CONTENTS

INTRODUCTION

10.1 This Chapter assesses the potential impacts of the proposed development on soils, geology and the water environment (hydrology and hydrogeology). The assessment of potential impacts has been made on the basis of the proposed wind turbine generator (WTG) and associated infrastructure layout as fully described in **Chapter 3: Description of Development**. It outlines the embedded good practice methods which have been incorporated into the design and would be used during the construction, operation and decommissioning of Kirkton Energy Park (the proposed development) to prevent or reduce identified effects and risks.

10.2 Further mitigation methods to address any potential effects are proposed, where appropriate, and residual effects assessed.

10.3 This Chapter presents summary information from the following Technical Appendices (TA):

- Technical Appendix 10.1: Peat Landslide Hazard and Risk Assessment (PLHRA);
- Technical Appendix 10.2: Peat Management Plan (PMP);
- Technical Appendix 10.3: Borrow Pit Assessment; and
- Technical Appendix 10.4: Watercourse Crossings.

10.4 This Chapter is supported by **Figures 10.1** to **10.8** (referenced within the text where relevant).

10.5 Planning policies of relevance to this assessment are provided in **Technical Appendix 4.1: Legislation, Planning Policy and Guidance**.

SCOPE AND CONSULTATION

10.6 The scope of the study has been determined through a combination of professional judgement, reference to relevant guidance documents and consultation with stakeholders.

Consultation and Scoping Responses

10.7 Consultation for the proposed development was undertaken with statutory and non-statutory bodies during 2021 as set out in **Chapter 6: Scoping and Consultation**. The outcome of the relevant consultations with regard to soils, geology and the water environment is summarised in **Table 10-1**.

Table 10-1: Key Issues

Consultee	Summary of Key Issues	Where Addressed in Chapter
The Highland Council (THC)	Response from Environmental Health Department (10 May 2021): "***Private Water Supplies*** *The applicant will require to carry out an investigation to identify any private water supplies, including pipework, which may be adversely affected by the development and to submit details of the measures proposed to prevent contamination or physical disruption. Highland Council has some information on known supplies but it is not definitive. An on-site survey will be required."*	See Baseline Conditions.
	Response from Flood Risk Management Team (no date): *"The Flood Risk Management Team do not wish to comment on this application."*	Noted.
	Response from Flood Risk Management Team (8 September 2020) *"We have no records of flooding in the area and there are no formal flood schemes developed by The Highland Council in the area."*	Noted.
	Scoping Opinion dated 25 May 2021: "The EIAR should include a full assessment on the impact of the development on peat. The assessment of the impact on peat must include peat probing for all areas where development is proposed."	See **TA 10.1 (PLHRA)**.
	"*Carbon balance calculations should be undertaken and included within the EIAR with a summary of the results provided focussing on the carbon payback period for the wind farm.*"	See **TA 10.3 (Borrow Pit Appraisal)**.
	"The EIAR should fully describe the likely significant effects of the development on the local geology including aspects such as borrow pits, earthworks, site restoration and the soil generally including direct effects and any indirect."	See Assessment of Effects.
	"The EIAR needs to address the nature of the hydrology and hydrogeology of the site and the potential impacts on water courses, water supplies including private water supplies, water quality, water quantity and on aquatic flora and fauna. Measures to prevent erosion, sedimentation or discolouration will be required, along with monitoring proposals and contingency plans. Assessment will need to recognise periods of high rainfall which will impact on any calculations of run-off, high flow in watercourses and hydrogeological matters.".	See Baseline Conditions and Assessment of Effects.
	The EIAR will be expected to identify all water crossings and include a systematic table of watercourse crossings or channelising, with detailed justification for any such elements and design to minimise impact. The table should be accompanied by photography of each watercourse affected and include dimensions of the watercourse.	See Assessment of Effects and **TA10.4 (Schedule of watercourse Crossings)**.
	The need for, and information on, abstractions of water supplies for concrete works or other operations should also be identified. The EIAR should identify whether a public or private source is to be utilised. If a private source is to be utilised, full details on the source and details of abstraction need to be provided.	See Assessment of Effects.

Consultee	Summary of Key Issues	Where Addressed in Chapter
	" The applicant will be required to carry out an investigation to identify any private water supplies, including pipework, which may be adversely affected by the development and to submit details of the measures proposed to prevent contamination or physical disruption." *The EIAR should include an assessment of the effects on Ground Water Dependent Terrestrial Ecosystems (GWDTE)."*	See Baseline Conditions. See Baseline Conditions and **Figure 10.8**.
Scottish Environmental Protection Agency (SEPA)	Response dated 20 April 2021: *"The information outlined below … should be submitted in support of the application.* *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.* *b) Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems and buffers.* *c) Map and assessment of impacts upon groundwater abstractions and buffers.* *d) Peat depth survey and table detailing re-use proposals.* *e) Map and site layout of borrow pits (if applicable).* *f) Schedule of mitigation including pollution prevention measures.* *g) Decommissioning statement."*	See Baseline Conditions and **Figure 10.1** and **Figure 10.8**. See **TA 10.1 (PLHRA), 10.2 (PMP)** and **10.3 (Borrow Pit Assessment)** See Assessment of Effects. See **Chapter 3.**
Scottish Water	Response dated 8 April 2021: *"We would advise applicant to investigate private water options.* *We would advise applicant to investigate private wastewater treatment options.* ***Drinking Water Protected Areas*** *A review of our records indicates that there are no Scottish Water drinking water catchments or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed activity."*	Noted. Noted.
NatureScot	Response dated 13 May 2021: *"We advise that EIAR should provide sufficient information and assessment, based on site-specific surveys to determine if the wind farm infrastructure will affect, directly or indirectly."* *"The Caithness and Sutherland Peatlands SAC is protected for it upland habitats and otter features. The application site boundary extends into the SAC. Given the close proximity between the SAC and the application site, a likely significant effect can be concluded. It is therefore important that the EIAR provides enough information to allow us to determine if the proposal could have an adverse impact on the integrity of the SAC."*	See **TA10.1 (PLHRA)** and **TA10.2 (PMP)**. See Baseline Conditions and Assessment of Effects.

Consultee	Summary of Key Issues	Where Addressed in Chapter
	"The watercourses within the application site drain into the coastal waters within the Strathy Coast SSSI. We advise that it is unlikely that the SSSI habitats will be affected by the proposed development however given the hydrological connectivity then potential impacts should be assessed within the EIAR."	See Baseline Conditions and Assessment of Effects
Fisheries Management Scotland	Scoping opinion dated 28 April 2021: Refers standard Marine Scotland and District Salmon Fishery Boards standard guidance.	Noted.
Flow Country Rivers Trust	Scoping opinion dated 28 April 2021: Requests scoping response from Northern District Salmon Board is considered.	Noted.
The Northern District Salmon Fishery Board	Scoping opinion dated 19 April 2021: "*NDSFB would wish to see full habitat and fisheries surveys performed for both Allt na hEaglaise and Allt nan Gall, covering those parts of both streams that are within the proposed wind farm site and also the stream reaches between the proposed wind farm site and the River Halladale iitself.* *Based on the survey results, NDSFB would expect any necessary measures for the protection of fish and aquatic habitat be specified in any planning application and adopted should the application succeed*."	Noted. See **Chapter 8 (Ecology)**.
Marine Scotland	Marine Scotland Science advice on freshwater and diadromous fish and fisheries in relation to onshore wind farm developments. July 2020: "*Developers should specifically discuss and assess potential impacts and appropriate mitigation measures associated with the following:* - *any designated area, for which fish is a qualifying feature, within and/or* - *downstream of the proposed development area;* - *the presence of a large density of watercourses;* - *the presence of large areas of deep peat deposits;* - *known acidification problems and/or other existing pressures on fish populations in the area; and* - *proposed felling operations.*"	See **Chapter 8 (Ecology)**.
RSPB	Scoping opinion dated 11th May 2021: "Impacts on peat and peatland habitats avoided and minimised where possible. The final infrastructure design should avoid deep peat over 50cm and any sensitive Annex 1 habitats. Suitable track construction should be planned across peatland areas. We welcome the preparation of a peat management plan (PMP) that is informed by peat depth probing, and by a full site appraisal of potential re-use opportunities, including information regarding the plans for excavated peat storage.	See **TA10.1 (PLHRA)** and **10.2 (PMP)**.

10.8 The following potential effects have been assessed in full in relation to the proposed development:

- pollution risk, including potential impact on surface water and groundwater quality and public and private water supplies during construction, operation and decommissioning;
- erosion and sedimentation which could give rise to potential impact on surface water and groundwater quality, and private water supplies during construction, operation and decommissioning;
- fluvial flood risk resulting from changes to runoff volumes and rates and modifications to natural and man-made drainage patterns during operation;
- potential impact upon the linkage between groundwater and surface water during construction, operation and decommissioning;
- potential impact on areas of peat during construction, operation and decommissioning;
- potential impact on areas of GWDTE during construction, operation and decommissioning; and
- potential cumulative impact during construction, operation and decommissioning.

Effects Scoped Out

10.9 On the basis of the desk based and survey work undertaken, policy, guidance and standards, the professional judgement of the EIA team, feedback from consultees and experience from other relevant projects, the following topic areas have been 'scoped out':

- potential effects on geology during both construction and operation as there are no protected geological features within the site. Furthermore, the nature of the activities during construction, operation and decommissioning of the proposed development would be unlikely to alter the geology of the site. Potential cumulative effects on geology have also been scoped out on this basis. For context, information on the geology of the site is presented in the 'Baseline Conditions' text of this Chapter and **Technical Appendix 10.1 (PLHRA)** and **Technical Appendix 10.2 (PMP)**;
- increased flood risk caused by blockages to flow in watercourses during operation and maintenance of the proposed development. These crossings would be subject to maintenance requirements under the Controlled Activities Regulations (CAR), flood risk onsite is negligible, and the proposed development design ensures no critical infrastructure is located near watercourses;
- changes to public/private water supply yield as a consequence of changes to runoff rates and volumes during operation and maintenance of the proposed development, as no significant alterations to runoff rates/infiltration or drawdown of the water table are anticipated during or as a consequence of construction or operation of the proposed development; and
- potential effects associated with forest felling on surface water quality and runoff as all forest felling would be undertaken in accordance with good practice guidelines published by Forestry and Land Scotland (formerly Forestry Commission Scotland) and the area of felling proposed is very small compared to the surface water catchment within which it will occur.
- Potential effects on the abnormal load turning areas (**Figure 3.2a** and **Figure 3.2b**) have been scoped out of the assessment as review of the baseline conditions and observations gathered during the site visit confirmed that there were no geological or hydrological receptors at

either location and subject to the adoption of best practice construction techniques no effects on hydrology, hydrogeology, geology and soils are expected.

APPROACH AND METHODS

10.10 The potential effects from the proposed development on soils, geology and the water environment have been assessed by completing an initial desk study followed by an impact assessment.

Study Area

10.11 The study area includes all of the proposed site infrastructure as illustrated in **Figure 10.1**. In addition, details of local water use and quality within a buffer of at least 1km from the proposed new and upgraded infrastructure have been considered. The study area encompasses the site as well as bodies of water and their catchments which could potentially be affected by the construction and operation of the proposed development.

10.12 The study area for potential cumulative effects uses the catchments within the study area, with a maximum downstream distance of 5km from the proposed infrastructure.

Information and Data Sources

10.13 An initial desk study has been undertaken to determine and confirm the baseline characteristics by reviewing available information on soils, geology, hydrology and hydrogeology, such as: groundwater resources; licensed and unlicensed groundwater and surface water abstractions; public and private water supplies; surface water flows; flooding; rainfall data; and water quality and soil data. This has also included a review of published geological maps, Ordnance Survey (OS) maps, aerial photographs and site specific data such as site investigation data, geological and hydrogeological reports, digital terrain models (slope plans) and geological literature.

10.14 The following sources of information, including good practice guidance and legislation have been consulted in order to characterise and assess the soils, geology, hydrogeology and hydrology of the area within and surrounding the site:

- OS 1:50,000 and 1:10,000 scale mapping data;
- Flood Estimation Handbook (FEH) web service (available online at https://fehweb.ceh.ac.uk/);
- British Geological Survey (BGS) 1:50,000 scale data - superficial deposits, bedrock, linear features, mass movement and artificial ground (available online at http://mapapps2.bgs.ac.uk/geoindex/home.html);
- BGS Hydrogeological Map of UK, 2019;
- James Hutton Institute The Soil map of Scotland (partial cover) (1:25,000) (available online at http://soils.environment.gov.scot/maps/);
- BGS Hydrogeological Maps of Scotland (groundwater vulnerability and aquifer productivity) 1:100,000 scale;

- The SEPA flood maps (available online at https://www.sepa.org.uk/environment/water/flooding/flood-maps/ and http://map.sepa.org.uk/reservoirsfloodmap/Map.htm);
- SEPA Water Environment Hub for water body classifications (available online at https://www.sepa.org.uk/data-visualisation/water-classification-hub/);
- NatureScot (SNH) Sitelink Online Information Service (available online at https://gateway.snh.gov.uk/sitelink/searchmap.jsp);
- Natural England Magic Map (available online at http://magic.defra.gov.uk/MagicMap.aspx);
- Data requests with SEPA regarding details of registered/licensed abstractions and discharges (March and April 2019); and
- Data requests with THC environmental health department regarding details of historic flooding records and private water abstractions (March 2019).

Field Surveys

10.15 The project hydrologists, geologists and ecologists have worked closely on this assessment to ensure that appropriate information is gathered to allow a comprehensive impact assessment to be completed.

10.16 Detailed site visits and walkover surveys have been undertaken by SLR on the following dates:

- September 2020: peat depth probing and peat characterisation;
- May 2021: peat depth probing and borrow pit consideration (covering the additional Upper Bighouse Land);
- October 2021: private water supply survey, GWDTE assessment and watercourse crossing survey; and
- January 2022: further peat probing around finalised infrastructure locations.

10.17 The scope of the private water supply survey was informed by data received from THC along with OS mapping and aerial photography. To complete the private water supply risk assessment, properties which may have or have a recorded private water supply within 1km and downstream of the site were visited and where possible the source of the water supply was verified and confirmed.

10.18 The field work has been undertaken in order to:

- verify the information collected during the desk and baseline study;
- undertake a visual assessment of the main surface waters and identify and verify private water supplies;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- visit any identified potential GWTDE (in consultation with the project ecologist);

- visit any potential watercourse crossings and prepare a schedule of potential watercourse crossings;
- inspect rock exposures and establish by probing, an estimate of overburden thicknesses, peat depth and stability;
- confirm underlying substrate, based on the type of refusal of a peat probe and by coring; and
- allow appreciation of the site, determine gradients, potential borrow pit locations, access routes, ground conditions, etc., and to assess the relative location of all the components of the proposed development.

10.19 The desk study and field surveys have been used to identify potential development constraints and have been used as part of the iterative design process. The peat probing completed as part of the initial field surveys has been developed further as part of the assessment of effects. This assessment is reported in **Technical Appendix 10.1 (PLHRA)** with a summary provided in this Chapter. Working together, the project ecologists and geologists made an assessment of the condition of the peat. This has included details related to the characteristics of the soils, classification of vegetation cover, assessment of current land use impacts, assessment of drainage paths and channels, evidence of peat erosion and coring to further characterise the peat. This is also reported in **Technical Appendix 10.2 (PMP)** and **Chapter 8 (Ecology)**.

10.20 The data obtained as part of the desk study and collected as part of the field work has been processed and interpreted to complete the impact assessment and recommend mitigation measures where appropriate.

Assessment Methods

10.21 The significance of potential effects of the proposed development has been assessed by considering two factors: the sensitivity of the receiving environment (the receptor) and the potential magnitude of impact, should that effect occur. The assessment methodology has also been informed by the assessor's experience of carrying out such assessments for a range of wind farm and other developments, a knowledge of soils, geology and the water environment characteristics in Scotland and cognisance of good practice.

10.22 This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying mitigation measures appropriate to the significance of potential effects presented by the proposed development.

10.23 Criteria for determining the significance of effect are provided in **Table 10-2**, **Table 10-3** and **Table 10-4**.

Sensitivity of Receptor

10.24 The sensitivity of the receiving environment (i.e. the baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria which is set out in **Table 10-2**. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 10-2: Sensitivity of Receptor Criteria

Sensitivity	Definition
High	▪ SEPA Water Framework Directive Water Body Classification: High-Good or is close to the boundary of a classification: Moderate to Good or Good to High; ▪ Receptor is of high ecological importance or National or International value (e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), habitat for protected species which may be dependent upon the hydrology of the development area; ▪ Receptor is at high risk from flooding above 0.5% Annual Exceedance Probability (AEP) and/or water body acts as an active floodplain or flood defence; ▪ Receptor is used for public and/or private water supply (including Drinking Water Protected Areas); ▪ Groundwater vulnerability is classified as high; ▪ If a GWDTE is present and identified as being of high sensitivity; and ▪ Soil type and associated land use is highly sensitive (e.g. unmodified blanket bog peatland).
Moderate	▪ SEPA Water Framework Directive Water Body Classification: Moderate or is close to the boundary of a classification: Low to Moderate; ▪ Receptor is at moderate risk from flooding (0.1% AEP to 0.5% AEP) but does not act as an active floodplain or flood defence; and ▪ Moderate classification of groundwater aquifer vulnerability; and ▪ Soil type and associated land use moderately sensitive (e.g. arable, commercial forestry).
Low	▪ SEPA Water Framework Directive Water Body Classification: Poor or Bad; ▪ Receptor is at low risk from flooding (less than 0.1% AEP); ▪ Receptor not used for water supplies (public or private); and soil type and associated land use not sensitive to change in hydrological regime and associated land use (e.g. intensive grazing of sheep and cattle).
Not Sensitive	▪ Receptor would not be affected by the proposed development e.g. lies within a different and unconnected hydrological / hydrogeological catchments.

Magnitude of Impact

10.25 The potential magnitude of impact would depend upon whether the potential effect would cause a fundamental, material or detectable change. In addition, the timing, scale, size and duration of the potential effect resulting from the proposed development are also determining factors. The criteria that have been used to assess the magnitude of impact are defined in **Table 10-3.**

Table 10-3: Magnitude of Impact

Magnitude	Criteria	Definition
Major	Results in loss of attribute	Fundamental (long term or permanent) changes to the baseline geology, hydrology, hydrogeology and water quality such as: ▪ permanent degradation and total loss of the soils habitat; ▪ loss of important geological structure/features; ▪ wholesale changes to watercourse channel, route, hydrology or hydrodynamics; ▪ changes to the site resulting in an increase in runoff with flood potential and also significant changes to erosion and sedimentation patterns; ▪ major changes to the water chemistry; and

Magnitude	Criteria	Definition
		▪ major changes to groundwater levels, flow regime and risk of groundwater flooding.
Medium	Results in impact on integrity of attribute or loss of part of attribute	Material but non-fundamental and short to medium term changes to baseline geology, hydrology, hydrogeology and water quality, such as: ▪ loss of extensive areas of soils habitat, damage to important geological structures/features; ▪ some fundamental changes to watercourses, hydrology or hydrodynamics. – changes to site resulting in an increase in runoff within system capacity; ▪ moderate changes to erosion and sedimentation patterns; ▪ moderate changes to the water chemistry of surface runoff and groundwater; and ▪ moderate changes to groundwater levels, flow regime and risk of groundwater flooding.
Low	Results in minor impact on attribute	Detectable but non-material and transitory changes to the baseline geology, hydrology, hydrogeology and water quality, such as: ▪ minor or slight loss of soils or slight damage to geological structures/feature; ▪ minor or slight changes to the watercourse, hydrology or hydrodynamics; ▪ changes to site resulting in slight increase in runoff well within the drainage system capacity; ▪ minor changes to erosion and sedimentation patterns; ▪ minor changes to the water chemistry of surface runoff and groundwater; and ▪ minor changes to groundwater levels, flow regime and risk of groundwater flooding.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity	No perceptible changes to the baseline soils, geology, hydrology, hydrogeology and water quality such as: ▪ no impact or alteration to existing important geological environs; ▪ no alteration or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns; ▪ no pollution or change in water chemistry to either groundwater or surface water; and ▪ no alteration to groundwater recharge or flow mechanisms.

Significance of Effects

10.26 The sensitivity of the receiving environment together with the magnitude of the impact determines the significance of the effect, which can be categorised into level of significance as identified in **Table 10-4**. This also takes into account good practice measures implemented and embedded as part of the design and construction of the proposed development and use of professional judgement where appropriate.

10.27 The table provides a guide to assist in decision making. However, it should not be considered as a substitute for professional judgment and interpretation. In some cases, the potential sensitivity of the receiving environment or the magnitude of potential impact cannot be quantified with certainty and therefore professional judgement remains the most robust method for identifying the predicted significance of a potential effect.

10.28 Effects of 'major' and 'moderate' significance are considered to be 'significant' in terms of the EIA Regulations 2017.

Table 10-4: Significance of Effect

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

Cumulative Effects

10.29 The assessment also considers potential cumulative effects associated with other wind farm developments within the same surface water catchments.

10.30 A cumulative effect is considered to be the effect on soils, geology, hydrological or hydrogeological receptors arising from the proposed development in combination with other proposed developments. That includes existing developments of the kind proposed, those which have permission, and valid applications which have not been determined.

10.31 Proposed developments within the same catchment as the site and within a distance of 5km from the proposed development have been considered.

10.32 Cumulative effects are considered using the same methodology as for effects of the proposed development in isolation.

Mitigation

10.33 Any potential effects of the proposed development on soils, geology and the water environment identified by the assessment have been addressed and mitigated by the conceptual site design and the application of good practice guidance implemented as standard during construction and operation to prevent, reduce or offset effects where possible. As such, a number of measures would form an integral part of the design/construction process and these have been taken into account prior to assessing the likely effects of the proposed development. Where appropriate, further tailored mitigation measures have been identified prior to determining the likely significance of residual effects.

10.34 Good practice measures would be applied in relation to pollution risk, sediment management, peat management and management of surface runoff rates and volumes. This would form part of the Construction Environment Management Plan (CEMP) to be implemented for the proposed development and would be prepared prior to construction, an outline of which is provided in **Technical Appendix 3.1: Outline CEMP**. The CEMP can be secured by a condition to a deemed planning permission and be submitted to THC for approval.

10.35 As the CEMP develops it would include details and responsibilities for environmental management onsite for site environmental aspects. It would outline the necessary measures for surface water

management, oil and chemical delivery and storage, waste management, traffic and transport management. It would also specify monitoring requirements for waste water, water supply including an Environmental Incident Response Plan (EIRP) and all appropriate method statements and risk assessments for the construction of the proposed development.

Residual Effects

10.36 A statement of residual effects, following consideration of any further specific mitigation measures where identified, is then given where required.

Statement of Significance

10.37 The assessment concludes with a statement of significance associated with the proposed development.

Assumptions, Limitations and Confidence

10.38 The assessment uses site investigation and survey data and publicly available data sources, including but not limited to SEPA, Met Office, Local Authority and commercial data supply companies, as well as additional information supplied from stakeholders during the scoping and consultation stages.

10.39 As a consequence, it is considered that the data and information used to complete this assessment is robust and that there are no significant data gaps or limitations.

BASELINE CONDITIONS

Current Baseline

10.40 This section presents information gathered regarding the existing soils, geological, hydrogeological and hydrological conditions at the site and its immediate surrounding.

Site Setting

10.41 The proposed development site is located approximately 2.1km south of Melvich in the county of Sutherland in northern Scotland and is centred at National Grid Reference (NGR) NC 87999, 59788. The application boundary occupies an area of approximately 419.38ha (including the two potential abnormal load turning areas), although only a small proportion of this would be occupied by new infrastructure associated with the proposed development.

10.42 An extract of OS mapping for the site, which shows its setting, is presented in **Figure 10.1**.

10.43 Ground elevations at site range between approximately 20m Above Ordnance Datum (AOD) in the east of the site to approximately 160m AOD in the north-west of the site. Elevations generally fall eastwards towards the Halladale River.

10.44 The primary access to the site is from the north from an unnamed road which leads from the A836.

10.45 The nearest rainfall gauging station is the Forsinian Station located approximately 18km south of the site. The average annual rainfall at the Forsinian Station over the period 2011 to 2021 was 1,098mm (SEPA).

10.46 The existing land use across the site includes rough grazing and commercial forestry.

Statutory Designated Sites

10.47 A review of the NatureScot Sitelink (NS, 2022) and Magic Map (DEFRA, 2022) webpages confirms that no element of the proposed infrastructure is located within a statutory designated site. The location of statutory designated sites near to site and within the Study Area are show shown on **Figure 10.1** and shows:

- West Halladale Site of Special Scientific Interest (SSSI) is located immediately adjacent to the western site boundary and within a small area in the north west of the site in which habitat management / improvement activities are proposed. The SSSI is at least 140m west of the proposed turbine locations. West Halladale SSSI is 8,562ha in area and is designated for birds (including black-throated diver, common scoter, breeding bird assemblage) and blanket bog. The SSSI is potentially hydraulically connected to the proposed development and therefore is carried forward in this assessment as a potential receptor.
- Caithness and Sutherland Peatlands Special Protection Area (SPA) is located immediately adjacent to the western site boundary and within a small area in the north west of the site in which habitat management / improvement activities are proposed. The SPA is at least 140m west of the proposed turbine locations. It is 145,313ha in area and is designated for black-throated diver, common scoter, dunlin, golden eagle, and breeding. Its citation does not include soils, geology or water and therefore it is not considered further in this Chapter.
- Caithness and Sutherland Peatlands Special Area of Conservation (SAC) is located immediately adjacent to the western site boundary and within a small area in the north west of the site in which habitat management / improvement activities are proposed. The SAC is at least 140m west of the proposed turbine locations. It is 143,561ha in area and is designated for lakes, ponds, and blanket bog. The SAC is potentially hydraulically connected to the proposed development, and therefore is carried forward in this assessment as a potential receptor.
- Caithness and Sutherland Peatlands Ramsar Site is located immediately adjacent to the western site boundary and within a small area in the north west of the site in which habitat management / improvement activities are proposed. The Ramsar Site is at least 140m west of the proposed turbine locations. It is 143,503ha in area and is designated for blanket bog and birds (including dunlin, greylag goose, and breeding). The Ramsar site is potentially hydraulically connected to the proposed development, and therefore is carried forward in this assessment as a potential receptor.

10.48 Within 5km, and downstream of the site, are the following designated sites:

- Strathy Coast SSSI is located approximately 2.69km north of the site. It is 675ha in area and is designated for moines, machairs, maritime cliffs, and saltmarsh.
- North Caithness Cliffs SPA is located approximately 3.4km north of the site. It is 14,629ha in area and is designated for fulmar, guillemot, kittiwake, peregrine, and breeding. Its citation

does not include soils, geology or water and therefore it is not considered further in this Chapter.

- Sgeir Ruadh Portskerra Geological Conservation Review Site (GCR) is located approximately 3.9km north of the site.

10.49 The Strathy Coast SSSI and Sgeir Ruadh Portskerra Geological Conservation Review (GCR) site are afforded protection for their geology and geomorphology. They are distant from the proposed development and given the measures proposed to safeguard geology and ground stability included in the site design (see Effects Scoped Out and Embedded Measures) potential effects on these sites are not considered further in this Chapter.

Geology

Soils and Superficial Deposits

10.50 An extract of the 1:25,000 Soil Survey of Scotland (James Hutton Institute, 2021) mapping is presented as **Figure 10.2**. The principal soil types underlying the site are:

- peaty podzols derived from schists, gneisses, granulites and quartzites of the Moine Series mainly across the eastern extent of the site, described as freely drained below iron pan and is located beneath the proposed site access, substation (including battery storage) and construction compound;
- peat mainly across the western extent of the site, and beneath the proposed turbines, described as blanket peat > 1m; and
- alluvium is shown outside of the site boundary and to bound the Halladale River.

10.51 Peatland classification (SNH, 2016) mapping shown as **Figure 10.3** illustrates that the majority of the proposed turbines may be underlain by Class 1 and 2 peatland (priority peatland). Turbine 5 is shown to be underlain by Class 3 acidic soils rather than peatland.

10.52 An extract of the 1:50,000 BGS superficial deposits data is presented as **Figure 10.3**, review of this shows that west of the site is underlain by peat. Smaller areas across the northern and eastern extents of the site are underlain by glacial deposits, these are described as hummocky (moundy) sand and gravel deposits. Alluvium bounds larger streams, and where streams fall steeply or on the highest parts of the site no superficial deposits are recorded.

10.53 As part of the baseline assessment, a comprehensive peat probing exercise has been conducted and informs the **PLHRA (Technical Appendix 10.1)**. In summary:

- the presence and depth of peat was assessed at more than 1,755 locations;
- peaty soil was present at 960 peat probe locations;
- 36 peat probe locations recorded no peat;
- a hazard impact assessment has been completed, which has concluded that subject to the employment of appropriate mitigation measures, the presence of peat and potential peat slide instability are not development constraints; and

- the site specific peat depth probing has shown that the extent of peat at site is not as extensive as suggested by published mapping and that the proposed turbines have been generally been located in areas of shallow peat.

Bedrock Geology

10.54 An extract of the 1:50,000 BGS bedrock and linear features data is presented in **Figure 10.4 and Figure 10.5**.

10.55 Metamorphic psammite and semipelite, associated with the Portskerra Psammite Formation underlies virtually all of the site.

10.56 There are small areas of Strath Halladale Granite which have been intruded into the Portskerra Psammite Formation, within the site.

Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

10.57 Where not degraded or eroded, peat is characteristically wet underfoot and dominated by Sphagnum. Typically peat consists of two layers: the upper very thin (up to 30cm) acrotelm layer contains upright stems of Sphagnum mosses and allows relatively free water movement and the lower catotelm layer comprising the thicker bulk of peat where individual plant stems have collapsed. Water movement in the catotelm layer is very slow and normally the water table in a peat never drops below the acrotelm layer.

10.58 Clay within the glacial till acts as an aquitard to the more discrete permeable sand and gravel lenses and will hinder/prevent large scale groundwater movement in the till. Regionally, groundwater flow will be limited by the variability of these deposits and consequently any groundwater yields are normally low.

10.59 Groundwater storage and movement will occur in the alluvial deposits and be in hydraulic continuity with the water in the adjacent watercourse. It is likely that this groundwater will be perched above the glacial till.

10.60 The BGS Hydrogeology Map of Scotland (**Figure 10.6**) shows that the bedrock geology beneath the site is a low productivity aquifer (Class 2c). The metamorphic rocks contain small amounts of groundwater in the near surface weathered zone and secondary fractures. These are capable of supporting only small water supplies or springs. There is no groundwater aquifer associated with the superficial deposits at site.

10.61 BGS groundwater vulnerability mapping (**Figure 10.7**) classifies the underlying aquifer according to the predominant groundwater flow mechanism (fracture or intergranular) and the estimated groundwater productivity. Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being most vulnerable.

10.62 The vulnerability map confirms that the superficial deposits within the site are not considered a significant aquifer, and that bedrock has a low or very low potential aquifer productivity. The mapping also confirms that the groundwater in the bedrock underlying the site is considered to

have a high vulnerability (Class 4a, 4b and 5), due to the dominance of fracture flow and thin superficial cover. Groundwater in the centre of the site is of slightly higher vulnerability (Class 5) due to the absence of superficial deposits. Groundwater is therefore vulnerable to pollution.

Groundwater Levels and Quantity

10.63 In the absence of published information or data held by SEPA, it is anticipated that limited groundwater will be present as perched groundwater within more permeable horizons (sand and gravels) of the Glacial Till deposits, and within weathered zones, fractures or fault zones within the bedrock deposits.

10.64 All of Scotland's groundwater bodies have been designated as Drinking Water Protected Areas under the Water Environment (Drinking Water Protected Area) (Scotland) Order 2013 and require protection for their current use or future potential as drinking water resources.

10.65 The current status of groundwater bodies in Scotland has been classified by SEPA in accordance with the requirements of the Water Framework Directive (2000/60/EC) (WFD). SEPA identifies one groundwater body that underlies the site: Northern Highlands (SEPA ID 150701), classified in 2020 with an Overall Status of Good and no pressures identified.

Groundwater Dependant Terrestrial Ecosystems

10.66 Areas of potential Groundwater Dependant Terrestrial Ecosystem (GWDTE) are shown on **Figure 10.8.** Areas of high and moderate potential GWDTE are classified by the SEPA Guidance Note LUPS-GU31[1]. A National Vegetation Classification (NVC) survey of the site has been undertaken, the methodology used and the findings are discussed in detail in **Chapter 8 (Ecology)**. The NVC survey has been used to identify area of potential GWDTE in accordance with SEPA's guidance.

10.67 An onsite assessment of potential areas of GWDTE was undertaken in October 2021 by an SLR hydrologist. The findings of that assessment, and consideration of the site geology and hydrogeology described in the preceding sections has been used to complete an assessment of the GWDTE, and in particular whether the potential GWDTE habitats recorded on site are sustained by ground or surface water. This is summarised below:

- areas of moderate potential GWDTE are recorded across the site (M15: Scirpus cespitosus - Erica tetralix wet heath, and M28: Iris Pseudacorus - Filipendula ulmaria mire). Their distribution is not linear, and not for example typical of that associated with a groundwater spring or groundwater emergence;
- areas of high potential GWDTE are recorded across the site (M6: Carex echinata - Sphagnum recurvum mire, M16: Erica tetralix - Sphagnum compactum wet heath, W4: Betula pubescens - Molinia caerulea woodland) and again their distribution is not typical of that associated with a zone of groundwater discharge. Typically, the habitat is recorded adjacent to surface watercourses or on elevated ground with shallow relief;

[1] LUPS-GU31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Version 3, September 2017.

- it has been shown that the site receives a very high annual rainfall (see Site Setting) and that the superficial and solid geology have little potential to allow infiltration or significant groundwater storage or movement. Rainfall onto the site will preferentially form surface water runoff; and
- during the onsite GWDTE assessment there was no evidence of groundwater emergence such as flushes or springs supporting areas of potential moderate or high GWDTE.

10.68 It is concluded that the areas mapped as potential high and moderate GWDTE are not sustained by groundwater but rather are sustained by incident rainfall and surface water runoff. On ground of shallower relief this results in frequent water logging of the soils.

10.69 Accordingly, the buffers to potential GWDTE specified in SEPA guidance need not apply. Safeguards would be required, however, to sustain existing surface water flow paths so that incident rainfall can continue to sustain these habitats (see Assessment of Effects and Embedded Measures).

Hydrology

Local Hydrology

10.70 The site is drained by two main surface water catchments: Allt na h-Eaglaise and Halladale River. The Allt na h-Eaglaise drains the northern extent of the site and is a tributary of the Halladale River. The catchment areas are shown in **Figure 10.1** and each described below.

Allt na h-Eaglaise Catchment

10.71 The Allt na h-Eaglaise has an overall catchment size of 14km^2 (of which c. 2.5km^2 is located within the application boundary). The Allt na h-Eaglaise discharges to Halladale River approximately 1.7km north east of the site.

10.72 The Allt na h-Eaglaise and its tributaries drain the northern extent of the site, including the site access, compounds, borrow pits and Turbines 1 to 5.

Halladale River Catchment

10.73 The Halladale River has an overall catchment size of 262.2km^2 (of which c. 4.9km^2 is located within the application boundary). The Halladale River discharges to the sea approximately 3.5km north-north-east of the site.

10.74 Turbines 6 – 11 are located in this surface water catchment.

Watercourse Crossings

10.75 The proposed development would require eleven watercourse crossings. **Technical Appendix 10.4** presents a schedule of watercourse crossings. The site design has used existing tracks and watercourse crossings where possible: six of the crossings are existing, and five would be new.

Surface Water Flow

10.76 **Table 10-5** presents catchment areas and the key catchment descriptors from the FEH Web Service for the Allt na h-Eaglaise and Halladale River catchments, which can be used to describe the catchments' anticipated response to rainfall.

Table 10-5: Surface Water Catchment Descriptors

Catchment	NGR	Area (km^2)	SAAR (mm)	ALTBAR (mASL)	DPSBAR (m/km)	LDP (km)	BFIHOST (dim)
Allt na h-Eaglaise	NC 89400 62950	13.96	1,016	113	65.30	9.62	0.326
Halladale River	NC 89400 61300	238.70	1,087	166	56.30	34.97	0.296

Note: Grid reference of downstream maximum extent of catchment as denoted by ether the proposed development Application Boundary or confluence with another watercourse; SAAR – surface average annual rainfall between 1961 and 1990; ALTBAR – mean catchment altitude (metres above sea level); DPSBAR – index of catchment steepness; LDP – longest drainage path; BFIHOST - base flow index is a measure of catchment responsiveness to precipitation.

Surface Water Quality

10.77 Water quality of the Allt na h-Eaglaise and Halladale River is monitored by SEPA and classified annually in accordance with the requirements of the Water Framework Directive (WFD). **Table 10-6** provides summary details of the SEPA classifications reported in 2020. Smaller watercourses within the proposed development are not monitored nor classified by SEPA.

Table 10-6: Surface Water Classification Data

Watercourse (SEPA ID)	Overall Status	Overall Ecology	Physico-Chemical Status	Hydromorphology
Allt na h-Eaglaise (20616)	Good	Moderate	High	Moderate
Halladale River (20614)	Good	Poor	Good	Poor

10.78 Both the Allt na h-Eaglaise and Halladale River are recorded to have a Good overall status.

10.79 SEPA identifies pressures on water bodies. Allt na h-Eaglaise and Halladale River both have physical pressures due to modifications to bed, banks, and shores from urban and rural land-uses.

Fisheries

10.80 Fisheries for watercourses that are downstream of the proposed development are managed by the Flow Country Rivers Trust in partnership with The Northern District Salmon Fishery Board. Fishery interests are discussed and assessed within **Chapter 8: Ecology** and **Technical Appendix 8.4: Fish Habitat Survey**.

Flood Risk

10.81 SEPA has developed national flood maps that present modelled flood extents for river, coastal, surface water and groundwater flooding. The river, coastal, surface water and groundwater maps were developed using a consistent methodology to produce outputs for the whole of Scotland, supplemented with more detailed, local assessments where available and suitable for use. Flood extents are presented in three likelihoods:

- High likelihood: A flood event is likely to occur in the defined area on average more than once in every ten years (1:10). Or a 10% chance of happening in any one year;
- Medium likelihood: A flood event is likely to occur in the defined area on average more than once in every two hundred years (1:200). Or a 0.5% chance of happening in any one year; and
- Low likelihood: A flood event is likely to occur in the defined area on average more than once in every thousand years (1:1000). Or a 0.1% chance of happening in any one year.

10.82 The flood risk from each of these potential sources is discussed below.

10.83 Consultation with THC and SEPA has also been conducted and used to inform this assessment. THC confirmed that they hold no historical records of flooding in the area and there are no formal flood schemes developed by the Council in the area.

Flooding from Rivers, or Fluvial Flooding

10.84 SEPA has identified that the Allt na h-Eaglaise floodplain across the site does not extend far from the watercourse. No development is proposed in the published floodplain, and therefore flood risk from this is not considered further.

10.85 SEPA has identified that the Allt na h-Eaglaise outside of the site boundaries and the Halladale River have extensive floodplains. However, neither floodplain extends into the site boundary and both floodplains are at lower elevations than the site. Floodplain elevations are around 10m OD in contrast to the lowest elevation onsite of 40m OD. Flood risk from this source is not considered further.

Flooding from the Sea, or Tidal Flooding

10.86 SEPA has identified that coastal flooding might occur approximately 4.5km inland along the Halladale River. This coastal flooding occurs on the floodplains of the Allt na h-Eaglaise and Halladale River, outside of the site boundary as outlined in paragraphs 10.84 – 10.85 above. Flood risk from this is not considered further.

Flooding from Surface Water

10.87 SEPA has identified several small surface water flood extents within the site, largely coinciding with localised low points within the site. It is noted however, that the flood extents are minor and localised, never forming large or linked areas. Flooding from this source is not therefore considered a development constraint.

Flooding from Groundwater

10.88 The SEPA groundwater flood map illustrates that the site is not at risk from predicted groundwater flooding. This concurs with the desk-based assessment which has shown that there is little potential for significant groundwater at site. Flooding from this source is not considered further.

Flooding from Infrastructure Failure

10.89 SEPA has produced reservoir inundation maps for those sites currently regulated under the Reservoirs Act 1975. Review of the SEPA mapping highlights that there is risk of reservoir inundation along the Halladale River but that this poses no risk to the proposed development. Flooding from this source is not considered further.

Private Water Supplies and Licenced Sites

10.90 As part of this assessment, a data requests were made to THC who provided details of five private water supply (PWS) sources within 5km of the proposed turbine area. This data was supplemented with data from a PWS surveys conducted onsite in October 2021.

10.91 There is one PWS source located with 5km and downstream of the site, at Kirkton Farm. Summary details are provided in **Table 10-7.**

Table 10-7: THC Private Water Supplies within 5km and downstream of the site

THC Unique ID	Private Water Supply Name	Easting	Northing	Classification	Address	Use
44419	PWS Kirkton Farm	289026	961917	Type B Domestic	Kirkton Farm, Melvich, By Thurso, KW14 7YJ	Domestic

10.92 During the site survey it was confirmed that the PWS source is located west of Kirton Farm and is a surface water abstraction from the watercourse discharges from Lochan Coulbackie, located west of the site boundary and the existing commercial forestry. It was also confirmed that the water source supplies Kirkton Cottage (to the north) and Ar Dachaidh (to the south) in addition to the farm.

10.93 No infrastructure forming part of the proposed development is located within the surface water catchment of Lochan Coulbackie or of the PWS source. Limited forest felling will occur in the surface water catchment to the PWS source.

10.94 SEPA has confirmed that there authorisations required under the Water Environment (Controlled Activities) Regulations 2011 (CAR) within 1km of the proposed development, at Kirkton Cottage (CAR/R/1045713) and on the Halladale River (CAR/S/1078440).

Historic Landfills

10.95 As part of this assessment, a data request was made to THC who provided details of one historic landfill within 5km of the area: Melvich Landfill Site, situated at NGR NC 86571 64519, which closed in 1996. The Landfill Site was regulated by a Waste Management Licence authorised by SEPA (Ref: WML/N/50060/M02) since 1997, which was modified in 2002 and 2010. The permitted waste types were inert, domestic, commercial and industrial. This historic landfill is located downstream of the site and poses no risk to the proposed development.

Summary of Sensitive Receptors

10.96 **Table 10-8** outlines the receptors identified by the baseline study, and their sensitivity based upon the criteria contained in **Table 10-2**. These receptors form the basis of the assessment, and as per the previously introduced methodology, are used in conjunction with an estimate of the magnitude of an effect to determine significance.

10.97 As described in the preceding text no geological designated sites have been confirmed as potentially at risk from the proposed development and therefore are not carried forward in this assessment.

Table 10-8: Summary of Identified Receptors

Receptor	Sensitivity	Reason for Sensitivity
Statutory Designated Sites	High	West Halladale SSSI, Caithness and Sutherland Peatlands SPA, SAC, and Ramsar are located immediately adjacent to the western site boundary and within a small area in the north-west of the site and contain habitats which are water dependent.
Soils	High	Sensitive peat soils have been recorded within the proposed development.
Groundwater	High	Groundwater has been classed by SEPA as Good Status and vulnerability as High. All of Scotland's groundwater bodies have been designated as Drinking Water Protected Areas.
Surface Water	High	Surface water watercourses have been classified by SEPA as Good.
Flooding	Low	No significant risk of flooding has been identified. It is recognised that the proposed development, without appropriate design, could increase flood risk downstream of the site.
Private Water Supplies	High	Whilst there is no PWS source within the water catchments that drain the proposed infrastructure. The felling of the forestry in the north-west of the site will occur in a small proportion of the water catchment to the PWS source to Kirkton Farm, Kirkton Cottage and Ar Dachaidh.
GWDTE	Low	It is concluded that areas of potential GWDTE are sustained by incident rainfall and surface water runoff rather than by groundwater. Measures would be required to sustain surface water flow paths to maintain these habitats.

Cumulative Situation

10.98 There are no known proposed wind farm developments within the same hydrological catchments as the proposed development nor within 5km upstream/downstream of any proposed infrastructure. Any developments which are outwith this study area are not considered.

Operational Period Baseline Changes Considered (Future Baseline)

10.99 Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside slightly higher average temperatures. This suggests that there may be greater pressures on water supplies and water levels in summer months in the future. In addition, summer storms are predicted to be of greater intensity. Therefore, peak fluvial flows associated

with extreme storm events may also increase in volume and velocity. These potential changes are considered in the assessment of effects.

ASSESSMENT OF EFFECTS

Embedded Measures

10.100 The proposed development has undergone design iterations and evolution in response to the constraints identified as part of the baseline studies and field studies so as to avoid and/or minimise potential effects on receptors where possible. This has included geological, hydrological and hydrogeological constraints which include areas of deep peat, slope stability, watercourse locations, areas of potential flooding, and groundwater dependent terrestrial ecosystems. Details of the embedded mitigation are given below.

Buffer to Watercourses

10.101 In accordance with SEPA's PPG5 (Works in, Near or Over Watercourses, V1.2, February 2018), a buffer distance between watercourses and any proposed construction activities or infrastructure was applied to those watercourses within the site. The 50m buffer applied is in excess of the PPG guidance. The only exceptions are the proposed substation compound (including battery storage), which is located on elevated ground above the nearest watercourse, and the temporary construction compound, which would be restored following construction of the proposed development. Both the substation compound and temporary construction compound lie just within the 50m watercourse buffer, and have been cited in these locations here in response to other constraints identified on site, including, landscape, ecology and access.

10.102 The layout of the access tracks was designed to minimise the number of new watercourse crossings across the site. The proposed development would require five additional watercourse crossings of the Allt na h-Eaglaise, and tributaries of Allt na h-Eaglaise and Halladale River.

Peat

10.103 The presence of peat within the site formed a key consideration in the design of the proposed development. Informed by the extensive programme of peat probing undertaken across the site, the design has avoided areas of deeper peat and limited development to small areas of shallow peat or where peat is absent.

Peat Management

10.104 A detailed review of the distribution and depth of peat at the site is contained in **Technical Appendix 10.1: PLHRA**.

10.105 As shown in **Technical Appendix 10.2: PMP**, the site design has avoided areas of deep peat and only very limited amounts of peat would be encountered by the proposed development which can be readily managed and accommodated within the site layout without significant environmental impact. No surplus peat would be generated and the limited volumes of peat generated from the proposed excavations would be used to reinstate track verges, turbine bases, crane hardstandings and restoration of onsite borrow pits.

Peat Landslide Hazard

10.106 A Design and Geotechnical Risk Register (referred to in Section 3.2 of **Technical Appendix 3.1: Outline CEMP**) would be compiled to include risks relating to peat instability, as this would be beneficial to both the developer and the Contractor in identifying potential risks that may be involved during construction.

10.107 Good construction practice and methodologies to prevent peat instability within areas that contain peat deposits are identified in the PLHRA. These include:

- measures to ensure a well-maintained drainage system, to include the identification and demarcation of zones of sensitive drainage or hydrology in areas of construction;
- minimisation of 'undercutting' of peat slopes, but where this is necessary, a more detailed assessment of the area of concern would be required;
- careful micrositing of turbine bases, crane hardstandings and access track alignments to minimise effects on the prevailing surface and sub-surface hydrology;
- raising peat stability awareness for construction staff by incorporating the issue into the site induction (e.g. peat instability indicators and good practice);
- introducing a 'Peat Hazard Emergency Plan' to provide instructions for site staff in the event of a peat slide or discovery of peat instability indicators;
- developing methodologies to ensure that degradation and erosion of exposed peat deposits does not occur as the break-up of the peat top mat has significant implications for the morphology, and thus hydrology, of the peat (e.g. minimisation of off-track plant movements within areas of peat);
- developing robust drainage systems that would require minimal maintenance; and
- developing drainage systems that would not create areas of concentrated flow or cause over/under-saturation of peat habitats.

10.108 Notwithstanding any of the above good construction practices and methodologies, detailed design and construction practices would need to take into account the particular ground conditions and the specific works at each location throughout the construction period. An experienced and qualified engineering geologist/geotechnical engineer would be appointed as a supervisor, to provide advice during the setting out, micrositing and construction phases of the proposed development. Further, the good practice measures and methodologies will be included in the in the final site CEMP and PMP that will be approved by THC post-consent and as part of a condition to the deemed planning permission.

Groundwater Dependent Habitats

10.109 SEPA's wind farm planning guidance states a National Vegetation Classification (NVC) survey should be undertaken to identify wetland areas that might be dependent on groundwater. If potential GWDTE are identified within (a) 100m of roads, tracks and trenches, or (b) within 250m of borrow pits and foundations, then it is necessary to assess how the potential GWDTE may be affected by the proposed development.

10.110 This guidance has been used to inform the site design and the proposed turbines and associated infrastructure has been located so as to minimise potential effects on areas of possible GWDTE. An assessment of GWDTE is presented in this Chapter. **Figure 10.8** shows area of potential GWDTE and the proposed development.

10.111 It is concluded that areas of potential GWDTE are sustained by incident rainfall and surface water runoff rather than by groundwater.

10.112 Measures have been proposed to safeguard existing water flow paths and maintain existing water quality. It is considered therefore that the water dependent habitats identified by the NVC mapping can be sustained. This would be confirmed, in accordance with good practice, by the Ecological Clerk of Works (ECoW) at the time of the construction of the proposed development.

Good Practice Measures

10.113 Good practice measures would be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes. This would form part of the CEMP: **Technical Appendix 3.1: Outline CEMP** to be implemented for the proposed development, The CEMP will be approved by THC post consent as part of a condition to the deemed planning permission.

10.114 The applicant is committed to implementing good practice measures as a matter of course during the construction of the proposed development and these are not considered to be mitigation measures but form an integral part of the design/construction process. Key good practice measures are stated below and the assessment incorporates these measures as part of the proposed development. Any further specific mitigation which may be required to reduce the significance of a potential effect is identified in the assessment of likely effects.

General Measures

10.115 As a principle, preventing the release of any pollution/sediment is preferable to dealing with the consequences of any release. There are several general measures which cover all effects assessed within this Chapter, details are given below.

10.116 Prior to construction, section specific drainage plans would be produced. These would take into account any existing local drainage which may not be mapped and incorporate any section specific mitigation measures identified during the assessment.

10.117 Measures would be included in the final CEMP for dealing with pollution/sedimentation/flood risk incidents and would be developed prior to construction. This would be adhered to should any incident occur, reducing the effect as far as practicable.

10.118 The final CEMP would contain details on the location of spill kits; identify 'hotspots' where pollution may be more likely to originate from; provide details to site personnel on how to identify the source of any spill; and state procedures to be adopted in the case of a spill event. As identified in the outline CEMP, a specialist spill response contractor would be identified to deal with any major environment incidents.

10.119 A wet weather protocol would be developed. This would detail the procedures to be adopted by all staff during periods of heavy rainfall. Toolbox talks would be given to

engineering/construction/supervising personnel. Roles would be assigned to site staff and the inspection and maintenance regimes of sediment and runoff control measures would be adopted during these periods. In extreme cases, this protocol would dictate that work onsite may have to be temporarily suspended until weather/ground conditions allow.

Water Quality Monitoring

10.120 The catchments of the Allt na h-Eaglaise and Halladale River have been highlighted as being at risk of potential construction effects due to the nature of works within the catchments as well as their high sensitivity. Water quality monitoring before and during the construction phase would be undertaken to ensure the proposed development has no significant impacts to water quality and/or water quantity in the main water channels. Monitoring would be carried out at a specified frequency (depending upon the construction phase) in these catchments.

10.121 This monitoring would continue throughout the construction phase and immediately post construction. Monitoring would be used to allow a rapid response to any pollution incident as well as assess the impact of good practice or remedial measures. Monitoring frequency would increase during the construction phase if remedial measures to improve water quality were implemented. Water quality monitoring plans would be developed during detailed design (SEPA, THC, Flow Country Rivers Trust and The Northern District Salmon Fishery Board would be consulted on the plan) and would be contained within the Construction Management Plan.

10.122 The performance of the good practice measures would be kept under constant review by the water monitoring schedule, based on a comparison of data taken during construction with a baseline data set, sampled prior to the construction period.

Pollution Risk

10.123 Good practice measures in relation to pollution prevention would include the following:

- refuelling would take place at least 50m from watercourses and where possible it would not occur when there is risk that oil from a spill could directly enter the water environment. For example, during periods of heavy rainfall or when standing water is present would be avoided;
- foul water generated onsite would be managed in accordance with PPG4 (Treatment and Disposal of Wastewater where there is no Connection to the Foul Sewer, October 2017);
- a vehicle management plan and speed limit would be strictly enforced onsite to minimise the potential for accidents to occur;
- drip trays would be placed under stationary vehicles which could potentially leak fuel/oils;
- areas would be designated for washout of vehicles which are a minimum distance of 50m from a watercourse;
- washout water would also be stored in the washout area before being treated and disposed of;
- if any water is contaminated with silt or chemicals, runoff would not enter a watercourse directly or indirectly prior to treatment;
- water would be prevented as far as possible, from entering excavations such as borrow pits;

- procedures would be adhered to for storage of fuels and other potentially contaminative materials in line with the Controlled Activity Regulations, to minimise the potential for accidental spillage; and
- a plan for dealing with spillage incidents would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMP for the Development.

Erosion and Sedimentation

10.124 Good practice measures for the management of erosion and sedimentation would include the following:

- all stockpiled materials would be located outwith a 50m buffer from watercourses;
- where possible, stockpiled material would either be seeded or appropriately covered;
- water would be prevented, as far as possible, from entering excavations such as borrow pits through the use of appropriate cut-off drainage;
- where the above is not possible, water that enters a borrow pit would pass through a number of settlement lagoons and silt/sediment traps to remove silt prior to discharge into the surrounding drainage system. Detailed assessment of ground conditions would be required to identify locations where settlement lagoons would be feasible;
- clean and dirty water onsite would be separated, and dirty water would be filtered before entering the water environment;
- if the material is stockpiled on a slope, silt fences would be located at the toe of the slope to reduce sediment transport;
- the amount of ground exposed, and time period during which it is exposed, would be kept to a minimum and appropriate drainage would be in place to prevent surface water entering deep excavations, specifically borrow pit excavations;
- a design of drainage systems and associated measures to minimise sedimentation into natural watercourses would be developed - this may include silt traps, check dams and / or diffuse drainage;
- silt/sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible; and
- construction personnel and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas.

Fluvial Flood Risk and Watercourse Crossings

10.125 It is proposed to adopt Sustainable Drainage Systems (SuDS) as part of the proposed development. SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of runoff that might have been experienced at site prior to development. Good practice in

relation to the management of surface water runoff rates and volumes and potential for localised fluvial flood risk would include the following:

- drainage systems would be designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse;
- onsite drainage would be subject to routine checks to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding;
- appropriate drainage would attenuate runoff rates and reduce runoff volumes to ensure minimal effect upon flood risk;
- where necessary, check dams would be used within cable trenches in order to prevent trenches developing into preferential flow pathways; and
- as per good practice for pollution and sediment management, prior to construction, section specific drainage plans would be developed and construction personnel made familiar with the implementation of these.

10.126 Further information on ground conditions and drainage designs would be provided in the final CEMP.

10.127 The design of new watercourse crossings would be agreed with SEPA prior to construction as required by CAR. The crossings would be designed to have a water conveyance capacity of at least the 1 in 200-year flood event.

10.128 The structural integrity of the existing culverts that will be retained to afford site access will be assessed prior to any construction and any maintenance or replacement works recorded. As above, any required works would be undertaken with approval and authorisation from SEPA.

Water Abstractions

10.129 Abstraction of water for construction activities is proposed from a suitable source yet to be identified. An application for a CAR Licence would be made to SEPA and managed through the regulation of the CAR Licence. Should a suitable source not be identified, a water bowser would be used. Good practice that would be followed in addition to the CAR Licence regulations includes:

- water use would be planned so as to minimise abstraction volumes;
- water would be re-used where possible;
- abstraction volumes would be recorded; and
- abstraction rates would be controlled to prevent significant water depletion in a source.

Potential Construction Effects

Pollution Risk

10.130 During the construction phase, there is the potential for a pollution event to affect surface water and local groundwater bodies impacting on their water quality. This would have a negative effect on the receptor and the resulting degradation of the water quality.

10.131 Pollution may occur from excavated and stockpiled materials during site preparation and excavation of borrow pits. Contamination of surface water runoff from machinery, leakage and spills of chemicals from vehicle use and the construction of hardstanding also have the potential to affect surface water bodies. Potential pollutants include sediment, oil, fuels and cement.

10.132 The risk of a pollution incident occurring would be managed using good practice measures as detailed in the Embedded Mitigation above. Many of these practices are concerned with undertaking construction activities away from watercourses and identifying safe areas for stockpiling or storage of potential pollutants that could otherwise lead to the pollution of watercourses.

10.133 The baseline assessment has shown that the proposed development is located in the catchments of Allt na h-Eaglaise and Halladale River which are considered high sensitivity receptors. Surface water has also been shown to support PWS abstractions, which are also considered a sensitive receptor.

10.134 After consideration of good practice measures, the magnitude of impact of a pollution event within the Allt na h-Eaglaise and Halladale River catchments, or of impairing water quality, is considered Negligible following adherence to good practice and site-specific mitigation measures.

10.135 The potential effect of a negligible magnitude impact on those hydrological receptors of High sensitivity would be of **Negligible significance**. No further mitigation measures are therefore required.

10.136 The groundwater bodies extending beyond the study area are very large when compared to the area of proposed development. Any effects are judged not to be detectable beyond the study area. Potential pollution events occurring during the construction of the turbines, borrow pits or any hardstanding would have a negligible impact magnitude as they would be controlled by good practice measures and would be subject to some attenuation in the soils before reaching groundwater. Should pollutants reach the groundwater, the scale of the effect would be low in relation to the overall groundwater body. The effect to groundwater, which has been assigned a High sensitivity, is therefore assessed as having **Negligible** significance. No further mitigation measures are required.

Erosion and Sedimentation

10.137 Site traffic during the construction phase has the potential to cause erosion and increase in sedimentation loading during earthworks, and due to increased areas of hardstanding and such features as stockpiles, tracks and borrow pits, etc., which could be washed by rainfall or overwhelm site mitigation, into surface water features. This has the potential to reduce the surface water

quality, increase turbidity levels, reduce light and oxygen levels and effect ecology including fish populations.

10.138 Excavation of borrow pits, construction of hardstanding, diversion of drainage channels and use of water crossings are the key sources of sediment generation. Adherence to good practice measures would ensure that any material generated is not transported into nearby watercourses.

10.139 Location specific good practice measures would be in place for sediment control for each of the borrow pits to control the amount of fine sediment that could potentially enter a watercourse if not managed appropriately. These measures would be dependent upon the final borrow pit designs and stone quality, but would potentially include cut-off drainage, sediment traps, sediment lagoons and flocculation stations.

10.140 Similar good practice measures to those applied at the borrow pit locations would be required around the track construction activities.

10.141 After consideration of good practice measures, the magnitude of impact to the receptors is assessed as negligible and therefore with the High sensitivity receptors described above, the significance of effect without mitigation is assessed as **Negligible** and no further mitigation measures are required.

Fluvial Flood Risk

10.142 Construction of hardstanding including the construction compound and turbine bases would create impermeable surface areas. This would lead to a relatively small increase in the total impermeable surface area of the site causing negligible increases in runoff rates and volumes within the Allt na h-Eaglaise and Halladale River catchments.

10.143 The permanent effect of the increase in impermeable surface area is assessed during the operational phase to avoid any double counting of effects. The construction phase includes the effects of temporary increases in impermeable area and temporary drainage diversions during the construction phase.

10.144 The proposed development would require five additional watercourse crossings of the Allt na h-Eaglaise, and tributaries of Allt na h-Eaglaise and Halladale River.

10.145 The drainage design would ensure management of any increase in runoff volumes for a 200-year return period at the detailed design stage. During the construction phase, the good practice measures would be in place to prevent materials entering watercourses and to ensure that man-made drains and blockages do not lead to bank erosion and localised flooding.

10.146 Adherence with good practice measures including appropriate drainage design and compliance with the final CEMP would limit potential effects to being local and short duration and of negligible magnitude.

10.147 Rainwater and limited groundwater ingress that collects in the turbine excavations during construction would be stored and attenuated prior to controlled discharge to ground adjacent to the excavation.

10.148 Attenuation of runoff generated within the proposed turbine excavations would allow settlement of suspended solids within the runoff prior to discharge in accordance with 'Site control' component of the SuDS 'management train'.

10.149 Where possible, it is proposed to develop the borrow pits with a fall on the floor of the pits which falls away from the edge of the pit. This would ensure that all surface water runoff generated on the floor of the pit during construction would be contained within the pit prior to controlled disposal by pump or gravity (in a cut trench with granular fill) under supervision of the ECoW.

10.150 If necessary, a shallow open drain would be developed around the pit rim to prevent surface water inflow to the borrow pits. This drain would route the drainage around the pit and thus maintain the pre-development drainage paths.

10.151 Water in the borrow pits would be managed in accordance with SuDS techniques. Attenuating runoff within the borrow pits would provide an opportunity for any suspended solids within the runoff to settle within the pit prior to controlled and pumped discharge from the pit.

10.152 The potential effect of a short-term increase in runoff on the hydrological receptors is therefore assessed of **Negligible** significance. No further mitigation is therefore required.

10.153 The magnitude of the increase in impermeable area is not sufficient to have a measurable effect on groundwater levels, therefore groundwater flood risk is not considered in this assessment.

Infrastructure and Man-made Drainage

10.154 During the construction period, drainage would be required to ensure construction areas are workable and not saturated. In particular drainage, some of which would be temporary, would be required around turbine working areas, the construction compound and borrow pits to manage surface flows. Excavation of turbine foundations may require temporary de-watering for the period of the foundation build. These drainage activities may lead to temporary changes in the water table surrounding these construction activities (where de-watering is required below the level of the natural water-table).

10.155 As construction of proposed infrastructure is required through the buffers associated with potential GWDTEs, there is potential to disrupt water contributions to these habitats. However, as it is concluded that the potential GWDTEs are sustained by rainfall and surface water runoff, the buffers to potential GWDTE specified in SEPA LUPS-GU31 guidance need not apply.

10.156 Excavations associated with construction works (e.g. cut tracks, turbine bases foundations, cable trenches, borrow pits etc.) can result in local lowering of the water table. This is an important consideration in areas of peat deposits, where the water table is characteristically near the ground surface (e.g. where the excavations are likely to intercept the groundwater table).

10.157 Dewatering associated with construction of turbine foundations is temporary and dewatering following construction would not be required. Cable laying, without appropriate mitigation measures, can also lower high groundwater levels and provide a preferential drainage route for groundwater movement that can lead to local and permanent drying of soils/superficial deposits and/or water supplies.

10.158 The design of the proposed development has avoided areas of high ecological or habitat interest wherever possible. Furthermore, the bedrock has little groundwater and therefore limited or little dewatering is likely to be required. There remains potential however, for local dewatering of soils near cable trenches, turbine bases and borrow pits, without incorporation of mitigation measures.

10.159 Peat has a very low bulk permeability which means the extent of dewatering of peat where intercepted by an excavation is very small and limited to the area immediately adjacent to the excavation. Also, as a consequence of the low bulk permeability, the volume of water seepage from peat into an excavation is small. Notwithstanding this, it is recognised that peat and organic rich soils are a valuable resource, and the measures proposed for the collection of water in excavations and the local discharge of this to habitat adjacent to the excavation under the supervision of the site ECoW would ensure that (a) the extent of any temporary dewatering is minimised, and (b) peat and organic soils do not dry.

10.160 As described above a large volume of water ingress from soils, peat or groundwater is not anticipated given the proven ground conditions. This would be confirmed by the site investigation (investigative boreholes and trial pits) at the proposed turbines and borrow pits and which would be undertaken to inform the detailed site design and prior to any construction. The investigation would include water level monitoring and permeability or infiltration capacity testing of the soils and geology if water ingress was witnessed. This investigation would ensure that appropriate temporary drainage was specified in the CEMP and deployed at site to ensure dewatering of soils and peat does not occur.

10.161 The sensitivity of West Halladale SSSI, Caithness and Sutherland Peatlands SPA, SAC, and Ramsar, soils and groundwater have all been assessed as High. Without mitigation the magnitude of impact is assessed as negligible and therefore the potential significance of effect of changing groundwater levels and flow due to dewatering is considered **Negligible** and requires no further mitigation.

10.162 The potential effect of the proposed development on organic soils, peat, groundwater and areas of GWDTE is not considered to change during the operation of the proposed development and therefore has not been considered under operational effects.

Water Abstraction

10.163 During the construction of the proposed development, water may be required for uses such as dust suppression and vehicle washing. The volume of water and mitigation required would be regulated through the CAR and therefore the magnitude of an effect on groundwater-surface water interactions is considered negligible. The significance of effect is therefore **Negligible**.

Peat Landslide Hazard

10.4 A detailed review of potential peat slide risk and appropriate mitigation is presented in **Technical Appendix 10.1: PLHRA**.

10.5 During the construction phase there is potential from the siting of turbines and other site infrastructure for the instability, removal or loss of soils. The magnitude of impact is negligible due to the careful micrositing that has occurred during the site design and therefore the significance of effect to potential soils, geology (including peat), groundwater and surface water receptors is assessed as **Negligible** and requires no further mitigation.

Proposed Mitigation

10.164 As there are no predicated significant effects under the terms of the EIA Regulations, other than the good practice measures that the developer would implement as standard (and as described above), no specific mitigation during construction is required.

Residual Effects

10.165 No significant residual effects on identified receptors are predicted during the construction period of the proposed development.

Potential Operational Effects

10.166 During the operational phase of the proposed development, it is anticipated that routine maintenance of infrastructure and tracks would be required across the site. This may include work such as maintaining tracks, drainage and turbine maintenance.

10.167 Should any maintenance be required onsite during the operational life of the project which would involve construction type activities; mitigation measures would be adhered to along with the measures in the CEMP to avoid potential effects.

Pollution Risk

10.168 The possibility of a pollution event occurring during operation is very unlikely. There would be a limited number of vehicles required onsite for routine maintenance and the developer's operational presence. Storage of fuels/oils onsite would be limited to the hydraulic oil required in turbine gearboxes and this is bunded in accordance with best practice to prevent fluid escaping.

10.169 Based upon this, the potential risk associated with frequency, duration and likelihood of a pollution event is low. It is therefore anticipated that the magnitude of a pollution event during the operational phase of the proposed development would be negligible, as no detectable change would likely occur. Therefore, the significance of effect for a pollution event during the operational phase of the development is predicted to be **Negligible** for all receptors. No mitigation is therefore required.

Erosion and Sedimentation

10.170 During the operation of the proposed development, it is not anticipated that there would be any excavation or stockpiled material, reducing the potential for erosion and sedimentation effects.

10.171 Immediately post-construction, newly excavated drains and track dressings may be prone to erosion as any vegetation would not have matured. Appropriate design of the drainage system, incorporating sediment traps, would reduce the potential for the increased delivery of sediment to natural watercourses. Potential effects from sedimentation or erosion during the operational phase are considered to come from linear features on steeper slopes, where velocity in drainage channels is higher. Immediately post-construction, flow attenuation measures would remain and be maintained to slow runoff velocities and prevent erosion until vegetation becomes established.

10.172 The likelihood, magnitude and duration of a potential erosion and sedimentation event occurring within the surface water catchments would be negligible following adherence to good practice measures. Therefore, the potential significance of effect on identified receptors is of **Negligible** significance. No mitigation is therefore required.

10.173 Should any non-routine maintenance be required at the sections of track crossing wet areas (defined visually onsite by a contractor or operational personnel) there would be potential for erosion and sedimentation effects to occur due to the existence of disturbed material. Should this type of activity be required, then the good practice measures as detailed for the construction phase would be required on a case-by-case basis. Extensive work at water crossings/adjacent to the water environment may require approval from SEPA under the CAR (depending upon the nature of the activity).

Fluvial Flood Risk

10.174 The risk of an effect on fluvial flood risk arises as a result of a potential restriction of flow at a permanent water crossing following intense rainfall. In accordance with good practice, routine inspection and clearing of the culverts at site would be undertaken, thereby reducing the likelihood of a blockage occurring. In the unlikely event of a blockage any flooding would be localised and the magnitude of impact is assessed as negligible, and thus the significance of effect is assessed as **Negligible**, and no further mitigation is required.

Infrastructure and Man-made Drainage

10.175 Operation of the proposed development requires limited activities relative to the construction phase. The presence of access tracks and hardstanding, as opposed to their construction, may affect the potential infiltration and groundwater conditions as well as the sub-surface flow paths around the infrastructure. In addition, cabling and crane hardstanding would also remain in situ to serve the proposed development.

10.176 Drainage would be required to service new sections of access track. This could also potentially alter water levels in organic soils and peat, as well as groundwater levels and recharge. The dispersed nature of new drainage, coupled with good practice, means that the magnitude of the predicted effect of an alteration to drainage and the saturation of soils and peat and of the groundwater body can be considered negligible. This magnitude level has been determined principally through the fact that any change is unlikely to be detectable through monitoring and the associated track drainage remaining during operation is likely to be less than 1m deep.

10.177 The magnitude of a potential effect on soils, peat and groundwater and sub-surface flows as a result of permanent hardstanding and associated drainage would be negligible. The significance of effect is **Negligible**. No further mitigation is required.

Proposed Mitigation

10.178 As there are no predicated significant effects under the terms of the EIA Regulations, other than the good practice measures that would be implemented as standard, no specific mitigation during operation is required.

Residual Effects

10.179 No significant residual effects on identified receptors are predicted during the operational period of the proposed development.

Potential Decommissioning Effects

10.180 Decommissioning of the proposed development would not result in any additional potential effects that are not considered by the construction and operational phase of the development.

10.181 The best practice measures identified for the construction and operational phases would also be used for the decommissioning phase of the development and would be used to safeguard soils, geology, PWS, surface water and groundwater.

10.182 As a result the magnitude of potential effect on identified receptors is negligible. The significance of effect therefore **Negligible**.

10.183 Further detail on decommissioning is provided in **Chapter 3: Description of Development**.

Proposed Mitigation

10.184 As there are no predicated significant effects under the terms of the EIA Regulations, other than the good practice measures that would be implemented as standard, no specific mitigation during decommissioning is required.

Residual Effects

10.185 No significant residual effects on soils, geology surface water or groundwater receptors are predicted during the decommissioning phase of the proposed development.

Cumulative Effects

10.186 There are no wind farm developments within the cumulative assessment Study Area. No cumulative effect would therefore occur and no mitigation is required.

STATEMENT OF SIGNIFICANCE

10.187 An assessment of the potential effects of the proposed development on hydrology, hydrogeology, geology and soils within a defined study area (comprising land within 1km of the site boundary) has been undertaken and no *significant* impacts in terms of the EIA Regulations have been identified.

10.188 The assessment has considered the construction, operational, and decommissioning phases of the proposed development.

FURTHER SURVEY REQUIREMENTS AND MONITORING

10.189 This Chapter has demonstrated that the proposed development is not likely to have any significant effects on the study area's hydrology, hydrogeology geology or soils (including peat). The lack of

significant effects relates primarily to the proposed 'Good Practice Measures' and the iterative design process (**Chapter 2: Site Description and Design Evolution**), which effectively act as 'designed-in' mitigation. No other further surveys or monitoring is considered necessary to complete this assessment.

10.190 The following monitoring requirements have been confirmed:

- a programme of water monitoring would be required prior to any construction activity and during construction of the proposed development. The monitoring programme would be agreed with THC, SEPA and Flow Country Rivers Trust in partnership with The Northern District Salmon Fishery Board;
- a Design and Geotechnical Risk Register would be compiled to include risks relating to peat instability, as this would be beneficial to both the developer and the Contractor in identifying potential risks that may be involved during construction. Areas of potential risk would be subject to routine inspection; and
- an ECoW would supervise activities on site and monitor the efficacy of the drainage, erosion and pollution control measures and ensure that receptors identified in this assessment, including saturation of soils (inc. peat), ground and surface water quality, are not impaired as a consequence of the proposed development.

REFERENCES

British Geological Survey (BGS) (1998). Hydrogeological Map of Scotland.

BGS Onshore GeoIndex. Available online from: http://mapapps2.bgs.ac.uk/geoindex/home.html [Accessed 9th August 2021]

BGS (2019). Hydrogeology 625K. Available online from: https://www.bgs.ac.uk/products/hydrogeology/maps.html [Accessed 9th August 2021]

Centre for Ecology and Hydrology Flood Estimation Handbook Web Service available online from: https://fehweb.ceh.ac.uk/ [Accessed 9th August 2021]

Construction Industry Research and Information Association (CIRIA) (1997). *Ground Engineering Spoil: Good Management Practice.* CIRIA Report 179.

CIRIA (2005). *Environmental Good Practice on Site* C650.

CIRIA (2006). *Control of Water Pollution from Linear Construction Projects – Technical Guidance*. C648.

CIRIA (2015). *The SUDS Manual.* C753.

EC Water Framework Directive (2000/60/EC) (2000). *Water Environment and Water Services (Scotland) Act 2003, and Water Environment (Controlled Activities) Regulations 2011.*

Forestry Commission (2006). *Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume/Low Cost Roads on Peat*.

Forestry Commission (2011). *Forests and Water – UK Forestry Standard Guidelines.*

Forestry Commission (2014). *Forestry and Surface Water Acidification*.

Institution of Civil Engineers (2001). *Managing Geotechnical Risk: Improving Productivity in UK Building and Construction*.

James Hutton Institute (2019). *1:25 000 Soil Map of Scotland (Partial cover)*. Available online from: https://www.hutton.ac.uk/learning/natural-resource-datasets/soilshutton/soils-maps-scotland/download#soilmapdata [Accessed 9th August 2021]

Natural England (2019). Magic Map. Available online from: https://magic.defra.gov.uk/ [Accessed 9th August 2021]

Scottish Executive (2005). *Scottish Roads Network Landslides Study Summary Report*.

Scottish Government (2014). *Scottish Planning Policy* (SPP).

Scottish Government (2007a). *Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments*.

Scottish Government (2007b). *Surface Waters (Fishlife) (Classification) (Scotland) Direction 1999 and 2007*.

Scottish Government (2003). *Water Environment and Water Services (Scotland) Act 2003*.

Scottish Natural Heritage (2001). SEPA, Scottish Government and The James Hutton Institute (2011). *Developments on Peatland – Site Surveys and Best Practice*.

Scottish Renewables and Scottish Environment Protection Agency (SEPA) (2012). *Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste*.

Scottish Renewables, SNH, SEPA, Forestry Commission Scotland, Historic Environment Scotland and Marine Scotland Science (2019). *Good Practice during Windfarm Construction*. 4th Edition.

SEPA (2010). *SEPA Regulatory Position Statement - Developments on Peat.*

SEPA (2014). *Land Use Planning System – SEPA Guidance Note 7*.

SEPA (2017a). *Land Use Planning System Guidance Note 31*.

SEPA (2017b) Water Environment Hub. Available online from: https://www.sepa.org.uk/data-visualisation/water-classification-hub [Accessed 9th August 2021]

SEPA (2017). PPG4 - Treatment and Disposal of Wastewater where there is no Connection to the Foul Sewer.

SEPA (2018a). Indicative River and Coastal Flood Map (Scotland). Available online from: www.sepa.org.uk/flooding/mapping/index.htm [Accessed 9th August 2021]

SEPA (2018). PPG5 - Works in, Near or Over Watercourses, V1.2.

SEPA (2018b). Reservoirs Inundation Map. Available online from: http://map.sepa.org.uk/reservoirsfloodmap/Map.htm [Accessed 9th August 2021]

SNH (2019). Sitelink. Available online from: https://cagmap.snh.gov.uk/website-maps/sitelink_map_search/index.html [Accessed 9th August 2021]