

# Hydrology, Hydrogeology, Geology & Soils

## Background

Pre-application advice for the proposed Development was requested from the Highland Council (THC) and a response provided in March 2019. Key aspects relating to hydrology, hydrogeology, geology and soils are summarised here.

THC identified that the Site (the area within the application boundary) contains areas of blanket bog listed as Class 1 peatland, which have significant protection under Scottish Planning Policy. Proposals will be required to demonstrate that significant effects on Class 1 peatland can be substantially overcome by siting, design and other mitigation. The advice identifies that a peat depth survey, peat management plan and peat slide risk assessment should be undertaken in line with current guidance, and a Construction Environmental Management Plan should be produced. Alternatives to peat excavation, such as floating infrastructure and piled turbine foundations should be considered, and peatland restoration opportunities should be identified. Floating tracks should be considered the preferred option throughout unless proven to be technically infeasible.

Any local private water supplies will require assessment and, if relevant, protection from impact. Groundwater-dependent terrestrial ecosystems will require protecting and an assessment will be expected.

Careful siting of infrastructure could avoid the requirement for a flood risk assessment. Development or land raising within a floodplain area should be avoided. New or upgraded watercourse crossings need to be designed to accommodate the 1-in-200 year flood flow, plus 20% climate change allowance. A drainage impact assessment was requested by THC, including details relating to field drains and management of surface water drainage.

## Consultant Experience and Expertise

The technical lead for Hydrology, Hydrogeology, Geology & Soils will be Catherine Isherwood from RSK. Catherine is a Chartered Geologist with an MA and PhD in Geological Sciences and an MSc in Hydrogeology. She has over 14 years' experience in environmental impact assessment, specialising in hydrology, hydrogeology, geology and soils assessments and the associated specialist assessments, such as peat slide and private water supply risk assessments. During her career, Catherine has worked on over 30 windfarm projects in the UK.

Catherine will be supported by a team of geologists, hydrogeologists and hydrologists with experience in environmental impact assessment within Scotland and the wider UK.

## Baseline

The underlying geology identified by the British Geological Survey's online mapping<sup>1</sup> is the Spital Flagstone Formation and the Mey Flagstone Formation, both part of the Upper Caithness Flagstone Subgroup of the Devonian-age Old Red Sandstone. Both formations are described as sandstone, siltstone and mudstone in varying proportions.

There are no faults recorded on the Site, although some faultlines are present east of the application boundary. There are no mining records for the area and the Site is not in an area with identified coal reserves. Two small former quarries have been identified within the application boundary.

The majority of the Site is underlain by peat deposits and glacial diamicton till. Some small areas are identified as having alluvium deposits, mainly in association with the Burn of Rattar in the western part of the Site. Some areas are indicated to have no superficial deposits present.

Much of the Site lies within an area identified as being peatland of national importance (Class 1) on the SNH Carbon and Peatland database, with the remainder of the Site mainly having the potential for peat with a mixture of peat

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<sup>1</sup> GeoIndex Onshore, <http://mapapps2.bgs.ac.uk/geoindex/home.html>

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soil and mineral soil from Classes 4 and 5. The Soils map of Scotland further identifies that the Site has mainly dystrophic blanket peat soils with some noncalcareous gleys and alluvial soils.

The proposed Development lies within the Thurso and Wick Coastal Catchment Areas, both in the Scotland River Basin District. The main hydrological catchment for the Site is the Link Burn/Burn of Rattar. Subsidiary catchments are the Burn of Mey, West Burn of Gills and Gill Burn. The Link Burn/Burn of Rattar is classified as having 'Good' ecological status and 'High' water quality. The Gill Burn is classified as having 'Good' ecological status and 'Good' water quality. Chemical data are not available for either waterbody.

The groundwater unit located under the hydrological study area is the Caithness groundwater body. This is classified as having 'Good' chemical status and 'Good' quantitative status.

Part of the Site is designated as Phillips Mains Mire Site of Special Scientific Interest. This site has been designated for its nationally important blanket bog habitat, including an extensive system of dubh lochans.

Although much of the Site is anticipated to be underlain by peat and peaty soils, the presence of forestry across much of the Site means that the peatland may be degraded or damaged. An extensive Site-wide peat depth survey 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 aspects have the potential for significant environmental effects during the construction and operation phases of the proposed Development, and will therefore require further consideration through the EIA process:

- changes to water quality, including sediment release and accidental spillage of contaminants, such as fuel or oils;
- changes to water quantity and flow paths, including installation or modification of watercourse crossing structures;
- temporary and long-term drainage infrastructure;
- changes to private water supplies, either quantity or quality;
- changes (particularly increase) in flood risk;
- changes to groundwater quality and flow paths;
- changes to the connection between groundwater and surface water, including potential reduction in baseflow to surface watercourses or groundwater-dependent habitats;
- changes to water supply to Groundwater-Dependent Terrestrial Ecosystems (GWDTE);
- modifications to peatland including peat slide risk, if relevant;
- damage to soils and peat from traffic movements and from handling, transport and storage of excavated material;
- soil and peat erosion; and
- potential cumulative and in-combination impacts during construction.

### 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 method will be informed by the project team's experience of undertaking such assessments for renewable energy developments, their knowledge of peatland, geology and the water environment characteristics in Scotland, and knowledge and understanding 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.

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A desk study will be undertaken to determine and confirm the baseline characteristics by reviewing available information relating to hydrology, hydrogeology, geology and soils, such as groundwater resources, licensed and unlicensed private water supply abstractions, any public and private water supplies, surface water flows, flooding, rainfall data, water quality and soil data. This will include a review of published geological mapping, OS maps, aerial photography and site-specific data including site investigation data, geological and hydrogeological reports, digital terrain model data and derived slope information, and geological literature.

A walkover and reconnaissance survey will be undertaken to:

- verify information gathered during the desk study;
- undertake a visual assessment of the main surface watercourses, and any relevant private water supplies and supply sources;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- visit any identified potential GWDTE (in consultation with the ecology team) to identify any groundwater linkages;
- prepare a schedule of potential watercourse crossings; and
- allow an understanding of the Site and its setting, including slope variation, any potential borrow pit locations, planned access routes, and variation in ground conditions, and to assess the relative location of the planned components of the proposed Development.

In addition to the walkover and reconnaissance survey, a Phase 1 peat depth survey will be undertaken. This will cover the proposed developable area with survey points on a 100 m grid to determine the area coverage and depth variation of peat deposits within the area. This information will feed into the design process, to allow areas of sensitive and/or deeper peatland to be avoided where possible.

The study area for the hydrology, hydrogeology, geology and soils assessment will include a standard buffer of up to 2 km from the proposed infrastructure. A cumulative assessment will be undertaken, up to an area of 5 km from the proposed Development, as at greater than 5 km any potential changes to hydrology, hydrogeology, geology and soils are not considered to be discernible.

### **Peat Slide Risk Assessment**

Should significant depths of peat be identified on the Site during the Phase 1 peat depth survey, a Peat Slide Risk Assessment (PSRA) will be undertaken in accordance with Scottish Government guidance<sup>2</sup> and in consultation with relevant statutory and non-statutory consultees.

The PSRA will comprise a detailed analysis of peat coverage and peat condition across the Site, with a detailed assessment of natural and induced peat slide risk for the proposed frozen infrastructure layout. To inform the assessment, a second phase of peat depth surveying will be undertaken on the frozen layout with peat depth measurements at 50 m centres along access tracks and 10 m crosshair probing at turbine locations. The assessment will include a hazard and slope stability assessment, taking account of factors known to influence slope stability, such as peat depth and slope angle. Management and mitigation measures will be set out on a location-specific basis to manage and control peat slide risk at the Site.

The PSRA will be provided as a technical appendix to the EIA Report, with key findings summarised within the hydrology, hydrogeology, geology and soils chapter.

### **Outline Peat Management Plan**

Should significant depths of peat be identified on the Site, an outline Peat Management Plan (PMP) will be prepared in line with current guidance<sup>3,4</sup>. This plan will include high-level estimation of the volume of peat requiring excavation and the volumes of peat that can be reused within the Development, including options for peatland restoration. The estimation will make use of peat depth data gathered for the PSRA and will be based on the

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<sup>2</sup> Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. Scottish Government, April 2017 (2<sup>nd</sup> Edition).

<sup>3</sup> Developments on Peat and Off-Site Uses of Waste Peat. SEPA Regulatory Position Statement WST-G-052, May 2017.

<sup>4</sup> Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat, and the Minimisation of Waste. Scottish Renewables & SEPA, January 2012.

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approximate infrastructure dimensions and anticipated peat reuse streams available within the Development area. In addition to identifying volumes of peat to be excavated and reused, the assessment will provide proposed peat management and handling plans for best practice handling, storage and transportation of peat between excavation and reuse or reinstatement.

The PMP will be provided as a technical appendix to the EIA Report, with key findings summarised within the hydrology, hydrogeology, geology and soils chapter.

### Issues to be Scoped In or Out

It is considered that the identified aspects listed below have no potential for significant environmental effects and can therefore be scoped out with respect to detailed assessment in the EIA:

- Detailed Flood Risk Assessment: Published mapping confirms that most of the Site is not located in an area identified as being at risk of flooding. It is proposed, therefore, that a high-level screening of potential flooding sources (fluvial, coastal, surface water, groundwater etc.) is presented in the EIA Report, and measures that would be used to control the rate and quality of surface 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 SEPA's website and there are no known sources of potential water pollution at the Site, no additional water quality monitoring is considered necessary at this stage. Recommendations for construction-phase monitoring will be provided in the CEMP.
- Potential effects on geology: There are no protected geological features within or near the Site. In addition, the nature of the activities during construction and operation of the proposed Development would be unlikely to alter the regional geology of the Site.
- Increased flood risk arising from restrictions to flow in watercourses during operation and maintenance of the proposed Development: All watercourse crossings required to be installed for the Development would be subject to a regular inspection and maintenance plan. In addition, flood risk on and downstream of the Site is low, development design would ensure that watercourse crossing structures are designed to a suitable flow capacity and would ensure that no critical infrastructure is located near a watercourse or waterbody.

The identified aspects listed below are considered likely to require detailed assessment in the EIA:

- GWDTE: The presence of a SSSI designated for peatland habitats within the Development area indicates that potential GWDTE are likely to be encountered within the Site. In addition, there are significant open areas within the forestry where potential GWDTE may have developed. It is considered that this aspect will require assessment, based on the findings of the National Vegetation Classification surveys to be carried out.
- Peat Slide Risk and Peat Management: Given the widespread published mapping of peatland and peaty soils across the proposed Development, peat surveys and the associated peat slide risk and peat management are considered to be necessary assessments for the proposed Development.

### Consultees

The consultees below will be approached for information to inform the EIA. These consultees may also be contacted by the Scottish Government regarding the scope of the EIA:

- The Highland Council, Flood Risk Management
- SEPA
- Scottish Natural Heritage

### 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 a hydrology, hydrogeology, geology and soils assessment?
  - Do consultees agree that 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 control and management of runoff will be presented in the EIA Report)?
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- Please confirm any additional requirements that you consider should be included in this part of the EIA, that have not been covered in this factsheet.

### Relevant Policy 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) (Scotland) Regulations 2011, as amended.
  - The Highland Council, (2012). Highland-wide Local Development Plan (HwLDP)..
  - Scottish Environment Protection Agency, (2017). Land Use Planning System Guidance Note 31: Guidance on Assessing Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, version 3.
  - Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science and AEECoW joint publication, (2019). Good Practice during Wind Farm Construction, 4th Edition.
  - CIRIA (2006). Publication C648: Control of water pollution from linear construction projects. Technical Guidance.
  - CIRIA (2015). Publication C741: Environmental good practice on site, 4th Edition.
  - Scottish Government guidance, (2017). Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, 2nd Edition.
  - Scottish Government guidance, (2017). Guidance on Developments on Peatland: Peatland Survey.
  - The Highland Council, (2018). Caithness and Sutherland Local Development Plan (CaSPlan).
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