

Hydrology, Hydrogeology, Geology & Soils

Relevant Legislation and Guidance

The assessment will be undertaken in accordance with the following relevant legislation and guidance:

- EC Water Framework Directive (2000/60/EC).
- Water Environment and Water Services (Scotland) Act 2003.
- Water Environment (Controlled Activities) Regulations 2011.
- Land Use Planning System – SEPA Guidance Note 31 (Guidance on Assessing Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems), Version 3, SEPA, 11/09/2017.
- Good Practice during Windfarm Construction. A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland and Historic Environment Scotland, Version 4, 2019.
- Control of Water Pollution from Linear Construction Projects – Technical Guidance, C648, CIRIA, 2006.
- Environmental Good Practice on Site C692, CIRIA, 2010.
- Peat Landslide Hazard and Risk Assessments. Best Practice for Proposed Electricity Generation Developments. 2nd Edition April 2017. Prepared for Energy Consents Unit (ECU) Scottish Government.
- Scottish Government (2014). Guidance on Development on Peatland – Site Surveys.

Baseline

The underlying geology identified by British Geological Survey Sheet 15W (New Cumnock Solid and Drift) is the Kirkcolm Formation (a turbidite sequence of medium to thin bedded quartzose greywacke sandstones with some thick siltstone intercalations).

A fault is recorded trending northeast-southwest across the southern part of the Site. This fault influences the underlying solid geology. To the south of the fault lies the Portpatrick Formation (medium-and coarse-grained greywacke sandstones), to the north the Moffat Shale Group (Black and dark grey silty mudstones, with thin chert beds) and Kirkcolm Formation.

No Coal Measures are recorded beneath the Site. The overlying superficial deposits are recorded as glacial till and peat. Superficial deposits are recorded as absent on the highest hills.

The proposed Development is located in the Solway Tweed River Basin District - River Nith and River Dee Catchments. The northern site area, as well as most of the southern area, is located within the catchments of the Euchan Water and Scuar Water which are tributaries of the River Nith. The River Nith is classified as possessing 'Good' ecological status and a chemical status of 'Pass'. The River Nith also has associated protection for fish under the Fresh Water Fisheries Directive (2006) for salmon.

The southern area to the west of Polskeoch is located within the catchment of the Water of Ken, a tributary of the River Dee which is classified as possessing 'Bad' ecological status and a chemical status of 'Pass'. The River Dee also has associated protection for fish under the Fresh Water Fisheries Directive (2006) for salmon.

The groundwater unit located under most of the hydrological study area is identified as the Nithsdale bedrock and localised sand and gravel aquifers, which is classified as having 'Good' chemistry status and having a 'Good' quantitative status.

The Site lies within an area identified as having the potential for peat on the SNH Carbon and Peatland database, having a mixture of peat soil and mineral soil (class 4 and class 5). The Soils map of Scotland further identifies this

potential for the Site to contain peat by identifying a mix of blanket peats, peaty gleys and peaty podzols within the proposed Development boundary.

Preliminary survey work undertaken in 2013 has also confirmed the presence of peat on the Site with deep peat primarily located on the central area. Although peat or peaty soils are developed across most of the Site, the potential development of peat on the steeper slopes has been proven to be limited. It is also recognised that peat on parts of the Site may have been degraded by commercial forestry operations. Additional peat depth probing is proposed and will be used to inform the emerging site design.

Potentially Significant Effects

Having regard to the nature of the proposed Development, key baseline characteristics and proposed embedded mitigation measures, it is considered that the following have the potential for significant environmental effects during the construction and operation phases of the proposed Development and therefore require further consideration through the EIA process:

- Pollution risk, including potential impact on surface water and groundwater quality and public and private water supplies;
- Erosion and sedimentation which could give rise to potential impact on surface water and groundwater quality, and private water supplies;
- 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 connection between groundwater and surface water and potential reduction in baseflow to surface water courses or groundwater dependent habitat;
- Potential impact on areas of Ground Water Dependent Terrestrial Ecosystems (GWDTEs); and
- Potential cumulative impact during construction.

It is considered that the construction and operation of the proposed Development has the potential to result in the following types of effects:

- Disturbance and loss of deposits of peat;
- Ground instability (including peat slide risk) and contamination;
- Impacts on surface water and groundwater quality from pollution, fuel, oil, concrete or other hazardous substances;
- Increased flood risk to areas downstream of the Site during construction through increased surface runoff;
- Potential change of groundwater levels and flow paths and contribution to areas of peat and GWDTEs;
- Disturbance of watercourse bed and banks from the construction of culverts; and
- Potential pollution impacts to public and private water supplies.

Proposed Assessment Methodology and Approach

The assessment of likely significant effects will be undertaken through desk-based characterisation of the Site and surrounding area and of likely effects on identified receptors. The desk study will be supported by a programme of field investigations.

The assessment methodology will be informed by the project team's experience of carrying out such assessments for renewable energy developments, knowledge of peatland, geology and the water environment characteristics in Scotland and cognisance of good practice. The assessment will be carried out by hydrological, geological and geotechnical specialists, in close liaison with project ecologists and other members of the EIA project team, to ensure that a robust and proportionate impact assessment is presented.

The desk study will be undertaken to determine and confirm the baseline characteristics by reviewing available information relating to 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, water quality and soil data. This will include review of published geological maps, 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.

A detailed site visit and investigation will be undertaken to:

- Verify the information collected during the desktop study;
- Undertake a visual assessment of the main surface waters and identify private water supplies, including their intakes;
- Identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- Visit any identified GWDEs (in consultation with the project ecologists);
- Prepare a schedule of potential watercourse crossings;
- Allow appreciation of the Site, determining gradients, possible borrow pits, access routes, ground conditions, etc., and to assess the relative location of all the components of the proposed Development;
- Undertake a phase 1 peat probing exercise at 100 m grid interval of the proposed developable area in line with SNH best practice guidance, and subsequently a more detailed phase 2 probing exercise along the proposed site infrastructure at 50 m centres as well as at 10 m centres at turbine locations. The surveys will be used to facilitate design of the proposed Development by avoidance if possible of thick peat, sensitive peat and any peat posing a risk to the development.

The study area for the hydrological assessment will consider a buffer of up to 2 km from the proposed infrastructure. A cumulative assessment will also be completed and include an area of 5 km from the proposed infrastructure as beyond this distance potential changes to hydrology and hydrogeology are not considered to be discernible.

Peat Slide Risk Assessment

Should significant quantities of peat be present within the Site, a Peat Slide Risk Assessment will be undertaken in accordance with the Scottish Government guidance¹ along with full consultation with the relevant consultees.

The Peat Slide Risk Assessment will comprise of detailed analysis and reporting on the design freeze and will include a hazard and slope stability assessment and preliminary peat management recommendations. The hazards existing on the Site will be ranked based on factors that influence stability, namely peat depth and slope gradient. In addition, potential receptors exposure to risk will be established and hazard rankings applied across the Site, with management and mitigation measures recommended for an acceptable construction.

The Peat Slide Risk Assessment will be included as a Technical Appendix to the EIA Report, although we anticipate the site to be a low risk due to limited presence of peat on the steeper slopes. We would use this assessment to guide our design and peat management concerns.

Outline Peat Management Plan

Should significant quantities of peat be present within the Site, an outline Peat Management Plan^{2 3} will also be prepared and included as a Technical Appendix to the EIA Report. This plan will include high level estimation on peat excavation and re-use volumes. This will be based on the approximate infrastructure dimensions and anticipated re-use streams. This will include:

- Defining the materials that will be excavated as a result of the proposed Development, focusing specifically on the excavation of peat;
- Determine volumes of excavated arisings, the cut/fill balance of the Development and proposals for re-use or reinstatement using excavated materials; and

¹ 'Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition)' April 2017'

² SEPA Regulatory Position Statement – Developments on Peat (SEPA, February 2010)

³ Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (SR, SEPA, January 2012)

- Detailing proposed management techniques for handling, storing and depositing peat for reinstatement.

Matters to be Scoped Out

It is considered that the potential effects listed below have no potential for significant environmental effects and can therefore be scoped out of requiring further assessment in the EIA:

- Detailed Flood Risk and Drainage Impact Assessment: Published mapping confirms that most of the Site is not located in an area identified as being at flood risk. It is proposed, therefore, that a simple screening of potential flooding sources (fluvial, coastal, groundwater, infrastructure etc.) is presented in the EIA Report and measures that would be used to control the rate and quality of runoff will be specified in the Construction Environmental Management Plan (CEMP).
- Water quality monitoring: As the assessment will be informed by watercourse classification data available from the Scottish Environment Protection Agency (SEPA) and there are no known sources of potential water pollution at the Site, no additional water quality monitoring is considered necessary at this stage.
- Potential effects on geology: 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.
- Detailed GWDTE Assessment: As the Site is currently used for commercial forestry it is not expected that a standalone or detailed GWDTE assessment will be required or warranted. National Vegetation Classification (NVC) data will be used to assess for potential areas of GWDTE, but at this stage no detailed assessment is expected.
- Increased flood risk caused by blockages to flow in watercourses during operation and maintenance of the proposed Development. Any required watercourse crossings would be subject to maintenance requirements under the Controlled Activities Regulations (CAR), flood risk onsite is low and the development design would ensure no critical infrastructure is located near a watercourse.

Consultee Questions

- Is the spatial extent of the study area considered to be appropriate?
- Do consultees have any information that would be useful in the preparation of the geology, hydrology, hydrogeology and soil assessment?
- Do consultees agree the scope of the flood risk assessment is appropriate and that a drainage impact assessment can be provided as part of the detailed site design and agreed as part of the site CEMP (noting the principles for the control and management of runoff will be presented in the EIA Report)?
- Please confirm any additional requirements that you consider should be included in this element of the EIA, that have not been covered in this fact sheet.