11 Geology, Hydrology and Hydrogeology

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11 Geology, Hydrology and Hydrogeology

11.1 Executive Summary

11.1.1 The Proposed Development is located on elevated moorland approximately 1.3 km west of the village of Lyness on the island of Hoy. The site topography is defined by slopes of variable steepness, generally falling from north to south.

11.1.2 The largest watercourse within the site is the Burn of Ore at the southern boundary, into which most of the site area drains. Two unnamed burns and the Burn of Longigill flow from north to south across the site, into the Burn of Ore. All site drainage is ultimately to the sea on the east coast of Hoy, less than 1 km from the site boundary.

11.1.3 Site geology comprises Upper Old Red Sandstone sedimentary strata. This is overlain by peat across most of the site area, with depth varying from nil to locally over 3 m. In parts of the site, there is evidence of recent and older peat cutting, and other localised disturbance or excavation associated with historical wartime structures.

11.1.4 A peat slide risk assessment has identified low and negligible risks at proposed turbine and infrastructure locations across the site. Low risks will be mitigated through micro-siting and/or targeted geotechnical/engineering controls, to be informed by detailed pre-construction site investigations.

11.1.5 There are no private water supplies located within 1 km of the site, although evidence of potentially moderately groundwater dependent habitats has been identified. Based on the site geology and topography, the habitats are interpreted as being at least partially surface water or rainwater fed.

11.1.6 Likely construction and operational effects include sedimentation or pollution of the water environment from surface runoff, compaction of soils, the removal of peat, peat landslide hazard, and effects on groundwater quality and flow regime.

11.1.7 Standard/embedded mitigation measures include design iteration to appropriately buffer watercourses, and avoid areas of deep peat wherever possible in siting turbines (taking account of other environmental and technical constraints). Standard good construction and design practice has also been considered as standard mitigation, including detailed pre-construction site investigations, agreement and implementation of a Construction Environmental Management Plan (CEMP), appropriate design of the single proposed watercourse crossing, and development of a detailed Drainage Strategy for the site.

11.1.8 The likely effects on hydrological, geological and hydrogeological receptors, taking account of the standard mitigation measures, have been assessed as **minor** or **minor to moderate** (not significant). However, some additional specific mitigation measures have been proposed to further reduce effects, including appropriate peat management and re-use on site, and implementation of a Habitat Management Plan to restore degraded areas of blanket bog (peat deposits) on site and in the local area.

11.1.9 The significance of residual effects on hydrological, geological and hydrogeological receptors is considered to be **minor** (not significant). No cumulative effects on hydrology, hydrogeology and geology are predicted.

11.2 Introduction

11.2.1 This chapter outlines the potential geological, hydrological and hydrogeological effects of the construction and operation of the Proposed Development. An assessment is provided based on the value of the receptor and the magnitude of the impact giving the significance of the effect. Where appropriate, mitigation measures to enhance, prevent, minimise or control identified effects are presented.

Statement of Competence

11.2.2 The assessment has been carried out by Jenny Hazzard (BSc (Hons), MSc, PIEMA) who has over 19 years consultancy experience in geology, peat, hydrogeology and hydrology.

11.3 Legislation, Policy and Guidelines

11.3.1 With regard to hydrology, management of water-borne pollution and protection of natural heritage areas, the Scottish Environment Protection Agency (SEPA) has statutory obligations in terms of the management and control of pollution into water resources in Scotland. Where careful design has avoided sensitive receptors, it would be reasonable to assume that the adoption of the SEPA's Good Practice Guidelines will, in general, prevent pollution to acceptable standards and make the majority of any 'significant' effects unlikely. Specific mitigation measures may be required in certain areas or at certain times of the site development.

Legislation

11.3.2 There is a range of environmental legislation that the Proposed Development must adhere to throughout its life cycle. Relevant legislation and guidance documents have been reviewed and taken into account as part of this geological, hydrogeological and hydrological assessment. Key legislative drivers relating to the water environment which have been considered within this assessment are listed below:

- Control of Pollution Act 1974;
- Environmental Protection Act 1990;
- Environment Act 1995;
- Water Framework Directive 2000/60/EC;
- Groundwater Daughter Directive 2006/118/EC;
- Water Environment and Water Services (Scotland) Act (WEWSA) 2003;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended in 2018) (CAR);
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 (amends and revokes the Private Water Supplies (Scotland) Regulations 2006);
- The Flood Risk Management (Scotland) Act 2009; and
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

11.3.3 The Water Framework Directive has been implemented in Scotland through WESWA and CAR. The primary objective of the Directive is for all surface and coastal water bodies to achieve good chemical and ecological status, and ground water bodies to achieve good quantitative and chemical status, by 2015 or 2021. This required assessment of a much wider set of water quality parameters than had previously been used. SEPA has published River Basin Management Plans (RBMPs) which detail the current and target status of water bodies, and the means of achieving these targets.

Planning Policy

11.3.4 Scottish Planning Policy (SPP) (Scottish Government, 2014) identifies the range of considerations likely to be relevant to the determination of energy projects, including onshore wind developments (Paragraph 169). These include:

- effects on hydrology, the water environment and flood risk; and
- impacts on carbon rich soils.

11.3.5 It also states that the planning system should '*promote protection and improvement of the water environment, including rivers, lochs, estuaries, wetlands, coastal waters and groundwater, in a sustainable and co-ordinated way*' (paragraph 194); and '*Development management decisions should take account of potential effects on landscapes and the natural and water environment, including cumulative effects*' (paragraph 202).

11.3.6 With respect to flooding, SPP paragraph 255 promotes a precautionary approach to flood risk from all sources and states that the planning system should prevent development which would have a significant probability of being affected by flooding or would increase the probability of flooding elsewhere. Policy 264 sets out aspects to be taken account for development management, in respect of flood risk. This includes consideration of the design and use of the proposed development. Policy 266 notes that Flood Risk Assessments should be required for development in the medium to high category of flood risk (annual probability of coastal or watercourse flooding is greater than 0.5% or 1:200 years).

11.3.7 The following Planning Advice Notes, issued by the then Scottish Executive, are also relevant to the assessments made in this chapter:

- Planning Advice Note 50: Controlling the Environmental Effects of Surface Mineral Workings, 1996 (in respect of borrow pit workings);
- Planning Advice Note 61: Planning and Sustainable Urban Drainage Systems, 2001; and
- Planning Advice Note 79: Water and Drainage, 2006.

11.3.8 The Orkney Local Development Plan (Orkney Islands Council, 2017), identifies considerations relevant to onshore wind developments, as well as Nationally Designated Sites related to geology and peat (Policies 7 and 9) These include:

- Section D, Policy 7: Onshore Wind Development; and
- Section D, Policy 9: The Water Environment.

11.3.9 Full details of relevant planning policy can be found in Chapter 5.

Guidance

11.3.10 A review plan for Pollution Prevention Guidance documents (PPGs) is currently underway by Natural Resources Wales (NRW), the Northern Ireland Environment Agency (NIEA) and the Scottish Environment Protection Agency (SEPA), replacing them with a replacement guidance series: Guidance for Pollution Prevention (GPPs). GPPs provide environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales only.

11.3.11 The PPGs and GPPs include the documents referred to below, which are the principal documents used for guidance on preventing contamination of surface water from construction activities. Those relevant to this Proposed Development include:

- PPG1: General guide to the prevention of pollution (EA, SEPA & EHSNI, 2013);
- GPP2: Above ground oil storage tanks (EA, SEPA & EHSNI, January 2018);
- GPP5: Works and maintenance in or near water (EA, SEPA & EHSNI, January 2017);
- PPG6: Working at construction and demolition sites (EA, SEPA & EHSNI, 2012); and
- GPP21: Pollution incidence response planning (EA, SEPA & EHSNI, 2017).

11.3.12 The following SEPA Guidelines are also relevant:

- SEPA Supporting Guidance (SAT-SG-75) – Sector specific guidance: construction sites (SEPA, 2018);
- Temporary Construction Methods, WAT-SG-29 (SEPA, 2009);

- Flood Risk and Planning Briefing Note (SEPA, 2014);
- Position Statement: The role of SEPA in natural flood management (SEPA, Feb, 2012);
- Technical flood risk guidance for stakeholders, version 12 (SEPA, May 2019);
- Land Use Planning System Guidance Note 4 (LUPS GU4) - Planning guidance on on-shore windfarm developments (SEPA, September 2017);
- Land Use Planning System Guidance Note 31 (LUPS-GU31) - Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (SEPA, October 2014);
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended in 2018 - A practical guide (SEPA, 2011 as amended in 2019);
- River Crossings, Engineering in the water environment: good practice guide (SEPA,2010);
- Development of a groundwater vulnerability screening methodology for the Water Framework Directive, Project WFD28 Final Report (SEPA 2004); and
- The River Basin Planning Strategy for the Scotland River Basin District (SEPA, 2009/2015).

11.3.13 Other relevant guidance includes:

- Control of water pollution from constructions sites. Guidance for consultants and contractors C532 (CIRIA, 2001);
- Environmental good practice on site C650 (CIRIA, 2010);
- Good practice during windfarm construction (Scottish Renewables, SNH, SEPA & Forestry Commission Scotland, 4th Edition 2019);
- Code of Practice for the sustainable use of soils on construction sites (DEFRA, 2011);
- Private Water Supplies: Technical Manual, Scottish Executive, 2006;
- Special Requirements for Civil Engineering Contracts for the Prevention of Pollution, Version 2, (SEPA, 2006);
- UK Technical Advisory Group on the WFD, UK Environmental Standards and Conditions Final Report, November 2013.
- Guidance on Developments on Peatland - Site Surveys (Scottish Natural Heritage, SEPA and The James Hutton Institute, 2017);
- Developments on Peatland: Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste (Scottish Renewables and SEPA, 2012);
- Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition) (Scottish Government, 2017); and
- Developments on Peat and Off-Site Uses of Waste Peat (SEPA, 2017).

11.4 Consultation

11.4.1 The following consultation responses were received during the Scoping process for the Proposed Development.

Table 11.1 – Consultations in Relation to Geology, Hydrology and Hydrogeology

Consultee	Consultation Response	Key Actions
SEPA	SEPA advises that the following key issues need to be addressed in the EIA process.	
	a) 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.	A site layout plan, including buffer zones around watercourses, has been generated (refer to Figure 11.1). Flood risk within the site area is considered as stated in section 11.6.
	b) Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems and buffers.	A map showing identified areas of potential GWDTE is provided as Figure 11.5. Figure 11.6 shows buffers around areas assessed as likely to actually be groundwater fed rather than surface- or rainwater-fed. The potential occurrence and distribution of GWDTE is discussed in Section 11.6, and likely effects on groundwater are assessed as set out in Sections 11.9 and 11.11.
	c) Map and assessment of impacts upon groundwater abstractions and buffers.	There are no groundwater abstractions (Private Water Supplies) within 250 m of the Proposed Development.
	d) Peat depth survey and table detailing re-use proposals.	Peat surveys have been conducted and findings have been used to derive outline peat management and re-use proposals, set out in Appendix 11.2.
	e) Map and site layout of borrow pits.	A proposed borrow pit search area is located in the northeast of the site, as shown on Figures 11.1 to 11.5.
	f) Schedule of mitigation including pollution prevention measures.	Chapter 17 of the EIA Report provides a schedule of all committed mitigation measures. A Construction Environmental Management Plan (CEMP) will be developed, outlining pollution prevention measures (an outline CEMP can be found in Appendix 3.1).
	g) Borrow Pit Site Management Plan of pollution prevention measures.	A single borrow pit search area is shown on Figures 11.1 to 11.5. The search area

Consultee	Consultation Response	Key Actions
		and proposed borrow workings are described in Chapter 3. An outline CEMP, including borrow pit management measures, is included as Appendix 3.1. If the proposed Development is granted consent, a Borrow Pit Management Plan will be produced, including additional details to be agreed prior to commencement of construction.
	h) Map of proposed surface water drainage layout (finalised site proposals and construction phase), details of foul drainage measures for welfare facilities.	Outline drainage arrangements are discussed in Chapter 3 and Section 11.8 and would be developed further as part of a detailed Drainage Strategy to be agreed prior to commencement of construction.
	i) Map of proposed water abstractions including details of the proposed operating regime.	There is no intention to abstract groundwater or surface water from the Proposed Development site. Should water abstraction be determined as a requirement, this would be regulated under the CAR licensing regime and any necessary licence would be sought from SEPA prior to the commencement of any operations on site.
	Decommissioning statement	The Applicant is seeking in-perpetuity consent for the Proposed Development. In the event of decommissioning, or replacement of turbines, it is anticipated that the levels of effect would be similar but of a lesser level than those during construction. Decommissioning would be undertaken in line with best practice processes and methods at that time and will be managed through an agreed Decommissioning Environmental Management Plan
	Site Specific Requirements	
	An outline Peat Management Plan will be included within the EIA Report.	An outline Peat Management Plan has been prepared and is presented as Appendix 11.2.

Consultee	Consultation Response	Key Actions
	Identification of all of the properties in proximity regardless of whether they are within/outwith the site boundary and confirm if they have a private or public water supplies. Where they have a private water supply the location of the source of this should be identified.	There are no groundwater abstractions (Private Water Supplies) within 250 m of the Proposed Development.
	Minimum buffers of 50m around each loch or watercourse	A 50m buffer has been applied to all watercourses within the site area.
SNH	SNH notes that assessment of any indirect impacts on qualifying habitats of the Hoy Special Area of Conservation (SAC), due to disruption of hydrological processes within the site, is required.	Consideration of potential impacts on the SAC is set out in Paragraphs 11.6.7 to 11.6.9.
Marine Scotland	Marine Scotland advises that potential impacts on water quality should be considered, and that water quality monitoring should be carried out within and downstream of the development area.	An assessment of likely effects on surface water quality is provided in Section 11.9, with mitigation discussed in Section 11.8 (standard/ embedded mitigation) and Section 11.10 (additional mitigation measures). Standard mitigation measures include for monitoring of surface water quality upstream and downstream of site works, prior to and during construction.
Orkney Islands Council (OIC)	OIC notes that assessment of effects of the development on local watercourses is required, with appropriate pollution and sediment control and monitoring strategies advised.	
	OIC advises that peat survey work should be undertaken to inform a strategic approach to peat across the site, with the aim of minimising disturbance and/or loss of peat.	Peat survey work is discussed in Section 11.5. Likely effects on peat are discussed in Section 11.9, with mitigation discussed in Section 11.8 (standard/ embedded mitigation) and Section 11.10 (additional mitigation measures). Mitigation measures include design iteration to minimise the requirement for peat excavation, and implementation of a Peat Management Plan.
RSPB	RSPB recommends undertaking a carbon calculation in line with current best practice, to determine the	A calculation of carbon payback, taking account of disturbance to peat deposits,

Consultee	Consultation Response	Key Actions
	'carbon payback period' of the development.	has been undertaken and is summarised in Chapter 16.

11.5 Assessment Methodology and Significance Criteria

11.5.1 The following section sets out the approach that was followed to collect relevant baseline information and the methodology for assessing impacts and the significance of effects.

Study Area

11.5.2 The study area has largely incorporated the area within the site boundary but has also included consideration of hydrological effects up to 1 km away from the site. Any Private Water Supplies within 1 km of the site have been considered.

11.5.3 The criteria for defining the study area with regard to hydrological resources have been established based on professional judgement and experience with regard to likely access and working areas, reference to SEPA guidance, and with due consideration to other relevant guidance on hydrological assessment.

Desk Study

11.5.4 Baseline conditions have been established primarily via desk-based research and has included the following:

- consultation with relevant regulatory authorities as described in Table 11.1 above;
- identification of the locations and characteristics of catchments and principal watercourses and waterbodies as shown on 1:50,000 scale OS mapping which may be affected by construction activities;
- identification of SEPA/WFD watercourse and waterbody classifications;
- review of online SEPA flood mapping;
- review and collation of pertinent information on surface hydrology, flooding, climate etc.;
- review of geological mapping of the area, British Geological Survey, Geology of Britain Viewer, 1:50,000 scale;
- review of hydrogeological characteristics and groundwater resource; and
- review of Private Water Supply records held by the Drinking Water Quality Regulator for Scotland (DWQR) and Orkney Islands Council.

Site Visit

11.5.5 The findings of the desk study have been supported by a site reconnaissance survey of surface watercourses and ground conditions which was undertaken on the 4th of September 2019. This included a visual inspection of watercourses where works are likely to occur within or in the close vicinity of the Proposed Development, visual assessment of gradients and drainage pathways across the site and an inspection of the ground conditions.

11.5.6 Habitat and botanical surveys were undertaken from the 16th to the 21st of November 2019, providing information relevant to the identification of habitats which could represent groundwater dependent terrestrial ecosystems (GWDTE).

Peat Depth Surveys

11.5.7 Based on a desk study review of published geological mapping and an earlier site visit during site feasibility work, the presence of peat had been identified across at least parts of the Proposed

Development site. A programme of peat depth survey work was therefore devised, in line with Guidance on Developments on Peatland - Site Surveys (Scottish Natural Heritage, SEPA and The James Hutton Institute, 2017).

11.5.8 Stage 1 peat depth probing was undertaken by a team of suitably qualified and experience surveyors, on 29th and 30th October 2019. The surveys aimed to provide a 100 m spaced grid, as per the above-noted guidance. This was achieved across the full area of the site which had previously been identified as "developable", i.e. other constraints prohibitive to development were not known to be present.

11.5.9 Data obtained from the peat depth surveys were used to plot the presence and distribution of peat across the proposed infrastructure development areas at the site, create a contour plan, and feed into detailed design iteration.

11.5.10 Following extensive design iteration work (refer to Chapter 2 of the EIA Report), a 'design chill' was agreed, considered by the project team to represent the best possible turbine and infrastructure layout to optimise yield whilst minimising environmental effects, including effects on geology, hydrology, hydrogeology and soils resources. It should be noted that the Stage 1 survey identified relatively shallow peat across much of the site, and taking account of the extent of other technical and environmental constraints guiding layout and design decisions, those other constraints have largely over-ridden potential impacts associated with encountering localised pockets of deeper peat. However, Stage 2 peat surveys were required to confirm and expand on Stage 1 findings, and refine the assessment of peat slide risk, and estimates of the volume of peat requiring excavation to build the development.

11.5.11 A Stage 2 peat depth probing exercise was undertaken on 13th to 15th July 2020, to record peat depth at each proposed turbine and hardstanding location, along the route of proposed access tracks, and at proposed infrastructure locations including the temporary construction compound, substation compound, permanent met mast, and borrow pit search area. Further information is provided in Appendix 11.1.

11.5.12 Data obtained from the peat depth surveys were used to inform a Peat Slide Risk Assessment (PSRA) and development of an outline Peat Management Plan (PMP); refer to Appendices 11.1 and 11.2. As set out in Section 11.8, the Applicant has committed to detailed pre-construction site investigation works to further inform appropriate micro-siting and/or other geotechnical or engineering controls that may be considered necessary during construction.

Significance Criteria

11.5.13 The characterisation of geological, hydrological and hydrogeological sensitivities has been guided by the matrix presented in Table 11.2 which lists the characterisation criteria.

Table 11.2 – Geological, Hydrological and Hydrogeological Sensitivity

Sensitivity	Description
High	Areas containing geological, geomorphological or hydrological features considered to be of international or national interest, for example Aquatic Natura 2000 sites, SACs, SSSIs. Highly permeable superficial deposits allowing free transport of contaminants to groundwater and surrounding surface waters. Wetland/watercourse of High or Good Ecological Potential. Raised or blanket bog. High risk of flooding.
Medium	Areas containing features of designated regional importance, for example Regionally Important Geological and Geomorphological Sites (RIGS), considered

Sensitivity	Description
	worthy of protection for their educational, research, historic or aesthetic importance. Moderately permeable superficial deposits allowing some limited transport of contaminants to groundwater and surrounding surface waters. Wetland/watercourse of Moderate Ecological Potential. Significant peat deposits. Moderate risk of flooding.
Low	Geological features not currently protected and not considered worthy of protection. Low permeability superficial deposits likely to inhibit the transport of contaminants. Wetland/watercourse of Poor or Bad Ecological Potential or no WFD classification. Thin superficial peat deposits. Low risk of flooding.

11.5.26 The criteria for sensitivity have been developed based on a hierarchy of factors relating to quality of the aquatic and geological environment including international and national designations, water and soil quality information, watercourse status from the WFD review work undertaken to date by SEPA, consultations, site reconnaissance and the professional judgement of the assessment team.

11.5.27 The prediction and assessment of effects on hydrology, hydrogeology and geology has been undertaken using a series of tables to document the various potential impacts from aspects of the construction works and operations. Effects have been predicted for the Proposed Development based on the guideline criteria for impact magnitudes set out in Table 11.3.

Table 11.3 – Impact Magnitude

Impact Magnitude	Guideline Criteria
High	Total loss of, or alteration to, key features of the baseline resource such that post development characteristics or quality would be fundamentally and irreversibly changed e.g. extensive excavation of peatland or watercourse realignment.
Medium	Loss of, or alteration to, key features of the baseline resource such that post development characteristics or quality would be partially changed e.g. instream permanent bridge supports or partial excavation of peatland.
Low	Small changes to the baseline resource, which are detectable, but the underlying characteristics or quality of the baseline situation would be similar to pre-development conditions e.g. culverting of very small watercourses/drains.
Negligible	A very slight change from baseline conditions, which is barely distinguishable, and approximates to the 'no-change' situation e.g. short-term compaction from machinery movements.

11.5.28 The significance of the predicted effects has been assessed in relation to the sensitivities of the baseline resource and magnitude of predicted impacts. A matrix of significance was developed to provide a consistent framework for evaluation and is presented in Table 11.4. Guideline criteria for the various categories of effect are included in Table 11.5.

Table 11.4 - Effect Significance Matrix

	Sensitivity			
Magnitude	**High**	**Moderate**	**Low**	**Not Sensitive**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

Table 11.5 - Effect Significance Categories

Significance	**Definition**	**Guideline Criteria**
Major	A fundamental change to the environment.	Changes in water quality or quantity affecting widespread catchments or groundwater reserves of strategic significance, or changes resulting in substantial loss of conservation value to geological or aquatic habitats and designations.
Moderate	A larger, but non-fundamental change to the environment.	Changes in water quality or quantity affecting part of a catchment or groundwaters of moderate vulnerability, or changes resulting in loss of conservation value to geological or aquatic habitats or designated areas.
Minor	A small but detectable change to the environment.	Localised changes resulting in minor and reversible effects on soils, surface and groundwater quality or habitats.
Negligible	No detectable change to the environment.	No effects on geological resources, drainage patterns, surface and groundwater quality or aquatic habitat.

11.5.29 In the above classification, fundamental changes are those which are permanent, either adverse or beneficial, and would result in widespread change to the baseline environment. For the purposes of this assessment, those effects identified as being major or moderate have been evaluated as significant environmental effects.

11.5.30 These matrices have been used to guide the assessment, although they have been applied with a degree of flexibility, since the evaluation of effects will always be subject to location-specific

characteristics which must be taken into account. For this reason, the evaluation of the significance of effects in particular will not always correlate exactly with the cells in the relevant matrix, especially where professional judgement and knowledge of local conditions may result in a slightly different interpretation of the impact concerned. Additionally, effects may be assessed as having a significance level between those noted above, i.e. Minor to Moderate, or Moderate to Major.

11.5.31 Cumulative effects have been accounted for through the prediction and evaluation of effects cumulatively with those which could arise as a result of the construction and operation of other developments (operational, consented or in planning) within the study area.

Requirements for Mitigation

11.5.32 Proposed mitigation measures are presented within this chapter (Sections 11.8 and 11.10) where the potential to affect sensitive geological, hydrological or hydrogeological receptors has been predicted. These may include temporary effects from construction or permanent/longer-term effects associated with the operational phase of the Proposed Development and its associated infrastructure.

Assessment of Residual Effect Significance

11.5.33 An assessment of any predicted significant residual effects on sensitive geological, hydrological or hydrogeological receptors, taking account of committed mitigation measures, is presented within this chapter (Section 11.11).

Limitations to Assessment

11.5.34 No water quality monitoring has been undertaken, although this is not considered warranted at this stage and would not materially affect the impact assessment.

11.6 Baseline Conditions

Geography, Topography and Geomorphology

11.6.1 The Proposed Development site lies approximately 1.3 km west of the village of Lyness on the island of Hoy and comprises moorland with coastal pastures in the east and south. The site lies within a sloping landscape area with a ridge running its full northern extent at an elevation of approximately 180 m Above Ordnance Datum (AOD). The site drops to elevations of approximately 30 m AOD within the valley towards the Burn of Ore (which forms the southern boundary of the western site area) and rises again to the south to approximately 100 m AOD.

11.6.2 The landform across the site comprises slopes of variable steepness, particularly steep near the hilltops at and beyond the northern site boundary, and at Binga Fea to the south of the site. Ground slopes trend mainly to the south and to the east within the site. Slopes become gentler towards the Burn of Ore valley, particularly on the north side of the watercourse.

11.6.3 The Proposed Development is mainly located on the slopes of Wee Fea, which also trend to the south and to the east. Turbine T1 is located on eastern trending slopes, T2 on south-eastern trending slopes and T3 – T6 on southern facing slopes.

11.6.4 Photographs 1 to 4 provide an overview of the moorland character and sloping topography of the site.

Photograph 1: Moorland character of the site

Photograph 2: Looking west/southwest across the site

Photograph 4: Looking south across the site

Photograph 4: Looking east/northeast across the site

Land Use, Historical Developments and Man-Made Features

11.6.5 The predominant land use of the area is low quality rough grazing. During site survey work, evidence of peat cutting was observed in the north-central site area (see Photograph 5). It is unknown how recently or how extensively peat has been cut across the site, although aerial photography demonstrates evidence of cutting in the northern site area in particular.

Photograph 5: Evidence of recent peat cutting in the northern site area

11.6.6 The remnants of numerous historical wartime features are evident on site, including bunkers/lookouts, and a large underground oil storage tank system.

Designated Sites

11.6.7 The Hoy Special Area of Conservation (SAC) is adjacent to the western part of the site boundary. The SAC is designated for its blanket bog and heath habitats, natural dystrophic lakes and ponds, and vegetated sea cliffs. This site is approximately 190 m from any Proposed Development infrastructure at its nearest point (to the north), but in this area it is within a different catchment and is considered to not be in hydrological continuity with the Proposed Development site. The area in which proposed infrastructure is sited is within the Burn of Ore catchment, draining to the south. The SAC is separated from the northern part of the Proposed Development by an elevated ridge and is within the Burn of Bailiefea/ Burn of Moifea/ Mill Burn catchment.

11.6.8 Part of the SAC is south of proposed T4 and is within the Burn of Ore catchment. However, this area of the SAC is some 270 m from any proposed infrastructure, and beyond the Burn of Ore itself.

11.6.9 It is therefore considered that the Proposed Development is not within a zone of hydrological influence on the Hoy SAC.

11.6.10 The Hoy Site of Special Scientific Interest (SSSI) contours the western boundary of the site. This site exhibits preserved non-marine Devonian geology as well as well-preserved coastal geomorphology. The SSSI boundary is 190 m from any proposed infrastructure and approximately 285 m from the nearest proposed turbine (T4). Given that the designated features would only realistically be sensitive to direct impact, for example excavation, and taking account of the distance to any proposed construction works, this designation is not considered to be a sensitive receptor in the context of the Proposed Development.

Surface Water

11.6.11 The Proposed Development site contains a number of streams and burns (refer to Figure 11.1).

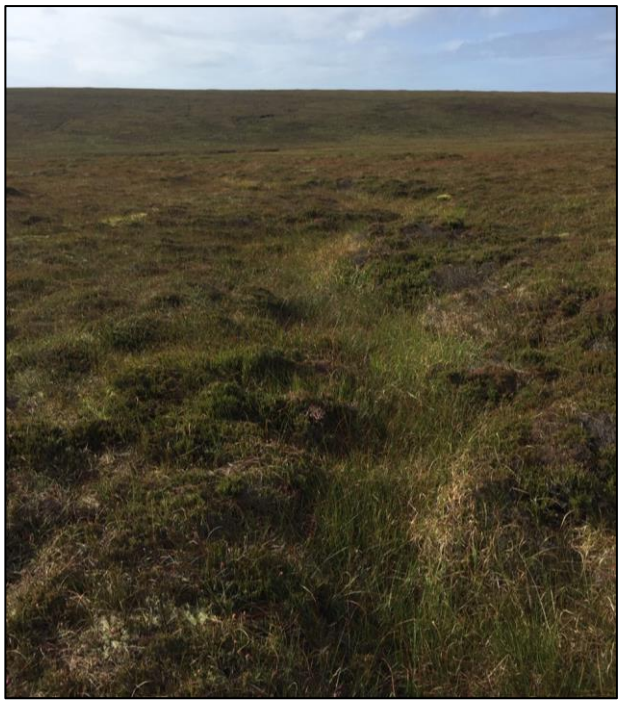
11.6.12 The Burn of Ore is the largest watercourse on the site. It rises in the sloping ground towards the western edge of site, on the southern site boundary. From there, it flows eastward, forming the southern boundary of the western part of the site and then cutting through the south-eastern area of the site. It continues off-site to the east, discharging into Ore Bay on the east coast of Hoy, approximately 850 m east of the site boundary.

11.6.13 Three small burns flow from north to south across the central and western part of the site, into the Burn of Ore. The westernmost and central burns are unnamed, and the easternmost is the Burn of Longigill. These all rise on the southward facing slopes of the site, interpreted as being derived from moorland surface runoff, and therefore rainwater fed.

11.6.14 The watercourses on site feature gently sloping banks overgrown with vegetation and not deeply incised, as illustrated in the photographs below. Standing water/ small pools were observed on the flat ground within the valley adjacent to the Burn of Ore (see Photographs 6 to 8).

11.6.15 Localised small pools are also present adjacent to the existing track in the east of the site, near the proposed track leading to T2. Ecological surveys identified dragonfly/damselfly species of conservation interest at these pools (refer to Chapter 8). Therefore, while the hydrological sensitivity of the pools is not inherently elevated, the importance of the pools as habitat for these species is recognised.

Photograph 6: Unnamed minor watercourse, barely discernible given flat banks and overgrown vegetation



Photograph 7: Western-most unnamed minor watercourse, again barely discernible

Photograph 8: Pools and standing water along the flat banks of the Burn of Ore

11.6.16 In the northern part of the study area, the Burn of Moifea rises in the high ground north of the central part of the site boundary, and flows initially to the southeast, turning east and then northeast to meet the Mill Burn and discharge into Mill Bay approximately 850 m north-northeast of the site boundary.

11.6.17 Other watercourses within the study area, but outside the site boundary, include minor field drains and tributaries around Lyness and Ore Farm, discharging either into the Ore Burn or directly to the sea.

11.6.18 There are also a number of small lochans immediately to the north of the central and western part of the site boundary. These are generally on quite high ground and do not appear to have direct connectivity to watercourses, and are therefore interpreted as being rainwater fed.

11.6.19 Virtually the entire site area where any infrastructure is proposed is within the Burn of Ore catchment, with the land draining to the south and east. The only proposed infrastructure which is not considered to be within the Burn of Ore catchment is the proposed substation and the short stretch of track (existing but requiring upgrade) to the east of the substation. This localised area is expected to drain to the northeast, into the confluence of the Burn of Moifea and Mill Burn.

11.6.20 All site drainage is ultimately to the sea on the east coast of Hoy.

11.6.21 The Mill Burn in the north of the study area has a SEPA classification of Good overall (2014), with both physical condition and water quality classified as Good. No update subsequent to 2018 is shown on the SEPA website.

11.6.22 None of the other surface watercourses within the study area, including the Burn of Ore, are classified by SEPA under the WFD.

11.6.23 The coastal water body at the Bay of Ore (Scapa Flow) is classified by SEPA as having an overall condition of Good (2014), therefore, it can be assumed that the Burn of Ore and its tributaries also exhibit good quality.

11.6.24 There will be one watercourse crossing over the burn of Longigill, located at Grid Reference ND 28112, 93792 (between T3 and T4), shown on Figure 11.1. The watercourse is narrow and exhibits a low flow at this location, and its banks are relatively flat.

11.6.25 Based on the occurrence of surface watercourses in the study area and taking account of the small scale of the site in the context of the 263.3 km^2 coastal water body, the sensitivity of hydrological resources is considered to be **medium**.

Flood risk

11.6.26 The online SEPA Indicative River & Coastal Flood Map illustrating the areas where there is a 0.5 % or greater probability of being flooded in any given year, i.e. the 1:200-year flooding event, in the vicinity of the site has been reviewed.

11.6.27 This map indicates that the only areas of fluvial flood risk (flooding from rivers) are directly adjacent to the Burn of Ore. Even this area is limited to the immediate banks of the burn, with no extensive flood plain indicated. The Burn of Longigill and the two unnamed burns to the west do not exhibit areas of fluvial flood risk.

11.6.28 This map indicates that there is no identified risk of surface water flooding on site.

11.6.29 With the only flood risk being associated directly adjacent to the Burn of Ore within the site, remote from any proposed infrastructure, the risk of flooding on the Proposed Development site, and the sensitivity of the site to flooding, is considered to be **low.**

Geology

Geological and Soils Mapping

11.6.30 Based on BGS digital mapping, the bedrock geology underlying the site comprises Upper Old Red Sandstone, specifically made up of the following formations, from west to east across the site:

- Trowie Glen Sandstone Member - western and north-central site area;
- Hoy Standstone Formation – central and eastern site areas, where essentially all proposed infrastructure is sited;
- Haist Pebbly Sandstone Member – north of the eastern part of the site and extending beneath a short stretch of the northern site access;
- Lower Eday Sandstone Formation – southeast site area, west-southwest of Ore Farm; and
- Upper Stromness Flagstone Formation – eastern stretches of the site access.

11.6.31 Bedrock geology is shown on Figure 11.2.

11.6.32 BGS digital mapping indicates that the site is predominantly covered in peat. BGS mapping shows peat to be absent from the northeast corner of the site, at the site access and T1, and at T6, where there is indicated to be little or no superficial deposits overlying bedrock. However, further detail on the distribution of peat deposits at the site has been obtained by site survey, described in the section below.

11.6.33 BGS mapping shows the presence of till overlying bedrock in the far east of the site, specifically along the access. Alluvial deposits are shown to be present along the banks of the Burn of Ore in the south of the site, only in the eastern site area.

11.6.34 In respect of the soil resource across the site, it is noted that soils across most of the site are dystrophic (acidic and low in oxygen) blanket peat. The far eastern parts of the site (the access) are indicated to have soils comprising noncalcareous gleys.

11.6.35 Superficial geology is shown on Figure 11.3.

Peat

11.6.36 The site area is mostly contained within areas of Class 1 Peat, based on the SNH *Carbon and Peatlands Map* (2016). This is defined as "*nationally important carbon-rich soils, deep peat and priority peatland habitat; areas likely to be of high conservation value*." Two isolated areas of Class 5 Peat are present within the site area, defined as areas with carbon-rich soil and deep peat but vegetation cover not indicating peatland habitat. These areas are located directly to the east of the Burn of Longigill and the north of the Burn of Ore, and at the source of the Burn of Longigill, stretching northwards to the site boundary.

11.6.37 Peat surveys were undertaken as described in section 11.5, to identify the extent, depth and nature of peat across the site, and to specifically target proposed turbine and infrastructure locations. Peat depths were recorded varying from nil to over 3m.

11.6.38 The locations and findings of the peat probes are illustrated on Figure 11.4.

11.6.39 The Guidance on Developments on Peatland - Site Surveys (Scottish Government, SNH and SEPA 2017) uses the definition of peat, deep peat and organo-mineral (peaty) soils which is presented in the Joint Nature Conservation Committee (JNCC) report 445 *Towards an Assessment of the State of UK Peatlands* (2011). This definition, which has been used within this chapter, is summarised below:

- **Peaty (or organo-mineral) soil:** a soil with a surface organic layer less than 0.5 m deep;
- **Peat:** a soil with a surface organic layer greater than 0.5 m deep which has an organic matter content of more than 60 %;
- **Deep peat:** a peat soil with a surface organic layer greater than 1.0 m deep.

11.6.40 Of 772 probes during all peat depth surveys, the peat depth was zero at 76 probes (9.8 %) and less than 0.5 m at 300 probes (38.9 %), the latter defined as peaty or organo-mineral soil. At 233 probes (30.2 %), peat depth between 0.5 m and 1.0 m was recorded, and at the remainder of the probes (163, or 21.1%), the peat depth was recorded to be equal to or greater than 1.0 m, defined as deep peat. The occurrence of deep peat is mainly located to the south of the site, the largest area being located in the southwest part of the site, with additional areas of deep peat in the southeast and northwest, and localised pockets in the central area. Each of these areas exhibit peat depths of generally 1 m to 2 m depth, but with four discrete probe points recording peat over 3 m deep. A map of all probing locations and associated peat depths are presented in Figure 11.4.

11.6.41 Full details of the peat depth survey, risk assessment and peat management proposals are provided in Appendix 11.1: Peat Slide Risk Assessment and Appendix 11.2: Outline Peat Management Plan.

11.6.42 It is also noted that evidence of recent and older peat cutting was identified in parts of the site. Historical wartime structures across various locations on the site will also have resulted in disturbance to and localised excavation of peat.

Summary of Geological Sensitivity

11.6.43 Overall, the sensitivity of the baseline geological resources at this site are considered to be **medium**, based on the presence of significant, though partly disturbed/excavated peat deposits.

Hydrogeology

Hydrogeology Mapping

11.6.44 The groundwater body at this location is the Hoy Groundwater, classified by SEPA as having an overall status of Good (2014), with both water quality and water flows and levels classified as Good.

11.6.45 The Hydrogeology Map of Scotland identifies the site as being underlain by Upper Old Red Sandstone, a moderately productive aquifer in which flow is virtually all through fractures and other discontinuities. Mapping notes that this is a "*regionally important multi-layered aquifer with moderate yields of up to 5 L/s …*".

11.6.46 Peat and peaty soils would be expected to contain perched groundwater, but would also be expected to inhibit groundwater flow. Till, where present, is also anticipated to be relatively low permeability, inhibiting groundwater flow. The alluvial deposits on the banks of the Burn of Ore may exhibit higher permeability.

Private Water Supplies

11.6.47 There are no Private Water Supplies (PWS) identified within a 1 km radius of the site boundary, based on a review of the Drinking Water Quality Regulator (DWQR) for Scotland database (DWQR, 2019). The DWQR data has been supplemented by a review of information provided by OIC on known private water supplies across Orkney and a review of OS mapping to identify any wells or springs marked at or near properties in the close vicinity of the site. None have been identified.

Groundwater Dependent Terrestrial Ecosystems (GWTDEs)

11.6.48 Habitats indicative of GWDTE were identified during NVC survey work (see Figure 11.5 for a summary of potential GWDTE within the site area and see Chapter 8: Ecology and Biodiversity and Figures 8.2 and 8.4 for further detail).

11.6.49 Within the site, habitats indicative of potentially high groundwater dependency were identified at five localised areas, shown on Figure 11.5 and each discussed in turn below.

- Area A – Rush pasture on the north side of the existing track leading onto the northeast part of the site, west of the war memorial (approximate grid reference 329900, 994325). This habitat occurs at the edge of a track which itself is on the edge of a localised wooded area. Apart from a small pond, there are no surface watercourses or features which would suggest this habitat is surface water fed. It is considered that there is potential for there to be a fissure or discontinuity in bedrock at this location, with groundwater at or near the surface.
- Area B – Wet heath with a small (10%) proportion of mire, on the west and south verges of the existing track at the viewpoint in the northeast of the site, near the proposed temporary construction compound (approximate grid reference 329340, 994415). This habitat occurs along a man-made drainage conduit (the track) and is interpreted as being fed by surface water runoff shedding from the hillside above and collecting at/ flowing along the course of the track. This is therefore considered to not be groundwater dependent.
- Area C – Rush pasture, slightly further southwest from the above, along the existing track between proposed T1 and T2 (approximate grid reference 329045, 994115). Similarly to Area B, this habitat occurs along a man-made drainage conduit (the track) and is interpreted as being fed by surface water runoff shedding from the hillside above and collecting at/ flowing along the course of the track. This is therefore considered to not be groundwater dependent.
- Area D – Rush pasture, on the south side of the Burn of Ore, south of proposed T3 (approximate grid reference 328485, 993250). This habitat occurs within a localised area adjacent to the burn and extending slightly upslope. It is considered that there is potential for there to be a fissure or discontinuity in bedrock at this location, with groundwater at or near the surface.
- Area E – Mire, between the two unnamed north-south flowing watercourses in the western site area (approximate grid reference 326820, 993985). It is considered that there is potential for there to be a fissure or discontinuity in bedrock at this location, with groundwater at or near the surface.

11.6.50 Therefore, of the above five localised areas exhibiting habitats potentially indicative of high groundwater dependence, it is considered that Areas A, D and E may be groundwater dependent, whereas Areas B and C are not. Figure 11.6 shows Areas A, D and E with 100 m and 250 m buffers. It can be seen that the only Proposed Development infrastructure within those buffers is the existing site access track.

11.6.51 Additionally, much of the site area was identified as supporting habitats indicative of potentially moderate groundwater dependency, largely comprising wet heath and mire communities. The distribution of these habitats is mainly on the sloping ground as it approaches the Burn of Ore valley, with the highest ground tending not to exhibit these habitats.

11.6.52 It should be noted that across substantial areas of the site, the NVC survey recorded mosaic habitat with only a proportion being defined as habitat which may represent moderate groundwater dependency. For example, much of the southeast hillside, down-gradient from proposed T1 is mapped as 65% M17b NVC community (blanket mire) and 35% M15c (wet heath). Other areas in the vicinity are mapped as a similar combination of these two communities, with differing proportions. The M15 NVC community is identified in SEPA guidance as being potentially indicative of moderate groundwater dependency, but the M17 NVC community is not.

11.6.53 As noted above, bedrock across the site comprises a moderately productive aquifer, in which flow is largely in fissures and other discontinuities. There is therefore potential for groundwater to be present near the surface in some areas and to be feeding at least some of the above-noted habitats. However, given that groundwater flow is expected to be largely via fissures, if groundwater was the main source of water to these habitats, it is expected that they would be more localised, in the vicinity of fissures or discontinuities at rockhead. The distribution of wet heath and more habitats across much of the site area, particularly on hillsides, suggests that these habitats are fed at least in part by rainwater/surface runoff shedding from the higher ground.

11.6.54 It is therefore considered that the presence of moderate GWDTE cannot be ruled out, but the observed wet heath habitats at the site are unlikely to be entirely fed by groundwater.

Summary of Hydrogeological Sensitivity

11.6.55 Given the moderately productive bedrock aquifer beneath the site, and the presence of potentially moderate GWDTE, but taking account of the absence of private water supplies within and close to the site, the sensitivity of groundwater as a receptor is assessed as **medium**.

11.7 Receptors Brought Forwards for Assessment

11.7.1 The following receptors have been taken forward for assessment:

- hydrogeology (groundwater), encompassing GWDTEs;
- surface water; and
- superficial geology, namely peat.

11.7.2 The following receptors and topics have been scoped out of further assessment:

- designated sites;
- bedrock geology; and
- flood risk.

11.8 Standard Mitigation

Project Design

11.8.1 A summary of the geological, hydrological and hydrogeological influences on the project layout are given below with full details of the project design provided in Chapter 2. Due to the nature of the environment occupied by the Proposed Development, it is imperative that the design of the infrastructure helps to maintain or even improve the local hydrology. Poor design of wind farm infrastructure can result in significant implications for the hydrological environment.

Watercourses and Surface Water Drainage

11.8.2 A 50 m buffer was implemented for all watercourses located on site and shown in Figure 11.1. All infrastructure has been designed to be located outwith the watercourses buffer, except at a single required watercourse crossing.

11.8.3 There will be one watercourse crossing over the burn of Longigill, located at Grid Reference ND 28112, 93792 (between T3 and T4). The watercourse is narrow and exhibits a low flow at this location, and its banks are relatively flat. It is anticipated that the crossing can be achieved via a piped culvert, suitably sized to convey greenfield flow conditions. The culvert will be designed in accordance with SEPA Good Practice Guidance (2010).

Peat

11.8.4 The findings from the desk study work, site reconnaissance, and peat depth surveys were carefully considered in the site design iteration process. The locations where deepest peat was recorded have been avoided. It has not been possible to entirely avoid areas of deep peat (>1 m depth) given its distribution across the site and the presence of numerous other constraints. However, siting of

infrastructure on deep peat has been avoided or minimised as far as practically possible, based on the survey findings.

11.8.5 Preliminary assessment of potential peat slide risk was also undertaken during the design iteration process, seeking to minimise the risk.

Construction

Construction Environmental Management Plan

11.8.6 With specific reference to the SEPA 'Guidelines for Water Pollution Prevention from Civil Engineering Contracts' and 'Special Requirements', the contractor will produce a CEMP which contains a construction method statement that includes:

- a detailed breakdown of the phasing of construction activities;
- a pollution risk assessment of the site and the proposed activities;
- identification of all Controlled Waters that may be affected by the works and temporary discharge points to these drainage ditches and the marine environment;
- planning and design of dewatering activities to minimise the local drawdown of perched groundwater in peatland habitat, and maintain the hydrology of identified sensitive habitats;
- planning and design of appropriate pollution control measures during earthworks and construction;
- management of the pollution control system, including dewatering of excavations away from drainage ditches and the marine environment;
- contingency planning and emergency procedures; and
- on-going monitoring of construction procedures to ensure management of risk is maintained.

11.8.7 While it is acknowledged that best practice to minimise run-off would be to undertake construction and dismantling during the driest period of the year, given the location of the Proposed Development on Orkney, there are likely to be significant periods of rainfall throughout the year. Therefore, site management will check the local weather forecast daily and prime all site staff to ensure that everyone is aware of their responsibilities to maintain the pollution control system during wet weather.

Pre-Construction Site Investigations

11.8.8 Detailed pre-construction site investigations would be conducted, focusing on areas where construction is proposed to be undertaken to inform suitable micro-siting of the turbines and associated infrastructure.

11.8.9 Targeted monitoring and assessment of the groundwater levels and flows beneath the site would also be carried out to inform micro-siting and to assist in the detailed design of infrastructure, the selection of appropriate materials for use during the construction process, and the requirement for any additional measures required to ensure protection of groundwater during construction. This will help to clarify whether identified areas of potential GWDTE are in fact groundwater fed and if any micro-siting or additional protective measures are required to minimise impacts to groundwater quality and flow in these areas.

11.8.10 Pre-construction baseline water quality sampling and analysis would be undertaken at the Burn of Ore and Burn of Longigill. A programme of regular monitoring and analysis of the water quality of the watercourses would be implemented throughout the construction period.

Control of Pollution from Chemical Contaminated Runoff

11.8.11 All fuel and other chemicals will be stored in accordance with best practice procedures, including in a designated fuelling site located at a safe distance from watercourses and any identified areas of ecological sensitivity (e.g. the small pools observed near the proposed track to T2), in appropriate

impermeable bunded containers/areas which will be defined within the CEMP. These will be designed to capture any leakage, whether from a tank or from associated equipment such as filling and off-take points, sighting gauges etc., all of which will be located within the bund.

11.8.12 Oil booms and soakage pads will be maintained in all work areas and spill kits kept in all vehicles to enable a rapid and effective response to any accidental spillage or discharge. All construction staff will be trained in the effective use of this equipment.

11.8.13 Construction vehicles and plant will be regularly maintained and all maintenance, fuelling and vehicle washing will be undertaken on appropriate impermeable surfaces away from watercourses in order to minimise risks of leaks to soil and surface waters.

11.8.14 The contractor will develop a method statement to address the transport, transfer, handling and pouring of liquid concrete at foundations.

11.8.15 Cement, grout and unset concrete will not be allowed to enter the water environment. No operations involving concrete transfer between vehicles or into vehicles will take place within 50 m of watercourses.

11.8.16 All vehicles used for delivery of concrete will only be washed out at locations to be agreed with SEPA. Excess concrete or wash-out liquid will not be discharged to watercourses on site or at compounds. Drainage from washout facilities will be collected and treated or removed to an appropriate treatment point/licensed disposal site.

11.8.17 The requirement for dewatering will be minimised in all locations by timely and efficient excavation of the foundation void and subsequent concrete pouring and backfilling.

Operation

Surface Water Drainage Strategy

11.8.18 Prior to construction, a detailed Drainage Strategy (DS) would be developed and agreed with SEPA and OIC. The DS would detail the site drainage design, including the type of surface to be used for the access tracks, the soft engineering and habitat enhancement measures proposed to slow surface water flows and any necessary ponds, swales, cross drains and bunds, to ensure that runoff from hard surfaces would be controlled and the hydrology of surrounding peatland and identified sensitive habitats (i.e. the small pools near the proposed track to T2) would be maintained. The DS would also detail the dimensions and final design of the one proposed watercourse crossing as noted above.

11.9 Likely Effects

Construction

11.9.1 The construction phase includes all activities prior to the operation of the Proposed Development, i.e. up to the point at which the turbines begin generating electricity. The following outlines the likely effects identified, with respect to geology, peat, hydrology and hydrogeology.

Pollution Impact from Sediment-laden Runoff

11.9.2 Surface runoff containing silt and sediment, particularly during and after rainfall events, has the potential to enter the watercourses located on site. Sediment-laden surface water runoff is predicted to arise from excavations, exposed ground and any temporary stockpiles. This has the potential to temporarily impact on the water quality and hydrological and ecological function of the receiving watercourses.

11.9.3 All watercourses on site have been buffered by 50 m with no infrastructure proposed within those buffers apart from the one crossing over the burn of Longigill, which will comprise a pipe culvert, designed in accordance with SEPA Good Practice Guidance (2010).

11.9.4 The sensitivity of the surface water receptors is moderate and the magnitude of impact is low with the implementation of the standard mitigation described in Section 11.8, resulting in an adverse, direct, temporary, short-term effect of **minor** significance (not significant).

Pollution Impact from Chemical Contaminated Runoff

11.9.5 Pollutants such as oils, fuel and cement may be mobilised through mechanical leaks or spillage and carried in surface drainage. Unless managed appropriately, the pollutants could be washed into watercourses, impacting on freshwater quality and ecological value.

11.9.6 The sensitivity of the surface water receptors is moderate and the magnitude of impact is low with the implementation of the standard mitigation described in Section 11.8, resulting in an adverse, direct, temporary, short-term effect of **minor** significance (not significant).

Impact on Groundwater Quality and Flow Regime

11.9.7 The introduction of turbine foundations has the potential to divert groundwater flows within superficial geology, and to impact groundwater quality as a result of alkaline leachate from concrete foundations. The potential requirement for dewatering of excavations during construction could locally reduce groundwater quantity.

11.9.8 There is anticipated to be perched groundwater within peat deposits at the site, with near-surface deposits likely to allow transmission of groundwater, therefore dewatering of excavations would likely result in localised drawdown of the water table and resultant dewatering of peat in the vicinity. The potential for groundwater within the bedrock to be near the surface in localised areas also cannot be ruled out, given the presence of habitats indicative of at least some potential groundwater dependence, and the moderately productive aquifer status (though noting that flow is likely to be restricted to fissures and other discontinuities).

11.9.9 Deeper, catotelmic peat deposits typically exhibit very low permeability, with extremely slow transmission of groundwater. Therefore, water table drawdown is likely to be localised to the area of excavations, recovering following completion of construction. Similarly, the spatial impact of any alkaline leachate is likely to be limited to the localised area around turbine bases. The potential magnitude of impact is therefore assessed as low.

11.9.10 The sensitivity of groundwater resource at the site is moderate. Therefore, with the implementation of the standard mitigation described in Section 11.8, the potential for construction-phase changes to the groundwater flow regime and quality could result in a direct adverse, temporary, short-term effect of **minor** significance (not significant).

Removal of and Impact on Peat

11.9.11 Although proposed turbines and infrastructure have been sited to minimise the need for extensive peat excavation as far as is possible, taking account of other constraints, there remains a requirement for some excavation of peat deposits. Further detail on the estimated volume of peat to be excavated, and the management of excavated peat, is given in Appendix 11.2: Outline Peat Management Plan.

11.9.12 Taking account of the standard mitigation set out in Section 11.8, the excavation of peat deposits to allow construction of the Proposed Development is assessed as an impact of low to medium magnitude, on a moderate sensitivity receptor, resulting in a direct, permanent effect of **minor to moderate** adverse significance (not significant).

Peat Slide Impact on Watercourses

11.9.13 Construction on peat soils can result in destabilisation of peat deposits on slopes and lead to slope failure, with subsequent potential for peat and soils to reach watercourses downslope and cause pollution/sedimentation and changes to fluvial geomorphology. A detailed assessment of peat landslide risk has been undertaken as presented in Appendix 11.1: Peat Landslide Hazard and Risk Assessment. This has identified negligible to low peat landslide risk at proposed turbine, hardstanding and other infrastructure locations.

11.9.14 As noted in Section 11.8, detailed site investigations would be undertaken prior to commencement of construction, to further inform the assessment of and protection against peat slide risks. This would include detailed topographical survey work to supplement the OS terrain data used for the risk assessment undertaken to date, and additional intrusive investigations to clarify the distribution, depth and nature of peat and substrate across proposed infrastructure areas. Any site-

specific geotechnical mitigation measures, or micro-siting to reduce risks, would be stipulated based on the findings of these further investigations. Additionally, it should be noted that proposed turbines and hardstandings would not be constructed on peat, rather any peat within the footprints of turbines and hardstandings would be excavated to allow construction on a suitable founding stratum (i.e. bedrock).

11.9.15 The overall potential magnitude of impact from peat landslide resulting from construction activities at the site is assessed as low, on a moderate sensitivity receptor, resulting in a direct, temporary, short-term effect of **minor** adverse significance (not significant).

Impact from Soil Compaction

11.9.16 Soil compaction can occur as a result of construction of permanent roads and by movement of construction vehicles and plant. Soil compaction can cause a reduction in water permeating to the ground, resulting in an increase in potentially contaminated surface runoff. Reduced permeability in soils also reduces the site's flood storage capacity which may result in localised flooding incidents.

11.9.17 Taking account of standard mitigation set out in Section 11.8, and the inferred low permeability of superficial deposits at the site, the magnitude of change prior to any additional, specific mitigation is negligible to low. The sensitivity of the surface water receptors is moderate, therefore there is potential for an adverse, indirect, temporary, short-term effect of **minor** significance (not significant).

Operation

Surface Water Drainage

11.9.18 The permanent access tracks and crane hardstandings for the wind turbines could result in additional surface water flows, potentially resulting in soil erosion and sediment-laden runoff, which could pollute downstream watercourses.

11.9.19 Taking account of the standard mitigation described in Section 11.8 (in particular the detailed DS to be developed and agreed with SEPA and OIC to ensure appropriate control of runoff from hard surfaces), there is potential for a negligible magnitude impact, on moderate sensitivity surface water receptors. Therefore, there is potential for an adverse indirect, long-term effect of **minor** significance (not significant).

Long-Term Changes to Groundwater Flow Regime

11.9.20 The presence of turbine foundations, access tracks and other infrastructure has the potential to interrupt groundwater flow; for example impermeable concrete foundations can act as barriers to flow. This could result in drying of peat deposits. However, given the nature of the superficial geology at the site, groundwater is anticipated to be limited to perched water in near-surface peat deposits, with flow likely to be limited and slow. Groundwater flow within bedrock is indicated to likely be restricted to fissures and other discontinuities, and this flow is very unlikely to be impacted by foundations, which would be within superficial deposits.

11.9.21 Taking account of standard mitigation measures set out in Section 11.8, the magnitude of impact is assessed as low, on a moderate sensitivity receptor. There is therefore potential for an adverse, indirect, long-term effect of **minor** significance (not significant).

Decommissioning

11.9.22 The Applicant is seeking in-perpetuity consent for the Proposed Development. In the event of decommissioning, or replacement of turbines, it is anticipated that the levels of effect would be similar but of a lesser level than those during construction. Decommissioning would be undertaken in line with best practice processes and methods at that time and will be managed through an agreed Decommissioning Environmental Management Plan

11.10 Mitigation and Enhancement

11.10.1 No significant environmental effects have been identified following the implementation of the standard mitigation outlined in Section 11.8. Therefore, no further mitigation is considered to be

required. However, the following additional mitigation and enhancement measures are proposed by the Applicant to further minimise potential effects and provide environmental benefit where possible.

- Given the short stretches of new cut track anticipated to cross deep peat (two segments of <150 m and <50 m, respectively), it is not considered practical to construct floated roads across these sections. If pre-construction detailed site investigation work identifies longer stretches of track needing to cross deep peat, with no opportunity for micro-siting (considered an unlikely scenario based on survey findings), then tracks would be floated to reduce the requirement for excavation of peat. Subject to detailed engineering design and confirmation of suitability, this would involve placing of a geotextile membrane on existing topsoil and vegetation followed by aggregate layers. Floating roads would be designed to ensure suitability for site traffic during construction and operation.
- Excavated peat would be re-used on-site as far as reasonably practicable and to provide suitable restoration, landscaping, and localised habitat enhancement at identified cut/degraded areas of peat, as set out in Appendix 11.2: Outline Peat Management Plan and discussed in Appendix 8.5: Outline Habitat Management Plan (HMP).
- Additionally, as discussed in the Outline HMP, identified areas of degraded blanket bog in the local area (off-site to the south) will be subject to habitat restoration using excavated peat from the development. This will include deposition of excavated peat, avoiding areas with mature vegetation, hag re-profiling and other actions (refer to Appendix 8.5 for further detail). A monitoring programme will be agreed to review the effectiveness of the HMP and agree any further work or modification. The HMP will be agreed with SNH, SEPA and OIC prior to construction, and will be implemented during the operation of the Proposed Development.
- Through the on-site and off-site re-use and restoration, all excavated peat will be used without the requirement for any disposal of excavated peat. This therefore mitigates the effect of peat excavation (although recognising the that habitat restoration will take time and will require monitoring as noted above). Carbon considerations relating to peat excavation and restoration are explored further in Chapter 16, including completion of the Scottish Government Carbon Calculator. This demonstrates that, after a short 'payback' period of approximately 1.4 years, the development will deliver a reduction in carbon emissions over its operational lifetime, through generation of renewable electricity.
- The above-noted habitat restoration works will also likely result in beneficial, though not material, hydrological effects on watercourses local to the agreed HMP area.
- The requirement for dewatering of excavations during construction would be minimised in all locations by timely and efficient excavation of the foundation void and subsequent concrete pouring and backfilling.
- Where topography dictates that working platforms are needed, these would be formed to ensure that surface water drains away from watercourses.
- To avoid unnecessary compaction and disturbance to site soils, working areas and corridors would be established and demarcated, with construction operatives appropriately inducted and trained to avoid work outside the designated work areas. Further detail is provided in the Appendix 11.2: Outline Peat Management Plan.

11.11 Residual Effects

Construction

Pollution Impact from Sediment-laden Runoff

11.11.1 The additional mitigation measures would not materially affect the likely effect, and the residual effect significance is assessed as **minor** (not significant).

Pollution Impact from Chemical Contaminated Runoff

11.11.2 The additional mitigation measures would not materially affect the likely effect, and the residual effect significance is assessed as **minor** (not significant).

Impact on Groundwater Quality and Flow Regime

11.11.3 The additional mitigation measures would not materially affect the likely effect, and the residual effect significance is assessed as **minor** (not significant).

Removal of and Impact on Peat

11.11.4 The additional mitigation measures (on-site re-use of peat for landscaping and restoration, and off-site use of peat for habitat restoration as part of habitat management plan implementation) are considered to reduce the magnitude of impact to low. Therefore, the residual effect significance is assessed as **minor** (not significant).

Peat Slide Impact on Watercourses

11.11.5 The additional mitigation measures would not materially affect the likely effect, and the residual effect significance is assessed as **minor** (not significant).

Impact from Soil Compaction

11.11.6 The additional mitigation measures would not materially affect the likely effect, and the residual effect significance is assessed as **minor** (not significant).

Operation

Surface Water Drainage

11.11.7 The additional mitigation measures would not materially affect the likely effect, and the residual effect significance is assessed as **minor** (not significant).

Long-Term Changes to Groundwater Flow Regime

11.11.8 The additional mitigation measures would not materially affect the likely effect, and the residual effect significance is assessed as **minor** (not significant).

Decommissioning

11.11.9 As noted in Paragraph 11.9.22, it is anticipated that the levels of effect would be similar but of a lesser level than those during construction.

11.12 Cumulative Effects

11.12.1 There are no proposed or operational wind farms within the study area, or which are directly hydrologically connected to the Proposed Development site. Therefore, no cumulative effects on hydrology, hydrogeology and geology are predicted.

11.13 Summary

11.13.1 The Proposed Development is located on elevated moorland approximately 1.3 km west of the village of Lyness on the island of Hoy. The site topography is defined by slopes of variable steepness, generally falling from high ground at the north, to the Burn of Ore valley near the south, and rising again to the south of the burn.

11.13.2 Most of the site area drains southward to the Burn of Ore, via direct surface runoff or via one of three small watercourses flowing from north to south across the southern part of the site (two unnamed and one called the Burn of Longigill). A localised area in the northeast of the site drains northward to the Burn of Moifea. Both the Burn of Ore and Burn of Moifea (joining with the Mill Burn) drain directly to the sea on the east coast of Hoy, less than 1 km from the site boundary.

11.13.3 Site geology comprises Upper Old Red Sandstone sedimentary strata, overlain by peat across most of the site area. Till is anticipated to overlie bedrock in the eastern extents of the site.

11.13.4 Peat depth surveys have identified peat across most of the site area, locally over 3 m thick but often thinner and sometimes absent. Peat has been cut or otherwise disturbed or excavated in some parts of the site.

11.13.5 Site design has sought to avoid areas of deep peat wherever possible, for proposed turbine locations and infrastructure, although this has not been entirely achievable given the presence of other environmental and technical constraints.

11.13.6 A peat slide risk assessment has identified negligible to low risks at all proposed turbine and infrastructure locations across the site. Opportunities for mitigation of low risks through micro-siting and/or targeted geotechnical/engineering controls, will be clarified following completion of detailed pre-construction site investigations.

11.13.7 There are no private water supplies located within 1 km of the site.

11.13.8 Habitats indicative of potential moderate groundwater dependency have been identified across much of the site, although based on the site geology and topography, the habitats are interpreted as being at least partially surface water or rainwater fed. Localised areas of potentially highly groundwater dependent habitats are either remote from proposed infrastructure (apart from minor upgrading of an existing track), or interpreted as being fed by rainwater/surface water rather than groundwater.

11.13.9 Likely construction and operational effects include sedimentation or pollution of the water environment from surface runoff, compaction of soils, the removal of peat, peat landslide hazard, and effects on groundwater quality and flow regime.

11.13.10 Standard/embedded mitigation measures include design and layout decisions taken through the design iteration process, including appropriate buffering of watercourses, and avoidance of areas of deep peat wherever possible in siting turbines. Standard good construction and design practice has also been considered as standard mitigation, including detailed pre-construction site investigations, agreement and implementation of a CEMP, appropriate design of the single proposed watercourse crossings, regulated under the CAR licensing regime, and development of a detailed Drainage Strategy for the site.

11.13.11 The likely effects on hydrological, geological and hydrogeological receptors, taking account of the standard mitigation measures, have been assessed as **minor** or **minor to moderate** (not significant). However, some additional specific mitigation measures have been proposed to further reduce effects. These include: appropriate peat management and re-use on site, additional dewatering and construction-phase surface runoff control, and establishing and demarcating working areas and corridors. Additionally, a Habitat Management Plan would be implemented, to restore degraded areas of blanket bog (peat deposits) in the local area.

11.13.12 The significance of residual effects on hydrological, geological and hydrogeological receptors is considered to be **minor** (not significant). No cumulative effects on hydrology, hydrogeology and geology are predicted.

Table 11.6 - Summary Table – Hydrology, Hydrogeology and Geology

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Construction					
Pollution from sediment-laden runoff	Minor	Adverse	Form working platforms to ensure surface runoff is away from watercourses. Implement Habitat Management Plan.	Minor	Adverse
Pollution from chemical contaminated runoff	Minor	Adverse	No additional mitigation than the standard mitigation identified.	Minor	Adverse
Effect on groundwater quality and flow	Minor	Adverse	Minimise dewatering requirement during foundation construction.	Minor	Adverse
Removal of and impact on peat	Minor to moderate	Adverse	Re-use of excavated peat on-site, implementation of Peat Management Plan. Implement Habitat Management Plan.	Minor	Adverse
Peat slide (impact on watercourses)	Minor	Adverse	No additional mitigation than the standard mitigation identified (in particular pre-construction site investigation works to inform detailed design, micro-siting and any additional geotechnical control measures required).	Minor	Adverse

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Soil compaction	Minor	Adverse	Establish and demarcate working areas and corridors.	Minor	Adverse
Operation					
Change in surface water drainage	Minor	Adverse	Implement Habitat Management Plan.	Minor	Adverse
Long-term changes to groundwater flow	Minor	Adverse	No additional mitigation than the standard mitigation identified	Minor	Adverse

11.14 References

BGS. (2019). The BGS Lexicon of Named Rock Units — Result Details. Available at: *https://www.bgs.ac.uk/lexicon/lexicon.cfm?pub=TILLD*

CIRIA (2001). Control of water pollution from constructions sites. Guidance for consultants and contractors C532. Available at: *https://www.ciria.org/*

CIRIA (2006). Control of water pollution from linear construction projects: technical guidance C648. Available at: *https://www.ciria.org/*

CIRIA (2015). SUDS Manual C753. Available at: *https://www.ciria.org/*

CIRIA (2010). Environmental good practice on site C650. Available at: *https://www.ciria.org/*

CIRIA (2016). Groundwater Control – design and practice C515. Available at: *https://www.ciria.org/*

DEFRA (2011). Code of Practice for the sustainable use of soils on construction sites. Available at: *https://www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites*

DEFRA (2009). UK (UKCP09) climate projections. Available at: *https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69257/pb13274-uk-climate-projections-090617.pdf*

DWQR. (2019). Private Water Supply map. Available at: *https://dwqr.scot/private-supply/pws-location-map/*

Dynamic Coast Scotland (2019). Web Map. Available at: *http://www.dynamiccoast.com/webmap.html*

EA, SEPA & EHSNI (2011): PPG26: Storage and handling of drums and intermediate bulk containers. Available at: *https://www.gov.uk/government/publications/storing-and-handling-drums-and-intermediate-bulk-containers-ppg26*

EA, SEPA & EHSNI (2012). PPG6: Working at construction and demolition sites. Available at: *https://www.gov.uk/government/publications/construction-and-demolition-sites-ppg6-prevent-pollution*

EA, SEPA & EHSNI (2013). PPG1: General guide to the prevention of pollution. Available at: *https://www.gov.uk/government/publications/basic-good-environmental-practices-ppg1-prevent-pollution*

EA, SEPA & EHSNI (2017). GPP21: Pollution incidence response planning. Available at: *http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/*

EA, SEPA & EHSNI (January 2017). GPP5: Works and maintenance in or near water. Available at: *http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/*

EA, SEPA & EHSNI (January 2018). GPP2: Above ground oil storage tanks. Available at: *http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/*

EA, SEPA & EHSNI (July 2017). GPP8: Safe storage and disposal of used oils. Available at: *http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/*

EA, SEPA & EHSNI (November 2017). GPP4: Treatment and disposal of sewage where no foul sewer is available. Available at: *http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/*

EC (1979). Groundwater Directive 80/68/EEC. Available at: *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31980L0068*

EC (2000). Water Framework Directive 2000/60/EC (WFD) 2000. Available at: *http://ec.europa.eu/environment/water/water-framework/index_en.html*

EC (2006). Groundwater Daughter Directive 2006/118/EC. Available at: *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0118*

Forestry Commission (2011). Guidance on Road Construction and Maintenance Forests and Water Guidelines Fifth Edition.

Joint Nature Conservation Committee. (2011). Towards an Assessment of the State of UK Peatlands. JNCC, Peterborough.

MAFF (2000). Good practice guide for handling soil. Available at: *https://webarchive.nationalarchives.gov.uk/20090317221756/http://www.defra.gov.uk/farm/environment/land-use/soilguid/index.htm*

Mykura W, (1976) British Regional Geology: Orkney and Shetland (HMSO, Edinburgh)

NERC. (2012). Geology of Britain. Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html Accessed in December 2019 and February to May 2020.

Ordnance survey (2019) OS Open Data Supply: Available at: *https://www.ordnancesurvey.co.uk/opendatadownload/products.html* Accessed: 30th of October 2019.

Ordnance Survey (1959). Orkney Islands (Kirkwall) One inch to One Mile Map, 7th Series. Sheet 6. Director General of the Ordnance Survey, Chessington, Surrey. Available at: *https://maps.nls.uk/view/91549033*

Ordnance Survey (1882). Orkney, Six inch to One Mile Map, 1st Edition. Sheet CII. Ordnance Survey, Southampton. Available at: *https://maps.nls.uk/view/74427911*

Ordnance Survey (1965) Orkney Islands (Kirkwall) 1:2,500 Map. Available at: *https://www.old-maps.co.uk/#/Map/345500/1010500/12/100954*

Scottish Executive (2000). Design Guidance on River Crossings and Migratory Fish. Available at: *https://www2.gov.scot/Topics/marine/Publications/publicationslatest/recreational*

Scottish Executive (2006). Private Water Supplies: Technical Manual. Available at: *http://www.privatewatersupplies.gov.uk/private_water/files/Full%20Doc.pdf*

Scottish Executive (2007). Flood Prevention and Land Drainage (Scotland) Act 1997. Available at: *http://www.legislation.gov.uk/ukpga/1997/36/section/3/enacted*

Scottish Executive (1996). Planning Advice Note 50: Controlling the Environmental Effects of Surface Mineral Workings, 1996. Available at: https://www.gov.scot/publications/planning-advice-note-pan-50-controlling-environmental-effects-surface-mineral/pages/0/

Scottish Government (2001). Planning Advice Note 61: Planning and SUDS, 2001. Available at: *https://www.gov.scot/publications/pan-61-sustainable-urban-drainage-systems/*

Scottish Government (2003). Water Environment and Water Services (Scotland) Act (WEWS Act) 2003. Available at: *http://www.legislation.gov.uk/asp/2003/3/contents*

Scottish Government (2006). Planning Advice Note 79: Water and Drainage, 2006. Available at: *https://www.gov.scot/publications/planning-advice-note-pan-79-water-drainage/*

Scottish Government (2009). The Flood Risk Management (Scotland) Act 2009. Available at: *http://www.legislation.gov.uk/asp/2009/6/contents*

Scottish Government (2011). The Waste Management Licensing (Scotland) Regulations 2011. Available at: *http://www.legislation.gov.uk/ssi/2011/228/contents*

Scottish Government (2011). Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended in 2018 (CAR). Available at: *http://www.legislation.gov.uk/ssi/2011/209/contents/made*

Scottish Government (2014). Scottish Planning Policy (SPP) June 2014. Available at: *https://www.gov.scot/publications/scottish-planning-policy/*

Scottish Government (2015). The Environmental Liability (Scotland) Regulations 2015. Available at: http://www.legislation.gov.uk/ssi/2015/214/contents/made

Scottish Government (2017). The Public Water Supplies (Miscellaneous Amendments) (Scotland) Regulations 2017. Available at: *http://www.legislation.gov.uk/ssi/2017/321/contents/made*

Scottish Government (2017). The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017. Available at: *http://www.legislation.gov.uk/ssi/2017/102/contents/made*

Scottish Government (2017). The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017. Available at: *http://www.legislation.gov.uk/ssi/2017/282/contents/made*

Scottish Government (Second Edition, 2017). Peat Landslide Hazard and Risk Assessments: Good practice Guide for Proposed Electricity Generation Developments. Available at: *https://www.gov.scot/publications/peat-landslide-hazard-risk-assessments-best-practice-guide-proposed-electricity/*

Scottish Government, SNH and SEPA. (2017). Guidance on Developments on Peatland - Site Surveys. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2018/12/peatland-survey-guidance/documents/peatland-survey-guidance-2017/peatland-survey-guidance-2017/govscot%3Adocument/Guidance%2Bon%2Bdevelopments%2Bon%2Bpeatland%2B-%2Bpeatland%2Bsurvey%2B-%2B2017.pdf

Scottish Natural Heritage (SNH) (2016). Carbon and Peatland Map. SNH, Scotland.

Scottish Renewables and SEPA. (2014). Developments on Peatland: Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste. Available at: https://www.gov.scot/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings/guidancepeatwaste

Scottish Renewables, SNH, SEPA & Forestry Commission Scotland (4th Edition 2019). Good practice during windfarm construction 3rd Edition. Available at: *https://www.nature.scot/guidance-good-practice-during-wind-farm-construction*

SEPA (2002). Managing River Habitats for Fisheries. (Available at: *https://www.sepa.org.uk/media/151323/managing_river_habitats_fisheries.pdf*

SEPA (2002). Managing River Habitats for Fisheries. Available at: *https://www2.gov.scot/Publications/2002/04/14606/3644*

SEPA (2004). Methodology for the Water Framework Directive, Scotland and Northern Ireland Forum for Environmental Research, Project WFD 28 Final Report.

SEPA (2006). Special Requirements for Civil Engineering Contracts for the Prevention of Pollution, Version 2. Available at: *https://www.sepa.org.uk/media/152220/wat_sg_31.pdf*

SEPA (2008). Regulatory Position Statement: Waste Water Drainage.

SEPA (2009/2015). The River Basin Planning Strategy for the Scotland River Basin District. Available at: *https://www.sepa.org.uk/media/37453/rbmp_planning-strategy_scotland.pdf*

SEPA (2010). River Crossings, Engineering in the water environment: good practice guide. Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/

SEPA (2010): Regulatory Position Statement – Developments on peat. Available at: *https://www.sepa.org.uk/media/143822/peat_position_statement.pdf*

SEPA (2011 as amended in 2018). The Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended in 2018 - A practical guide. Available at: *https://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf*

SEPA (2014). Flood Risk and Planning Briefing Note. Available at: *https://www.sepa.org.uk/media/143403/sepa-briefing-note-to-planning-authorities-on-the-flood-risk-management-scotland-act-2009.pdf*

SEPA (2014). Land Use Planning System Guidance Note 31 (LUPS-GU31)- Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Available at: *https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf*

SEPA (Feb 2012). Position Statement: The role of SEPA in natural flood management. Available at: *https://www.sepa.org.uk/media/42133/sepa-04-12-position_statement_the_role_of_sepa_in_natural_flood_management.pdf*

SEPA (January 2014, updated April 2018). Indicative River & Coastal Flood Map (Scotland). Available at: *http://map.sepa.org.uk/floodmap/map.htm*

SEPA (July 2012). Environmental Standards for River Morphology, WAT-SG-21. Available at: *https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/*

SEPA (July 2019). Technical flood risk guidance for stakeholders, version 12. Available at: *https://www.sepa.org.uk/media/162602/ss-nfr-p-002-technical-flood-risk-guidance-for-stakeholders.pdf*

SEPA (2017). Developments on Peat and Off-Site Uses of Waste Peat. Available at: https://www.sepa.org.uk/media/287064/wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf

SEPA (September 2017). Land Use Planning System Guidance Note 4 (LUPS GU4) - Planning guidance on on-shore windfarm developments. Available at: *https://www.sepa.org.uk/media/136117/planning-guidance-on-on-shore-windfarms-developments.pdf*

SEPA. (2018). Supporting Guidance (WAT-SG-75) – Sector Specific Guidance: Construction Sites. Available at: https://www.sepa.org.uk/media/340359/wat-sg-75.pdf

Orkney Local Development Plan 2017 – Orkney Islands Council. Available at: *https://www.orkney.gov.uk/Files/Planning/Development-and-Marine-Planning/Local-Plan/OLDP_2017/Orkney_Local_Development_Plan_2017_2022.pdf*

SNH (2016). Carbon and Peatland Map (2016). Available at: *http://map.environment.gov.scot/Soil_maps/?layer=10*

SNH (2018). A Handbook of Environmental Impact Assessment, 5th Edition. Available at: *https://www.nature.scot/handbook-environmental-impact-assessment-guidance-competent-authorities-consultees-and-others*

(SEPA, 2009) Temporary Construction Methods, WAT-SG-29

UK Government (1974). Control of Pollution Act 1974. Available at: *https://www.legislation.gov.uk/ukpga/1974/40*

UK Government (1990). Environmental Protection Act 1990. Available at: *https://www.legislation.gov.uk/ukpga/1990/43/contents*

UK Government (1994). Waste Management Licensing Regulations 1994. Available at: *http://www.legislation.gov.uk/uksi/1994/1056/contents/made*

UK Government (1995). Environment Act 1995. Available at: *https://www.legislation.gov.uk/ukpga/1995/25/contents*

UK Government (1998). Groundwater Regulations 1998. Available at: *http://www.legislation.gov.uk/uksi/1998/2746/contents/made*

UK Technical Advisory Group on the WFD (2013). UK Environmental Standards and Conditions Final Report, November 2013.

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