and store oils and fuels in designated areas

9.12.57 Further details on the measures to appropriately manage the excavation, storage and reinstatement of excavated material is provided in the following paragraphs.

Excavation and Re-use Volumes

9.12.58 Based on the infrastructure details provided in Chapter 4: Project Description, and the average peat depths provided in Table 9.10, Table 9.16 provides a summary of total peat extractions from the proposed development as well as re-use volumes. The following design assumptions salient to the re-use of excavated peat are highlighted below:

- Excavated peat can be accommodated as part of the reinstatement works along the newly formed access tracks within the turbine array from T3 to T8. This is based on a track height of 0.75 m, with batter widths on each side of the track extending for 3.5 m. A batter slope of 1:4 is required to maintain stability but the reinstatement values provided are indicative for the purposes of this assessment only and will vary according to the prevailing ground conditions;
- For Turbine 6, the peat re-use potential is within the excavation area around the protruding concrete foundation to a depth of 0.5 m; and
- For the crane hardstand at turbine 6 it is assumed that peat can be used for reinstatement around the two peripheral edges to a height of 0.75 m with a batter slope extending to 3.5 m.

9.12.59 Whilst it can demonstrated that all peat can be accommodated in reinstatement, the practicalities and suitability for peat re-use will be considered across individual distinct work areas. The formulation of a detailed construction method statement shall incorporate detailed construction design and sequencing for the reinstatement purposes that will allow refinement of the excavation volumes presented in Table 9.16.

Table 9.16: Estimate of peat excavation and re-use volumes

Infrastructure	Peat extraction volume (m^3)	Peat re-use volume (m^3)	Surplus (+) or Deficit (-) (m^3)
Turbines (T6)	473	236	237
Crane hardstanding (T6)	3500	197	3303
Access tracks	2940	6773	-3833
Ancillary infrastructure	0	0	0
Borrow pit	0	0	0
	6913	**7206**	**-292**

Excavation

9.12.60 Prior to any excavation, detailed method statements will be produced identifying where and how excavated soil and peat will be used in reinstatement or landscaping works. Specific requirements for the excavation, handling, storage and reinstatement of peat will be outlined in the above method statement. The method statements will consider peat layering and the potential impacts on downstream hydrological receptors and the potential for instability issues with the excavated material.

9.12.61 The principal requirements are outlined below

- All excavations where required should be monitored and measures taken to prevent collapse and the destabilising of peat deposits adjacent to excavations;
- A system of daily reporting of excavations will be established during construction and utilised to monitor the geotechnical performance of slopes including peat, sub-soil and bedrock. This would be implemented and undertaken by a suitable, experienced and trained member of the site team;
- A system of daily reporting of excavations should be established during construction and utilised to monitor the geotechnical performance of slopes including peat, sub-soil and bedrock. This should be implemented and undertaken by a suitable, experienced and trained member of the site team;
- When excavating areas of peat, excavated turves should be as intact as possible. Peat turves will be stored to promote the retention of structure prior to use in reinstatement;
- Underlying catotelmic peat will then be removed and stored separately and kept damp;
- Excavated peat turves and catotelmic peat will be handled, through careful excavation to reduce the risk for cross contamination between distinct horizons and to maximise the potential for reuse;
- Care will be taken when stripping and removing topsoil and peat turves and appropriate storage methods will be used on site, i.e. excavated material will be stored in separate horizons with turves being placed on top of excavated peat to minimise desiccation and oxidisation. They would be placed in a manner to maximise coverage in a ‘checkerboard’ pattern; and

- Classification of excavated materials will depend on their identified re-use in reinstatement works. At this site it is anticipated that the material to be excavated will comprise peat (which may be sub-divided into amorphous peat (catotelmic), fibrous peat (acrotelmic) and turf.

Temporary Storage of Excavated Material

9.12.62 Excavated material that is stockpiled on site for further use should be managed to prevent silty run-off or losses due to drying out and wind. The temporary storage of excavated material, including peat, shall seek to minimise the disturbance of peaty soils/soil deposits through minimising haul distance between temporary storage sites.

9.12.63 The suitability of temporary storage areas will confirmed prior to works taking place and the following key control measures will be considered:

- Topsoil and peat will be stripped and stored separately within the pre-identified areas to maximise the success of safe storage and swift and successful reinstatement;
- If space does not allow storage and the surplus is to be stored elsewhere on the site, the ECoW will be consulted in advance to agree appropriate areas;
- Separate areas will be created for the different layers and topsoil will not be mixed with subsoil layers;
- Stacked topsoil will not exceed a height that enables the topsoil to breakdown. The maximum height for stacked material will be agreed in advance with a maximum height likely to be 1.5 m. The maximum height for peat storage is likely to be 1 m;
- Storage areas will be located away from watercourses (minimum of 50 m, where practical) protected from run-off from adjacent areas;
- Storage areas should be reinstated to their original condition on completion of their use for storage;
- If soil storage is being carried out on sensitive habitats, consideration will be given to storage on top of a geotextile mat and storage duration shall be minimised;
- Good practice will be adopted in order to minimise the amount of compaction or other disturbance of the general structure of the superficial deposits;
- Other site works will not impact on stored soil (e.g. construction traffic will not track over stored soils);
- If significant soil erosion is occurring from storage piles during periods of heavy rain action will be taken to cover the stockpiles, where practical. The silt fencing or other mitigation around the base of the stockpile will be monitored and replaced as necessary;
- In periods of dry weather check the need for watering to reduce dust and potential nuisance;
- A silt fence will be constructed at the base of the stockpile using a suitable geotextile if required;
- Construct drainage channels to direct surface water away from stockpiles and prevent erosion at the base; and
- Construct drainage channels to direct water through settlement ponds.

9.12.64 For the temporary storage of peat it would also be a priority to ensure that a future detailed site investigation provides information on the suitability of these temporary peat storage areas including the topographic profile, GW regime, and geotechnical properties of deposits underlying the temporary storage sites. Furthermore, it may be necessary to undertake further peat stability calculations based on finalised placement of temporary peat storage areas.

9.12.65 Owing to the position of the site within an upland setting, with a relatively high SAAR it is anticipated that watering the stored peat through natural precipitation will be sufficient for the peat to remain damp, thus preventing drying out and desiccation and allowing the vegetation layer and seed bank to be sustained. This is an important element in the restoration of infrastructure, providing continuity with surrounding local vegetation upon reinstatement. For the duration of the temporary storage it shall be necessary to periodically monitor the condition of the stored peat and ensure the stability is maintained, of which may need to be undertaken by a suitably qualified geotechnical engineer. During prolonged dry spells artificial wetting could be undertaken, however this will be done under the agreement and supervision of the EcoW with appropriate mitigation in place to ensure the protection of the stored peat, as well as any nearby receptors such as watercourses or GWDTE.

Site Reinstatement

9.12.66 So far as is reasonably practicable, all disturbed areas which require reinstatement will be reinstated with the same vegetation types as exist at present, thereby ensuring minimum disruption to the surrounding landscape.

9.12.67 The reinstatement and storage of any excavated materials will involve replacement of previously stripped soils, vegetated layers or turves. Timing of reinstatement works will also consider adjacent construction activities which may disturb any reinstatement works already carried out.

9.12.68 The longer the stripped turves are stored for, the more they will degrade and become unsuitable for successful reinstatement. Therefore, the amount of time between the construction activities and subsequent reinstatement will be minimised as much as practically possible.

9.12.69 The fundamental aspects of reinstatement are summarised as follows:

- Stripped soil, including peat will be reinstated, including landscaping of infrastructure verges, as close to where it was removed as possible. This will help to maintain a local seed base and the local geological/hydrological characteristics;
- Subsoil, topsoil and turfs replaced in same order as removed;
- During periods of dry weather, exposed peat shall be kept moist;
- Unless otherwise agreed, turfs will be reinstated following the works and orientated vegetation side up;
- Reinstatement will be carried out as soon as is possible following stripping to ensure integrity of material is maintained;
- Where turfs are not available, areas will be left to re-vegetate naturally. If there is not sufficient turf to completely cover an area, then turf will be spread in smaller sections to offer some protection and spread the seed bank rather than leave larger exposed areas;
- Any soil found to be contaminated will not be used for reinstatement but disposed of off-site to a licensed or exempted facility, if necessary;
- The reinstatement of the construction areas will be undertaken to a high standard, using the existing soil and vegetation material wherever possible, in accordance with industry good practice; and
- If re-vegetation is not successful and has not occurred within an agreed period of time and following consultations with NatureScot re-seeding using a native species mix may be considered.

9.12.70 Reinstatement of T6 will also consider the following:

- Construction works will be carried out to the detailed specification of the turbine foundation design and to permit adequate temporary works. Excessive peat excavation will be minimised.
- Stripping, storage and reinstatement of excavated materials will be as per industry good practice;
- A detailed plan of where excavated material will be stored will be created;
- Subsoil/peat will be spread over the backfilled area during reinstatement. Peat turves will then be placed on top to encourage natural re-growth of the vegetation;
- Time between turbine foundation excavation and reinstatement will be planned to reduce the potential for stored turf layers to dry out and decompose; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration.

9.12.71 As well as consideration of the above, reinstatement of the access track between T3 and T6 will further consider the following:

- Consider haulage methods and specified storage locations in relation to areas being worked. Haulage distances to storage locations will be minimal;
- Vegetated turves and topsoil will be stripped with care and stored correctly i.e. separated in horizons and vegetation stored vegetation side up in a checkerboard pattern on top of stockpiled peat;
- For track reinstatement peat will be placed back in the correct horizon order and topsoil containing the seed bank will be on the top. If vegetated turves have been previously stripped, then these will be placed on top to maximise vegetation growth potential;
- Reinstatement of verges will be completed as soon as practical to minimise turf drying i.e. reinstatement can take place whilst track construction continues; and
- Peat soil will not be spread too thinly during verge reinstatement in order to prevent cracking/drying out and excessive amounts of peat will also not be used as this can lead to unstable surfaces, effect drainage, loss of habitat via smothering of adjacent vegetation and create sediment laden runoff;
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration, however, if required, following consultation with NatureScot, re-seeding using a native species mix may be considered; and
- Lateral water loss from track edge peat “cliffs” will be minimised. This can be achieved through appropriate re-profiling and reinstatement of the track verges at an angle that blends into the surrounding landscaping as well as placing vegetated turves onto the verges. Consideration will be given to the placement of turves in a checkerboard fashion should there be insufficient turves available. This will be considered in greater details as part of the detailed track design.

Additional Mitigation Measures

9.12.72 Where specific risks exist for individual receptors as a result of the construction and operation of the Proposed Development, additional mitigation will also be used alongside standard good practice and embedded mitigation to further reduce measurable impacts. The recommendations outlined will be incorporated into the CEMP and PPP post-consent.

9.12.73 The use of General Site Pollution Control and other Mitigation Measures outlined in this Chapter apply to the entire Proposed Development Area (as shown in Figure 1.2 in Volume 3a). Site-specific mitigation will be undertaken at the relevant private water supplies situated adjacent to or within the Proposed Development Area. This will include the implementation of a series of additional measures for the Holylee – Caberstaingrains PWS and Colquhar farm PWS;

- Completion of further investigations to further characterise the GW system;
- Detailed design of drainage system to encourage infiltration of treated and discharged runoff;
- Demarcation of supply and infrastructure and appropriate design of standard good practice mitigation to avoid potential for impact;
- Establishment of a program of inspection and monitoring;

9.12.74 As outlined in Appendix 9.2, the above measures will be provided in a detailed Private Water Supply Monitoring Plan and Method Statement (PWSMP) that will prepared following the completion of the recommendation detailed investigations. The implementation of this additional mitigation will be the responsibility of the Developer and nominated Principal Contractor.

9.12.75 An Outline Habitat Management Plan has been provided within Appendix 7.1. Commitment to offsite peatland restoration is presented and will require ongoing engagement with SBC to finalise details.

9.13 POTENTIAL CONSTRUCTION EFFECTS

9.13.1 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 construction of the Proposed Development is discussed in the following paragraphs, this information is considered in the mitigation and management measures outlined in the mitigation measure section below.

Pollution Incidents

9.13.2 During the construction phase, a number of potential pollutants will be present onsite, including oil, fuels, chemicals, unset cement and concrete, waste and waste water from construction activities and staff welfare facilities. Most potential pollutants will be located or stored within the construction compound. In addition, there is the potential for contamination of the hydrological and terrestrial environment caused by spillages along the access tracks and construction areas.

Erosion and Sedimentation

9.13.3 Soil and sediment generation may occur in areas where the ground has been disturbed, particularly where surface runoff has been concentrated. Drainage ditches are particularly prone to this, due to the high velocities of surface water runoff passing through the drainage network. Considerable sediment generation is expected where the ground has been excavated for the Proposed Development infrastructure.

9.13.4 Sediment transport in watercourses can result in high turbidity levels which can impact on the water quality, particularly affecting the ecological potential of the watercourses. High turbidity in watercourses can reduce the light and oxygen levels in the watercourses, while sediment deposition can smother plant life and spawning grounds. Sediment deposition can also reduce the flood storage capacity of the watercourses and block culverts, resulting in an increased flood risk.

9.13.5 As a result of the construction operations, all catchments with new and upgraded infrastructure present are vulnerable to erosion and sedimentation.

Increase in Runoff

9.13.6 Turbine bases, hardstanding areas and access tracks will act as impermeable areas, restricting the natural movement of water within the hydrological environment, potentially resulting in increased rates of runoff into the onsite catchments.

9.13.7 Localised increases could cause issues for downstream flood storage capacity and/or pollution incidents. Increases in the volume of runoff entering watercourses could also cause erosion and sedimentation, therefore having detrimental effects on surface water hydrology.

Modification of Surface Drainage Patterns

9.13.8 The interception of diffuse overland flow by the Proposed Development and associated drainage may disrupt the natural drainage regime of the area, concentrating flows and potentially diverting flows from one catchment to another. This may have implications on flood issues downstream of the Proposed Development.

Impediments to Surface Water Flow

9.13.9 The construction of watercourse crossings may restrict flow in the various channels and reduce hydraulic capacity, resulting in an increase in flood risk, and promotion of erosion and sedimentation. In addition, poorly designed watercourse crossings may impede the migration of fish and mammal movement in the riparian corridor.

Modification of Groundwater Flows and Levels

9.13.10 Deep excavations, such as those required for the turbine foundations are likely to disrupt the shallow GW systems and bedrock geology. Surface water ingress will be minimised utilising upgradient cut-off drains or other drainage measures. The installation of cut-off drains as well as dewatering excavations has the potential to lower local GW levels within surrounding peat and peat dominated soils.

9.13.11 Access tracks have the potential to disrupt flow pathways, such as interrupting shallow GW flow or altering the hydrological regime. This may have implications for shallow GW flows to and from the Moorfoot Hills SSSI.

9.13.12 Actual GWDTE habitats have been assessed as having a moderate dependency on GW. Construction of the Proposed Development may have the following potential effects on the quantity and quality of GW supplying GWDTE habitats:

- Turbine foundations, borrow pits and hardstand areas located up-gradient from GWDTE could disrupt shallow GW flow from dewatering and diversion of flow paths;
- Turbine foundations, borrow pits and hardstand areas located down-gradient from GWDTE could cause temporary lowering of the water table from dewatering;
- Access tracks, drainage ditches and cable trenches located up-gradient from GWDTE could disrupt and divert shallow GW flow-paths;
- Infrastructure located directly over GWDTE habitats could contaminate and lower the quality of GW supplying GWDTE through pollution and sedimentation; and
- Runoff from construction areas up-gradient of GWDTE may infiltrate into shallow GW aquifers and contaminate and lower the quality of GW supplying GWDTE through pollution and sedimentation.

Compaction of Soils

9.13.13 The movement of construction traffic within the Site is likely to cause localised compaction of the ground surface, leading to changes in both the hydrological and hydrogeological regime. The impacts of compaction are likely to be highly localised but will damage the vegetation and result in a reduction in the soil permeability and rainfall infiltration, thereby increasing the potential for flood risk and erosion.

9.14 ASSESSMENT OF CONSTRUCTION EFFECTS

9.14.1 Table 9.17 identifies the likely construction effects on the identified receptors and their significance assuming the successful implementation of good practice and mitigation measures. The assessment is based on the criteria outlined in Section 9.6.

Table 9.17: Assessment of Construction Effects

Potential Effect	Identified Receptor(s)	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
Surface Waters								
• Pollution incidents • Erosion and sedimentation • Changes in Water Quality • Increase in Runoff • Modifications to Surface Drainage Pattern • Impediments to Surface Water Flow	Gatehopeknowe Burn	High	Slight	Moderate	None	-	-	-
	Walker Burn	Low	Slight	Minor	None	-	-	-
	Hope Burn	Low	Slight	Minor	None	-	-	-
	Harpershiel Burn/ Shaw Burn	Low	Slight	Minor	None	-	-	-
	River Tweed	High	Slight	Moderate	None	-	-	-
Flood Risk								
• Increase in runoff • Modifications to Surface Drainage Patterns • Impediments to Surface Water Flow • Compaction of Soil	The Proposed Development	Low	Negligible	Minor/Negligible	None	-	-	-
	Watercourses downstream of the Proposed Development	Medium	Slight	Moderate/Minor	None	-	-	-

Potential Effect	Identified Receptor(s)	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
Water Resources								
• Pollution incidents • Erosion and sedimentation • Modification of GW Flows and Levels • Changes in Water Quality • Increase in Runoff • Modifications to Surface Drainage Pattern • Impediments to Surface Water Flow • Modification of GW Flows and Levels • Compaction of Soils	Holylee - Caberstongrains PWS (K)	High	Moderate	Major/ Moderate	Additional mitigation presented in Appendix 9.2: Private Water Supply Risk Assessment	High	Negligible	Moderate/Minor
	Colquhar Farm PWS (AC)	High	Moderate	Major/ Moderate	Additional mitigation presented in Appendix 9.2: Private Water Supply Risk Assessment	High	Negligible	Moderate/Minor
	River Tweed SAC	High	Negligible	Moderate/Minor	None	-	-	-
Soils								
• Pollution incidents • Modifications to Surface Drainage Patterns • Modification of GW Flows and Levels • Compaction of Soils	Moorfoot Hills SAC	High	Negligible	Moderate/Minor	None	-	-	-
	Site soils and peat < 0.5 m depth	Low	Negligible	Minor / Negligible	None	-	-	-
	Site soils and peat > 0.5 m depth	High	Slight	Moderate	Additional mitigation presented within the Outline Habitat Management Plan (Chapter 7 and Figure 7.9)	High	Negligible	Moderate/Minor
Geology								
• Excavation and removal required for construction	On-site Geology	Low	Negligible	Minor / Negligible	None	-	-	-
Hydrogeology and Groundwater								
• Pollution incidents	Hydrogeology and GW	High	Negligible	Moderate / Minor	None	-	-	-

Potential Effect	Identified Receptor(s)	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
• Modification of GW flows and levels • Compaction of Soils	GWDTE	Medium	Negligible	Minor	None	-	-	-

9.15 POTENTIAL OPERATIONAL EFFECTS

9.15.1 The effects of the Proposed Development are expected to be substantially lower during the operational phase. The following paragraphs discuss the potential effects that may occur during the operational phase of the Proposed Development.

Pollution Incidents

9.15.2 The potential risk of pollution is substantially lower during operation than during construction because of the decreased levels of activity in the operational phase. The majority of potential pollutants will have been removed when construction is complete; however, lubricants for turbine gearboxes, transformer oils and possible fuel leaks from maintenance vehicles will remain.

Erosion and Sedimentation

9.15.3 Levels of erosion and sedimentation during operation will be much lower than construction as there will be no excavations or bare exposed ground. Some erosion and sedimentation is still possible on site tracks and drainage ditches as a result of scouring during extreme rainfall events. Similarly, there could be some erosion and sedimentation around new stream crossings as watercourses reach new equilibrium.

Modification of Surface Drainage Patterns

9.15.4 Modification of surface runoff will occur as a result of the construction of the new infrastructure associated with the Proposed Development. The operational effects are likely to result in changes to volume and/or changes to runoff rate.

9.15.5 Poorly designed site tracks and associated drainage could allow surface water to travel through a catchment much faster than if it were to travel as diffuse overland flow. This could result in an increase in runoff rates, peak flows and influence response times during storm events. The utilisation of many of the existing tracks reduces the magnitude of the changes expected to the drainage regime.

Impediments to Surface Water Flows

9.15.6 During the operational phase impediments to flows can generally occur as a result from blockages to watercourse crossing, ditches and watercourses resulting from vegetation and erosion debris.

Modification of Groundwater Flow and Levels

9.15.7 Tracks and their drainage as well as turbine foundations and hardstandings will potentially alter the water table within the upslope and downslope peat and upper bedrock aquifers, which can also have implications for the long term functionality of peatland environments. Backfilled cable trenches can also provide preferential flow pathways for GW.

9.16 ASSESSMENT OF PREDICTED OPERATIONAL EFFECTS

9.16.1 Table 9.18 below identifies the likely operational and ongoing effects on the identified receptors and their significance assuming the successful implementation of good practice and mitigation measures. The assessment is based on the criteria outlined in Section 9.6.

Table 9.18: Assessment of Predicted Operational Effects

Potential Effect	Identified Receptor(s)	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
Surface Waters								
• Pollution incidents	Gatehopeknowe Burn	High	Negligible	Moderate/Minor	None	-	-	-
• Erosion and sedimentation • Changes in Water Quality	Walker Burn	Low	Negligible	Minor/Negligible	None	-	-	-
• Increase in Runoff	Hope Burn	Low	Negligible	Minor/Negligible	None	-	-	-
• Modifications to Surface Drainage Pattern	Harpershiel Burn/ Shaw Burn	Low	Negligible	Minor/Negligible	None	-	-	-

Potential Effect	Identified Receptor(s)	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
• Impediments to Surface Water Flow	River Tweed	High	Negligible	Moderate/Minor	None	-	-	-
Flood Risk								
• Increase in runoff • Modifications to Surface Drainage Patterns	The Proposed Development	Low	Negligible	Minor/Negligible	None	-	-	-
• Impediments to Surface Water Flow	Watercourses downstream of the Proposed Development	Medium	Negligible	Minor	None	-	-	-
Water Resources								
• Pollution incidents • Erosion and sedimentation • Modification of GW Flows and Levels • Changes in Water Quality • Increase in Runoff	Holylee - Caberstongrains PWS (K)	High	Negligible	Moderate/Minor	Additional mitigation presented in Appendix 9.2: Private Water Supply Risk Assessment	High	Negligible	Moderate/Minor
• Modifications to Surface Drainage Pattern • Impediments to Surface Water Flow	Colquhar Farm PWS (AC)	High	Negligible	Moderate/Minor	Additional mitigation presented in Appendix 9.2: Private Water Supply Risk Assessment	High	Negligible	Moderate/Minor
• Modification of GW Flows and Levels	River Tweed SAC	Medium	Negligible	Minor	None	-	-	-
Soils								
• Pollution incidents • Modifications to Surface Drainage Patterns • Modification of GW Flows and Levels	Moorfoot Hills SAC	High	Negligible	Moderate/Minor	None	-	-	-
	Site soils and peat < 0.5 m depth	Low	Negligible	Minor/Negligible	None	-	-	-
	Site soils and peat > 0.5 m depth	High	Slight	Moderate	Additional mitigation presented within the Outline Habitat Management Plan (Chapter 7 and Figure 7.9)	High	Negligible	Moderate/Minor
Hydrogeology and Groundwater								
• Pollution incidents • Modification of GW flows and levels	Hydrogeology and GW	High	Negligible	Moderate/Minor	None	-	-	-

Potential Effect	Identified Receptor(s)	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
	GWDTE	Medium	Negligible	Minor	None	-	-	-

9.17 CUMULATIVE EFFECTS AND INTERACTION OF EFFECTS

9.17.1 The application of a hydrological catchment methodology enables a logical evaluation of the potential for cumulative effects of the hydrological environment. A cumulative impact is considered to be the impact on a hydrological, hydrogeological or geological receptor arising from the Proposed Development in combination with other developments which are likely to affect surface water, GW or geology. Developments (operational, consented and in planning) within the same catchment as the Proposed Development and within a distance of 10 km from the Proposed Development have been considered. Cumulative impacts are considered using the same methodology as for impacts of the Proposed Development in isolation.

9.17.2 The operational Bowbeat and Longpark Wind Farms, with a single project application currently submitted (Greystone Knowe) are located within 10 km of the Proposed Development and within the catchment of the River Tweed.

9.17.3 Off-site cumulative hydrological effects are primary related to changes in water quality and increases in flood risk. Mitigation has been presented in Section 9.12 to adequately protect on-site hydrological receptors and therefore will be suitable to ensure the protection of those situated downstream and should not contribute to or exacerbate any effects arising from other developments, land uses or activities. With regards to flood risk specifically, the design of the drainage will mimic the existing hydrological and greenfield regime of the Proposed Development Area, as outlined in Section 9.7.

9.17.4 It is concluded that following the successful implementation of the mitigation outlined in 9.12, cumulative impacts of the Proposed Development during construction and during operation will be **negligible**.

9.18 MONITORING

9.18.1 A programme of surface water quality monitoring will 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.

9.18.2 The details of any required monitoring should be discussed and agreed with SEPA, and SBC prior to commencement. The extent and the frequency of the monitoring will 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 effects on the water environment; and
- Understand the long-term effects of the Proposed Development on the natural environment.

9.18.3 A baseline surface water monitoring programme will be undertaken prior to the commencement of construction works. 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.

9.18.4 It is also recommended that a suitably qualified ECoW 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.

9.18.5 Monitoring should be undertaken throughout construction of the Proposed Development. The monitoring will help to identify areas where infrastructure is having a negative effect on peaty soils and utilise the appropriate methods to prevent further deterioration and/or promote further enhancement.

9.18.6 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 SBC. 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[6].

9.19 LICENCING REQUIREMENTS

9.19.1 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 runoff permit relating to surface water drainage, rather than individual activities required to adhere to the regulations.

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

9.20 RESIDUAL EFFECTS

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

9.20.2 This has identified that there will be no significant environmental effects from the Proposed Development on the hydrological, hydrogeological and geological environment and therefore it can be concluded that no significant residual effects will take place.

[6] SEPA (2021), The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), A Practical Guide, version 8.5

9.21 DECOMMISSIONING

9.21.1 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.

9.21.2 The decommissioning of the Proposed Development would adhere to the latest legislative and guidance requirements at the time.

9.22 FUTURE BASELINE

9.22.1 Without the Proposed Development, the recorded baseline scenario for the hydrological, geological and hydrogeological of the Site has the potential to change due to climate change scenarios. This includes, but is not limited to:

- An increase in intense rainfall events that have the potential to increase the risk of flooding to receptors downstream of the Proposed Development; and
- Prolonged periods of drier, warmer weather reducing the availability of water supplying PWS as well as reducing water flows in watercourses.

9.22.2 There is the potential that the landowners may choose to pursue alternative development opportunities which cover a greater footprint of the site area than current proposals.

9.22.3 The adoption of permeant drainage as part of the Proposed Development will also seek to mitigate pressures on the water environment through the incorporation of sustainable design features as well as impacts of peatland habitat improvement which will have been proven to attenuate peak flows and improve water quality.

9.23 SUMMARY

9.23.1 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 and operation of The Proposed Development.

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

- Pollution Incidents;
- Erosion and sedimentation;
- Changes to water resources i.e. private water supplies;
- Modification of surface water and GW flows;
- Modification of natural drainage patterns;
- Impediments to flow and flood risk;
- Excavation of material, including rock, soils and peat;
- Peat instability; and
- Compaction of soils.

9.23.3 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 as well as detailed design of infrastructure and associated mitigation will be implemented to protect the GW and surface water resources from pollution and minimise changes to the hydrological environment.

9.23.4 Table 9.19 below summarises the likely significant environmental effects of the Proposed Development. The impact assessment has taken into account the hydrological regime, highlighting that the principal effects will 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 minor or no significance. The assessment of predicted ongoing and operational effects has also determined that the significance of effects on all receptors to be of minor/moderate minor or negligible significance. The assessment of predicted ongoing and operational effects has also determined that the significance of effects on all receptors to be of minor or negligible significance.

Table 9.19: Summary of Likely Significant Environment Effects of the Proposed Development

Likely Significant Impact	Mitigation Proposed	Means of Implementation	Significance of Residual Effect
Construction Phase			
impacts to on-site and downstream water quality l effects to on-site and downstream fisheries as a result of changes to water quality Increases to on-site and downstream flood risk) Impacts to PWS on and near to the Proposed Development	Appropriate drainage design that incorporates sediment management measures to attenuate and treat runoff from construction activities. Appropriate storage and handling of potential pollutants. Refuelling of construction plant in designated areas. Adoption and agreement on emergency measures should significant effects occur. Demarcation of PWS infrastructure during construction	Preparation of detailed CEMP prior to construction. Hydrological elements of the CEMP can include, but not limited to the following: • A Drainage Management Plan; • Pollution Prevention and Incident Response Plan Watercourse crossing assessment (detailed design prior to construction); and • Water quality monitoring programme; • Further investigations to quantify risk via updated Private Water Supply Risk Assessment; and • Private Water Supply Monitoring Plan and Method Statement	Moderate Minor / Negligible Minor
Peat/peaty soils as a result of interrupting surface and sub-surface drainage pathways.	Appropriate drainage design that incorporates sediment management measures to attenuate	Preparation of detailed CEMP prior to construction. Hydrological elements of	Moderate/ Minor Minor/ Negligible Minor

Likely Significant Impact	Mitigation Proposed	Means of Implementation	Significance of Residual Effect
Modification of GW flows and levels with consequential impacts on GWDTEs	and treat runoff from construction activities. Measures will be designed to encourage water retention within peat/soils. Appropriate design of tracks, watercourse crossings etc in areas of flushes.	the CEMP can include, but not limited to the following: • Peat Management Plan; • Drainage Management Plan; • Water quality / habitat monitoring programme.	
Operational Phase			
impacts to on-site and downstream water quality through degradation of The Proposed Development infrastructure such as drainage or track surfaces.	Appropriate drainage design that incorporates sediment management measures to attenuate and treat runoff from Wind Farm infrastructure. Appropriate storage and handling of potential pollutants. Adoption of a long-term monitoring programme to monitor functionality of drainage management measures as well as degradation of infrastructure (including the removal of blockages from watercourse crossings). Adoption of long term monitoring strategy for PWS	Operational drainage and monitoring plan (designed prior to construction). Plan can detail the appropriate monitoring methods, including: Visual monitoring and completion of checklists signed off by SEPA; Regular water quality monitoring for a period post construction to determine potential long terms effects of Wind Farm on water quality.	Moderate / Minor Minor / Negligible
effects to on-site and downstream fisheries as a result of changes to water quality (as described above)			Minor
Increases to on-site and downstream flood risk as a result of degradation of infrastructure			Minor / Negligible Minor
effects on the long term viability on the quality and quantity of water serving PWS			Minor

9.23.5 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, SBC and other engaged stakeholders, will result in overall effects that are considered to be not significant in terms of the EIA Regulations.