Chapter 10

Hydrology, Hydrogeology, Geology and Soils

SCOTTISHPOWER RENEWABLES

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Chapter 10

Hydrology, Hydrogeology, Geology and Soils

10.1 Introduction

1. This Chapter of the Environmental Impact Assessment Report (EIA Report) describes the existing geological, hydrogeological and hydrological conditions within the Site, and identifies and assesses the potential impacts that may be caused by the Hollandmey Renewable Energy Development, hereafter the 'proposed Development'. This includes site preparation, construction works, restoration of construction works, site operation and decommissioning. Mitigation measures that may be employed to relieve any adverse effects are also set out.

2. This Chapter is supported by a number of Technical Appendices which provide additional in-depth information on relevant aspects of the proposed Development. These Technical Appendices are:

- **Technical Appendix 10.1: Peat Slide Risk Assessment**
- **Technical Appendix 10.2: Peat Management Plan**
- **Technical Appendix 10.3: Borrow Pit Assessment**
- **Technical Appendix 10.4: Groundwater-Dependent Terrestrial Ecosystems Assessment**
- **Technical Appendix 10.5: Drainage Impact Assessment and Watercourse Crossing Inventory**

3. Key findings are summarised within this Chapter.

10.2 Scope and Methodology

4. The assessment was undertaken through a desk study and site inspection of existing geological, hydrogeological and hydrological related features on and surrounding the Site. The existing conditions were described and potential risks that may be associated with the proposed Development were identified and assessed. The following effects were assessed:

- physical changes to overland drainage and surface water flows;
- particulates and suspended solids;
- water contamination from fuels, soils, concrete batching or foul drainage;
- changes in or contamination of water supply to vulnerable receptors;
- increased flood risk;
- physical removal of bedrock;
- modification to groundwater flow paths;
- soil erosion and compaction; and
- peat instability.

5. No potential effects were scoped out of the assessment.

6. Within this Chapter, the Site is considered to include the application boundary (see **Figure 3.1, Chapter 3: Proposed Development**) and an area up to 2 km from this boundary. For hydrological concerns, areas downstream of the application boundary are considered at a distance up to 5 km as it is possible for effects to be transmitted downstream further than 2 km.

7. The initial desk studies were undertaken to determine and verify the baseline conditions through review and collation of available and relevant information relating to hydrology, hydrogeology, geology and soils. This included a review of published mapping, including OS topographical mapping at 1:25,000 and 1:50,000 scales, BGS geological mapping and Scotland's Soils soil and peatland mapping, aerial photographs and site-specific data such as available site investigation data, geological and hydrogeological reports, digital terrain models (DTM, to provide slope data) and geological literature.

8. Private water supply (PWS) data were requested from The Highland Council's (THC) Environmental Health Officer.

9. A site visit and walkover survey were undertaken to:

- verify the information collected during the baseline desk study;
- undertake a visual assessment of the main surface waters and verify any PWS, including intakes that could be affected by the proposed Development;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- visit any identified groundwater-dependent terrestrial ecosystems (GWDTE) (in consultation with the project ecology team);
- prepare a schedule of potential watercourse crossings and existing crossings that would require upgrading;
- inspect rock exposures and establish by probing an estimate of overburden thickness and confirmation of likely substrate;
- allow appreciation of the Site including awareness of gradients, possible borrow pit sites, access route options and prevailing ground conditions, and to assess the relative location of all the components of the proposed Development; and
- collection of peat and substrate information where exposures are present, e.g., in watercourse channels and alongside existing track cuttings.

10. The reconnaissance survey was undertaken on 25 August 2020. The weather was mainly dry and breezy with some showers and stronger wind later in the day.

11. In parallel with the site visit and walkover survey, a peat probing exercise was undertaken. This involved undertaking a peat depth survey with a hand-held probe on a 100 m grid across the proposed Site, to identify areas of deeper peat and natural variation in the peat substrate across the area. These surveys were undertaken in May and June 2020.

12. Following the field surveys, a limited geomorphological mapping exercise was undertaken to link the topographic features with the underlying geology, and to identify areas of the site that may be potentially at risk from peat landslide. This made use of collected field data, DTM, topographical mapping and aerial photography.

13. Following finalisation of the infrastructure design, a second phase of peat survey work was scheduled. This included peat probing at 50 m centres along all proposed new access tracks and 25 m crosshair probing at turbine locations (T1-10). Additional probing was undertaken as required in areas where existing tracks would require widening or modification to corners or junctions, and at all other infrastructure locations, to ensure that there was sufficient peat depth information to support the infrastructure design process and related studies on peat instability and peat excavation and reuse. These surveys were undertaken in September 2020, November 2020 and October 2021.

14. The information obtained from the review of existing data, site surveys and guidance documentation formed the basis of assessment of the potential effects associated with the proposed Development. Where potential likely significant effects were identified, mitigation measures have been proposed.

15. A peat slide risk assessment (PSRA) was undertaken in accordance with the Scottish Government's Peat Landslide Hazard & Risk Assessments: Best Practice Guide for Proposed Electricity Developments (The Scottish Government, 2017). The PSRA was informed by the peat depth model, site walkover and peat depth surveys, detailed geomorphological mapping and terrain classification. The assessment used a combined qualitative (contributory factor) and quantitative (factor of safety) approach to determine the likelihood of peat landslides. Areas with the highest likelihoods were compared with identified receptors to identify risks and determine appropriate mitigation measures. The assessment is provided in **Technical Appendix 10.1**.

16. A peat management plan (PMP) was prepared in accordance with the Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (Scottish Renewables & SEPA, 2012). The PMP was informed by the collated peat depth probing described above, combined with a full site appraisal of potential reuse opportunities e.g., reinstatement and landscaping requirements associated with infrastructure, mapping of drainage ditches and peat hagging.

Where opportunities were identified to integrate the PMP with wider environmental enhancement measures, such as peatland restoration, the PMP identifies the volume and type of peat to be used for this activity.

17. An assessment of bedrock suitability for track and hardstanding construction was undertaken, together with a mapping exercise to identify potentially suitable locations for use as borrow pits for the proposed Development. The assessment is provided in **Technical Appendix 10.3**.

18. An assessment of GWDTE was undertaken based on the NVC mapping undertaken by the ecology team. Where areas of potentially moderate or highly GWDTE were identified in proximity to proposed infrastructure, additional investigation was undertaken to identify if the wetland areas are truly groundwater-dependent, refine their mapped extent, conceptualise the hydrogeology and assess any potential effects on these areas. The assessment is provided in **Technical Appendix 10.4**.

19. An assessment of drainage requirements to manage surface runoff and potential downstream flood risk was undertaken for the proposed Development. The assessment also includes an inventory of all proposed watercourse crossings, both for new structures and for existing crossings that may require upgrading. The assessment is provided in **Technical Appendix 10.5**.

A number of data sources were considered in writing this Chapter; the main sources are detailed below:

- Ordnance Survey topographical mapping, current and historical, at 1:25,000 and 1:50,000 scale and equivalent;
- British Geological Survey (BGS) geological mapping, superficial and bedrock;
- BGS online borehole database;
- Scotland's Soils mapping; and
- Scottish Environment Protection Agency's (SEPA) *A functional wetland typology for Scotland*.

10.2.1 Effects Evaluation

20. The significance of potential effects has been classified taking into account three principal factors: the **sensitivity** of the receiving environment, the potential **magnitude** of the effect and the **likelihood** of that effect occurring. This approach is based on guidance contained within the joint Scottish Natural Heritage (SNH, now 'NatureScot')/Historic Environment Scotland (HES) publication Environmental Impact Assessment Handbook v5 (SNH/HES, 2018).

10.2.1.1 Receptor Sensitivity

21. The sensitivity of a receptor represents its ability to absorb the anticipated effect without resulting perceptible change. Four levels of sensitivity have been used, as defined in **Table 10.1**.

Table 10.1 Sensitivity ratings

Sensitivity	Definition
Very high	The receptor has very limited ability to absorb change without fundamentally altering its present character, is of very high environmental value and/or is of international importance e.g., Special Areas of Conservation, RAMSAR sites.
High	The receptor has limited ability to absorb change without significantly altering its present character, is of high environmental value and/or is of national importance e.g., National Nature Reserves, Sites of Special Scientific Interest.
Moderate	The receptor has moderate capacity to absorb change without significantly altering its present character, has moderate environmental value and/or is of regional importance e.g., Geological Conservation Review sites.
Low	The receptor is tolerant of change without detriment to its present character, is of low environmental value and/or of local importance e.g., Local Nature Reserves, Local Geodiversity Sites.

10.2.1.2 Effect Magnitude

22. The magnitude of effects includes the timing, scale, size and duration of the potential effect. Four levels of magnitude have been used, as defined in **Table 10.2**.

Table 10.2 Magnitude ratings

Magnitude	Definition
Substantial	Substantial changes, over a substantial area, to key characteristics or to the geological/hydrogeological/peatland classification or status for more than 2 years.
Moderate	Noticeable but not substantial changes for more than 2 years or substantial changes for more than 6 months but less than 2 years, over a substantial area, to key characteristics or to the geological/hydrogeological/peatland classification or status.
Slight	Noticeable changes for less than 2 years, substantial changes for less than 6 months, or barely discernible changes for any length of time.
Negligible	Any change would be negligible, unnoticeable or there are no predicted changes.

10.2.1.3 Likelihood of Effect

23. The likelihood of an effect occurring is evaluated to three levels: **unlikely**, **possible** or **likely**.

10.2.2 Effects Significance

24. The findings in relation to the three criteria discussed above have been brought together to provide an assessment of significance for each potential effect as shown in **Table 10.3**. Potential effects are concluded to be of major, moderate, minor or negligible significance. Potential effects are assessed considering the proposed mitigation measures. The assessment concludes with a review of various effects to determine if they would be significant in terms of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. Effects assessed as major or moderate are deemed to be significant; those assessed as minor or negligible are deemed to be not significant.

Table 10.3 Significance of Effects matrix

Sensitivity	Magnitude	Likelihood	Significance
Very High	Substantial	Likely	Major
		Possible	Major
		Unlikely	Moderate
	Moderate	Likely	Major
		Possible	Moderate
		Unlikely	Moderate
	Slight	Likely	Moderate
		Possible	Minor
		Unlikely	Minor
	Negligible	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
High	Substantial	Likely	Major
		Possible	Major
		Unlikely	Moderate
	Moderate	Likely	Moderate
		Possible	Moderate
		Unlikely	Minor
	Slight	Likely	Minor

Sensitivity	Magnitude	Likelihood	Significance
		Possible	Minor
		Unlikely	Minor
	Negligible	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
Moderate	Substantial	Likely	Major
		Possible	Moderate
		Unlikely	Minor
	Moderate	Likely	Moderate
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Negligible
	Negligible	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible
Low	Substantial	Likely	Moderate
		Possible	Minor
		Unlikely	Negligible
	Moderate	Likely	Minor
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
	Negligible	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible

25. In addition to the **Sensitivity, Magnitude** and **Likelihood** of an effect, effects can be **Adverse** or **Beneficial**, **Temporary** or **Long-Term**, **Direct** or **Indirect, Single** or **Cumulative**. Definitions of these terms are provided in **Table 10.4.**

Table 10.4 Definitions for types of effect used in impact assessment

Type of Effect	Definition
Adverse	Having a negative, harmful or unfavourable effect on the receptor
Beneficial	Having a positive, enhancing or favourable effect on the receptor
Temporary	Short-term, lasting for only a limited period of time e.g., may be present only through construction; recovery may take a period of months or a small number of years in comparison with the Development lifespan
Long-term	Anticipated to be required for the duration of the Development
Direct	A change made directly to a receptor e.g., excavation has a direct effect on soils
Indirect	Effects arising as a result of change made to a different receptor e.g., loss of fish habitat resulting from release of sediment to a watercourse
Single	Effects arising from this Development alone
Cumulative	Effects arising as a combination of works on this Development and other nearby developments. 'Nearby' can have different meanings depending on the receptor being considered e.g., effects on geology and soils are mainly very localised; effects on hydrology can travel with the water movement.

10.2.3 Limits and Uncertainties

26. The site visits followed a standard 'reconnaissance level' walkover survey to obtain an overview of site conditions at the time of the visit. A reconnaissance level survey involves walking through and around an area to gather visual information concerning elements such as slope, rock outcrop, ground wetness and bogginess, nature and type of watercourses, and the presence or absence of groundwater seepages or spring points. No ground investigation was undertaken as part of the site visits. As a result, information is limited to detail that can be gathered from a visual survey of this kind. Uncertainties may arise as a result of preceding weather conditions, e.g., very wet preceding conditions may cause an over-estimation of the watercourse nature or ground bogginess than would be considered 'normal' for the area.

27. The information gathered has been combined with information from site visits for other disciplines, including site surveys to map peat depths and vegetation classes, and available photography to give as full a picture of site conditions as possible. All reasonable attempts were made to ensure that good coverage of the site was included. However, it is possible as a result of the type of survey undertaken that some information was not collected as a result of access restrictions (ornithology exclusion zones, active forestry works, unsafe ground), the lack of intrusive investigation or the areas visited during the surveys.

10.3 Consultation

28. Consultation was undertaken with a number of statutory and non-statutory consultees and interested parties, including the Scottish Government, The Highland Council (THC), SEPA, NatureScot (formerly SNH), Scottish Water and local stakeholders. Responses with relevance to geology, hydrogeology and hydrology are provided in **Table 10.5**.

Table 10.5 Consultee responses relevant to geology, hydrogeology, hydrology and peat

Name of Stakeholder/ Consultee	Key concerns	Response
THC	Significant issues for consideration include impacts on the water environment, peat and groundwater-dependent terrestrial ecosystems (GWDTE).	Effects on the water environment are considered in **Section 10.5**. Effects on peat and GWDTEs are addressed in **Technical Appendices 10.1**, **10.2** and **10.4.**
THC Contaminated Land	Note the presence of two former quarries and the ruined steading at Hollandmey and advise that these areas may need consideration for potential contamination if construction is to take place nearby.	Noted. No construction activity is planned near any of these locations.
THC Flood Risk Management Team	Water crossings in the form of culverts or bridges, or upgrades to existing crossings must be designed to accommodate to 1 in 200 year flood event, plus climate change;	Water crossings are addressed in **Technical Appendix 10.5.**
	Access tracks not acting as preferential pathways for runoff and efforts being made to retain existing natural drainage wherever possible;	Effects on runoff from the proposed Development are considered in **Section 10.6**, and **Technical Appendix 10.5.**
	A minimum of a 50 m buffer of all watercourses / bodies, except water crossings is required	All development work is at least 50 m away from watercourses and waterbodies, except where crossings are required. A reduced buffer of 10 m at T8 has been agreed with SEPA to minimise incursion into adjacent peatland. Additional protection measures will be included at this location.
	Natural flood management techniques should be applied to reduce the rate of runoff where possible; use of SuDS to achieve pre-development runoff rates and to minimise erosion on existing watercourses;	Natural flood management techniques are used where possible, considered in **Section 10.6**.
John Muir Trust	Note the presence of carbon-rich soils within the proposed site and in the interests of climate would expect disturbance to these soils to be kept to a minimum through careful design and sensitive siting of the turbines, tracks and associated infrastructure.	Effects on peat are addressed in **Technical Appendices 10.1** and **10.2.**
Royal Society for the Protection of Birds	Development proposals should demonstrate how they have avoided unnecessary disturbance, degradation or erosion of peat and soils through a peat depth survey.	Effects on peat are addressed in **Technical Appendices 10.1** and **10.2.**
SEPA	All tracks should be a minimum of 50 m from waterbodies and watercourses, with scope for minor changes for layout. Avoid exacerbating flood risk on the development site with high level Drainage Impact Assessment.	All development work is at least 50 m away from watercourses and waterbodies, except where crossings are required. Flood risk is considered in **Section 10.4.8** and impacts on flood risk in **Section 10.6**. Effects on Drainage impact are addressed in **Technical Appendix 10.5**. A reduced buffer of 10 m at T8 has been agreed with SEPA to minimise incursion into adjacent peatland. Additional protection measures will be included at this location.
	Plan to identify and map peat depth, National Vegetation Classification (NVC) survey results presented to SEPA along with all peat probing results. Infrastructure to avoid deep peat or minimise impacts on habitat; mapped results.	Effects on peat are addressed in **Technical Appendices 10.1** and **10.2**. NVC survey results are discussed in **Chapter 8: Ecology and Biodiversity.**
	Construction of the solar array in relation to impact on ground conditions.	Effects arising from the solar array are addressed in **Sections 10.6.2.1, Sections 10.6.2.4 and Sections 10.6.2.4**
	Plan on protection of the water environment, including existing drainage management, water-crossings and new infrastructure.	Effects on the water environment are considered in **Section 10.4**, **10.6** and **Technical Appendix 10.5**
	Development should minimise impact on GWDTE through assessment of baseline information and site surveys, with results being mapped.	Effects on GWDTE are considered in **Technical Appendix 10.4**
NatureScot	Welcome proposals to undertake an NVC, advise that this should be undertaken at any infrastructure locations located on priority peatland habitat.	NVC mapping discussed in **Chapter 8: Ecology and Biodiversity**. and illustrated in **Figure 8.3.**
	Assessment of the impact on peat should be made through peat depth survey and outline peat management plan. Any priority peatland habitat identified then efforts to avoid impacting this habitat should be considered through siting, design and mitigation.	Peat Management Plan addressed in the **Technical Appendix 10.1**.
Marine Scotland	Recommends the developer to carry out and present the following in the EIA Report: Water quality; Provide appropriate site-specific mitigation measures; Establish an integrated water quality and fish monitoring programme before, during and after construction.	Baseline water quality status is detailed in **Section 10.4**. Water quality monitoring is set out in **Section 10.6.6.2** and **Table 10.14**. Monitoring relating to fish population is covered in **Chapter 8: Ecology and Biodiversity**. Mitigation measures are provided in **Section 10.6.6**.

29. In addition to formal consultation with SEPA, a consultation call was held on 29 October 2020 to discuss the working layout design in order to allow feedback from SEPA regarding any concerns they had. In general, the SEPA staff were content with the design and proposed layout. One section of proposed floating track, between T2 and T3, was raised as a concern mainly as the peat in this area is over 4 m deep. Further discussions were held with the design team and an alternative route, reducing the area of peat to be crossed and taking advantage of an existing vehicle track and fire break, was identified. This route change is shown on **Figure 10.6 Design Iterations**.

10.3.1 Statutory and Planning Context

30. In preparing this Chapter of the EIA Report, consideration has been given to relevant planning guidance at all levels. This includes, but is not limited to, the following:

- The European Water Framework Directive (2000/60/EC) and associated daughter Directives including the Groundwater Directive (2006/118/EC);
- The European Mining Waste Directive (2006/21/EC);
- The Environmental Protection Act 1990 (as amended);
- The Water Environment and Water Services (Scotland) Act 2003;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended;
- The Pollution Prevention and Control (Scotland) Regulations 2012;
- The Water Environment (Oil Storage) (Scotland) Regulations 2006;
- Scottish Planning Policy 2014;

- Scottish Government's Planning Advice Note 51: planning, environmental protection and regulation (2006);
- SEPA's Position Statement WAT-PS-10-01: Assigning Groundwater Assessment Criteria for Pollutant Inputs (2014); and
- SEPA's Guidance for Pollution Prevention, with particular reference to:
    - PPG 1: Understanding your environmental responsibilities – good environmental practice;
    - PPG 6: Working at construction and demolition sites.

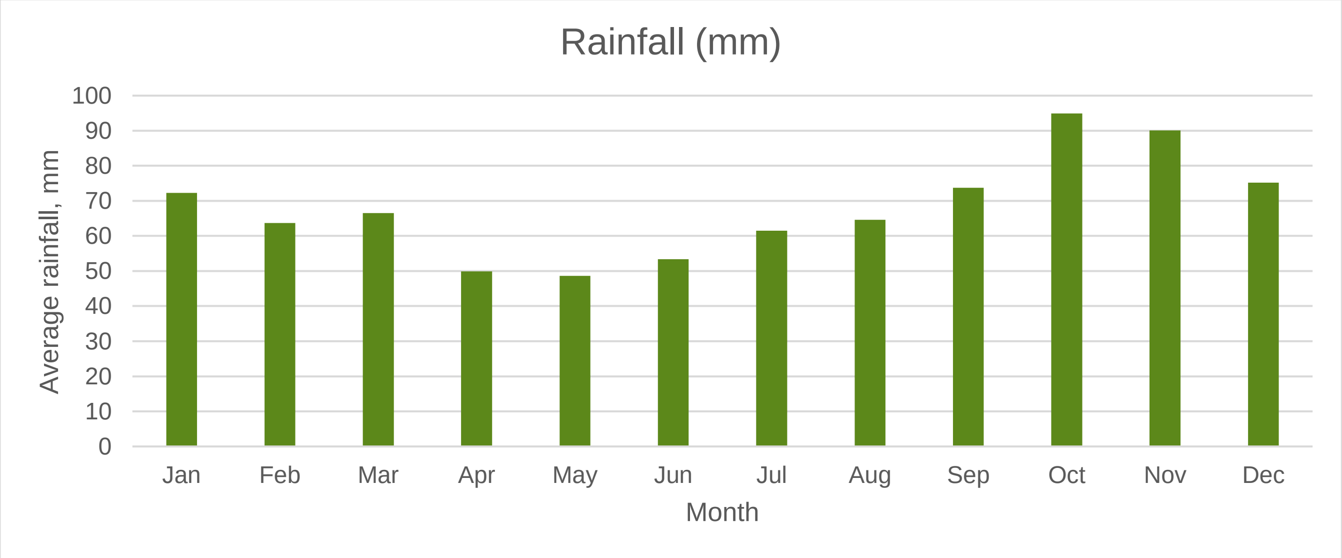
10.4 Existing Environment

10.4.1 Meteorology and Climate

31. The Site is located approximately 3 km inland from the north coast of Scotland, within the UK Meteorological (Met) Office's Northern Scotland regional climatic area. Much of Northern Scotland is exposed to the rain-bearing westerly winds, particularly areas along the west coast. The Site's location in the north eastern tip of the north coast of Scotland affords the Site reasonable protection from rain-bearing westerly winds. Rainfall is generally well-distributed throughout the year, but normally greatest in the autumn and winter.

32. Much of the Northern Scotland climatic area constitutes high ground (i.e., more than 200 metres above sea level), including the mountainous regions of the Grampians, Monadh Liath and the northern Highlands, and encompasses the highest point in the UK, Ben Nevis at 1,345 m. Much of Northern Scotland has a climate strongly influenced by the rain-bearing westerly winds, particularly the Western Isles and the western coastal area which have an average annual rainfall of over 1,700 mm. As the Site is located in the eastern part of the climatic area, it benefits from the rain shadow of the mountains in the northern Highlands and has a comparatively dry climate as a result. The Northern Scotland climatic area includes the wettest place in the UK: Fort William, which has an average annual rainfall of over 4,000 mm. In contrast, coastal areas around the Moray Firth receive an average of only 700 mm per year.

33. Average annual rainfall for the Site catchments varies between 888 mm and 894 mm (CEH, 2020), indicating that the Site is in a relatively dry region of the Northern Scotland climatic area. The mean catchment altitudes range from 39 m to 63 m across the catchments. Average annual rainfall for the climate monitoring station at Wick John O' Groats Airport is 814.3 mm. **Graph 10.1** shows the average rainfall distribution through the year from the Wick John O' Groats Airport monitoring station.



Graph 10.1 Monthly rainfall averages for monitoring station at Wick John O' Groats Airport. Averages cover the period 1981-2010 (Met Office, 2020).

10.4.2 Geology

10.4.2.1 Bedrock Geology

34. Geological information is derived from the BGS GeoIndex online geological mapping bedrock geology 1:50,000 and 1:625,000 maps (BGS, 2020) and the Geological Survey of Scotland 1:63,360/1:50,000 geological map series (Mykura, 1986). Bedrock and superficial geology mapping are provided on **Figure 10.1**.

35. The Site is underlain by bedrock of the Middle Old Red Sandstone group of Early-Middle Devonian age, part of the Old Red Sandstone Supergroup. Rocks from this Supergroup dominate the Caithness and Orkney areas of Scotland. Two distinct formations have been identified within the Site. The south east, south west and north western quarters of the Site are underlain by the Spital Flagstone Formation, described as sedimentary rocks comprising siltstone, mudstone and sandstone. The north eastern quarter of the Site is underlain by the younger Mey Flagstone Formation, described as sedimentary rocks comprising sandstone, siltstone and mudstone.

36. There are no mapped dykes or faults within the Site. There is inferred faulting shown 0.1 km east of the south eastern Site and extending eastward. There are two sets of inferred faults, trending east north east to west south west and north north west to south south east, respectively.

10.4.2.2 Mineral Extraction

37. There is no known history of mining at the Site (BGS, 2020; Coal Authority, 2020). No evidence of mining was identified during the field surveys.

38. Two former quarries are noted within the Site, as identified by THC's Contaminated Land team in their consultation response, detailed in **Table 10.5**. Two active sandstone quarries have been identified near the development (BGS, 2020). There is also a disused quarry visible on OS 1:25,000 maps located 1.09 km west of the Site. Details of all identified active and former quarries are provided in **Table 10.6**.

Table 10.6 Active and disused quarries within and near the Site

Name	Commodity	Status	Distance & Direction from the Site
Quarry near Hollandmey steading	Aggregate (assumed)	Disused, flooded	Within the Site
Quarry south east of Philips Mains	Aggregate (assumed)	Disused, flooded	Within the Site
Hollandmake Quarry	Sandstone	Active	1.60 km West
Inkstack Quarry	Sandstone	Active	3.70 km West
Syster Quarry	Unknown	Disused	1.09 km West

10.4.2.3 Superficial Geology

39. Superficial geology information is derived from the BGS GeoIndex online geological mapping superficial deposits 1:50,000 map (BGS, 2020) and the Geological Survey of Scotland 1:63,360/1:50,000 geological map series (Peach et al, 1914). Superficial geology mapping is provided on **Figure 10.1**.

40. Superficial deposits are shown to be present across the entire Site, except for a few very small zones within the northern Site and surrounding area, and along part of the east of the Site. The majority of the Site is overlain by peat of Quaternary age. Parts of the Site (particularly in the middle and southern regions) are overlain by Devensian till, comprising diamicton deposited during the last glacial period. Diamicton is a very variable glacial sediment consisting of unsorted material ranging in size from clay to boulders, usually with a matrix of clay to sand.

41. Small areas of alluvium and river terrace deposits are present along the south western boundary of the Site, loosely following but extending beyond the present-day river valley of the Link Burn. Alluvium is also present within the present-day river valley of the Gill Burn. Alluvium is a sorted or semi-sorted mixture of clay, silt, sand and gravel of fluvial origin deposited in the Holocene. This alluvium is bordered in some areas by river terrace deposits of gravel, sand, silt and clay of Quaternary age.

10.4.3 Soils and Peat

42. The Site soils mainly consist of blanket peat and noncalcareous gleys, with a small area of alluvial soils, as shown on the Soil Survey of Scotland digital soils mapping (Soil Survey of Scotland, 1981). Soil mapping identifies extensive blanket peat within the Site, with deep blanket peat covering much of the Site, particularly in the north east and north west regions, surrounding a central strip of noncalcareous gleys.

43. Noncalcareous gleys extend from the northern to central Site and also cover a number of small areas to the east of the Site. Alluvial soils cover a small area on the south west boundary of the Site. Further details on soils within the Site are provided in **Table 10.7**. Soils and peat mapping are provided on **Figure 10.2**.

44. The Carbon and Peatland 2016 map has been consulted to understand the carbon-rich soils, deep peat and priority peatland habitat within the Site (SNH, 2016). The map classifies soils into five carbon classes plus three classes for mineral soils, non-soil or unknown. Classes 1 and 2 are considered to be nationally important carbon-rich soils. Within the Site, the soils are principally assigned Class 1; this correlates well with the mapped distribution of significant peat soils. Some areas of Class 5 are present; these represent areas of commercial forestry plantation on peat soils and have a lack of peatland vegetation. The remainder of the Site is Class 0 (mineral soils) with two small areas of Class 4 (unlikely to include carbon-rich soils). The areas of each carbon and peatland class within the Site are provided in **Table 10.8.**

45. There is widespread evidence of modification to peatland areas within, and around the Site. These mainly relate to historic peat cutting, notably within the peatland areas north and south of the application boundary. Within the Site, the peatland has been significantly modified for commercial forestry and agriculture with extensive drainage systems present in many areas.

Table 10.7 Soil types within the Site

Soil Assoc.	Parent Material	Component Soils	Landforms	Vegetation	Area (%)
Organic soils	Organic deposits	Dystrophic blanket peat	Uplands and northern lowlands with gentle and strong slopes	Blanket and northern blanket bog. Upland and flying bent bog. Deer-grass bog. Sedge mires.	85.5
Thurso	Greyish brown drifts derived from Middle Old Red Sandstone flagstones and sandstones	Noncalcareous gleys	Undulating lowlands with gentle slopes	Arable and permanent pastures. Rush pastures and sedge mires. Acid bent-fescue grassland.	14.3
Alluvial soils	Recent riverine and lacustrine alluvial deposits	Mineral alluvial soils with peaty alluvial soils	Flood plains with river terraces and former lake beds	Arable and permanent pastures. White bent grassland. Swamp, rush pastures and sedge mires.	0.2

Table 10.8 Carbon and peatland classes present within the Site

Peatland Class	Description	Area (%)
Class 0	Mineral soils; peatland habitats are not typically found on such soils	14.0
Class 1	All vegetation cover is priority peatland habitat; all soils are carbon-rich soils and deep peat	64.5
Class 4	Area unlikely to be associated with peatland habitat or wet and acidic type; area unlikely to include carbon-rich soils	1.1
Class 5	Soil information takes precedence over vegetation data; no peatland habitat recorded; may also show bare soil; all soils are carbon-rich and deep peat	20.4

46. Peat depth surveys were undertaken in May-June across the application boundary area and in September and November 2020 for areas of proposed infrastructure. An additional survey of the offsite area of the application boundary was undertaken in October 2021, to identify any areas of peat that may be present beside the existing roads. The combined peat depth surveys include a total of 1,617 individual peat depth records plus seven peat coring locations. The entire Site has been covered by the survey effort, excluding only the area of Philips Mains Mire SSSI and the agricultural field immediately south east of the solar array; both these areas were excluded from potential development at an early stage and were therefore not included in the field surveys.

47. A summary of the peat depth records is provided in **Table 10.9**.

Table 10.9 Summary of peat depth records from all combined surveys

Peat depth range (m)	No. of points	Percentage of points (%)
0.00	36	2.2
0.01 – 0.50	632	39.1
0.51 – 1.00	371	22.9
1.01 – 1.50	160	9.9
1.51 – 2.00	88	5.4
2.01 – 2.50	86	5.3
2.51 – 3.00	83	5.1
3.01 – 3.50	36	2.2
3.51 – 4.00	34	2.1
4.01 +	91	5.6
Total:	**1,617**	**100.0**

48. The peat depth survey and reconnaissance survey both confirm that there are two main areas with extensive peat deeper than 2 m. The eastern part of the Site, including around Philips Mains Mire Site of Special Scientific Interest (SSSI) and the area east of T8, appears to form a continuous area of very deep peat. A second area is present around the Link Burn between T2, T3, T5 and T6, extending north to Hollandmey Moss and the area immediately west of the solar array. Smaller additional areas of relatively deep peat (2 m or deeper) are present in parts of the Development but are generally not extensive. The probing data indicate that the peat depth can vary very substantially over short distances. More details of peat depth and peat depth variation are provided in **Technical Appendix 10.1**. An overview map of the peat depth distribution within the Site is provided in **Figure 10.3**.

Table 10.10 Peatland condition categories and descriptions (SNH, 2018)

Peatland Condition Category	Description
1	Near-natural
2	Modified
3	Drained
4	Actively eroding
5	Forested/previously afforested

49. As the Site is mainly under forestry, the peat condition is largely classed as ‘Forested/Previously Afforested’ (peatland condition category 5; **Table 10.10**). The remaining open areas except for the area of Philips Mains Mire SSSI, have been extensively drained for forestry and agriculture (category 3). Philips Mains Mire SSSI is the only part of the Site where the peatland remains in a near-natural (category 1) condition. Where present in the Site, the peat is mainly in the form of blanket peat. There are two main sub-sections of the Site where peat forms a major part of the soil cover; these sub-sections are

described separately below. The other sub-sections of the Site are largely without peat. More details of peat condition are provided in **Technical Appendix 10.1**.

50. Peat has provided an important constraint to Site infrastructure design. Where possible areas of peat deeper than 1 m have been avoided completely. In areas where construction in peat deeper than 1 m is proposed this provides a balance between peatland and other environmental constraints including forestry felling, hydrology and ecology as well as engineering practicalities. The layout design makes use of existing tracks and fire breaks where these are suitable for infrastructure.

10.4.4 Geomorphology

51. The Site is characterised by undulating lowlands with gentle slopes, with most of the Site having an elevation between 45 and 55 m Above Ordnance Datum (AOD). The highest ground is located on small, isolated hills, in the north east, south east and south west of the Site. The Hill of Rigifa' forms a high point just beyond the north east of the Site, reaching an elevation of 80 m AOD; in the southern part of the Site the Hill of Slickly reaches an elevation of 75 m AOD.

52. The lowest elevations within the Site are to the west, around the Link Burn and the Burn of Ormigill (40 m AOD), and the north west around the Burn of Horsegrow (35 m AOD). The west and south western part of the Site is characterised by a shallow valley which slopes westwards around the Link Burn. The north western part of the Site slopes north west towards the Loch of Mey, with a shallow valley around the Burn of Horsegrow.

53. Following topography, the majority of the Site drains roughly west to join the Burn of Rattar. Outwith the Site, topography generally slopes north towards the coast.

10.4.5 Hydrogeology

54. Bedrock and superficial aquifers are classified on the basis of the type of flow and level of productivity (**Table 10.11**).

Table 10.11 Aquifer classification (Scottish Government, 2021)

Aquifer class	Flow type	Level of productivity
1A	Significant intergranular flow	Highly productive aquifer
1B	Significant intergranular flow	Moderately productive aquifer
1C	Significant intergranular flow	Low productivity aquifer
2A	Flow is virtually all through fractures and discontinuities	Highly productive aquifer
2B	Flow is virtually all through fractures and discontinuities	Moderately productive aquifer
2C	Flow is virtually all through fractures and discontinuities	Low productivity aquifer
3	None	Rocks with essentially no groundwater

55. The Site is underlain by bedrock forming part of the Caithness groundwater body, classed as a 2B moderately productive aquifer, comprising sandstones, in places flaggy, with siltstones, mudstones and conglomerates, and interbedded lavas, locally yielding small amounts of groundwater (Scottish Government, 2020; BGS, 2020). Groundwater flow is virtually all through fractures and other discontinuities.

56. The superficial deposits covering the majority of the Site have a range of potential permeabilities, and their productivity depends on their local composition and connectivity. Any pockets of sand and gravel-rich material within the diamicton till and alluvium are likely to have higher permeability, whereas areas of clay and silt will have low or negligible permeability.

57. The peat bodies in the area will also hold significant amounts of groundwater; however, flow within peat is usually very slow and likely to contribute only limited baseflow to local burns. Significant flow can occur through subsurface drainage structures such as peat pipes where these are present. Peat pipes were not identified within any of the project surveys.

58. Regional groundwater flow will tend to mimic the natural topography, flowing north and west towards the sea.

59. No springs or seepages have been identified within the Site.

10.4.5.1 Groundwater Vulnerability

60. Groundwater vulnerability is divided into five main categories (**Table 10.12**).

Table 10.12 Groundwater vulnerability classifications and their interpretation (Dochartaigh *et al*., 2011)

Vulnerability class	Description	Frequency of activity	Travel time
5	Vulnerable to most pollutants, with rapid impacts in many scenarios	Vulnerable to individual events	Rapid
4	Vulnerable to those pollutants not readily adsorbed or transformed	↓	↓
	4a: May have low permeability soil; less likely to have clay present in superficial deposits		
	4b: More likely to have clay present in superficial deposits		
3	Vulnerable to some pollutants; many others significantly attenuated		
2	Vulnerable to some pollutants, but only when they are continuously discharged/leached		
1	Only vulnerable to conservative pollutants in the long term when continuously and widely discharged/leached	Vulnerable only to persistent activity	Very slow
0	Not sufficient data to classify vulnerability		

61. The Site is a mixture of Classes 4a and 4b, reflecting the variations in superficial deposits.

10.4.5.2 Groundwater-Dependent Terrestrial Ecosystems

62. GWDTE are defined by the UK Technical Advisory Group (UKTAG) (2004) as:

"A terrestrial ecosystem of importance at Member State level that is directly dependent on the water level in or flow of water from a groundwater body (that is, in or from the saturated zone). Such an ecosystem may also be dependent on the concentrations of substances (and potentially pollutants) within that groundwater body, but there must be a direct hydraulic connection with the groundwater body."

63. In line with the guidance provided in UKTAG (2004), a dual ecological and hydrogeological approach to identifying GWDTE has been used. This involves a detailed study of vegetation communities in order to determine the potential level of groundwater dependency, combined with a detailed hydrogeological study in order to identify locations where groundwater reaches the surface and is therefore able to provide a source of water to terrestrial ecosystems.

64. NVC communities identified by SEPA as likely highly or moderately groundwater-dependent, depending on the hydrogeological setting, are listed in SEPA's publication 'Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems' (SEPA, 2017). At the Site, the potentially groundwater-dependent NVC communities identified are:

- M15 – *Scirpus cespitosus – Erica tetralix* wet heath; and
- M23 - *Juncus effusus/acutiflorus - Galium palustre* rush-pasture.

65. Communities M15 and M23 are each described as potentially having moderate groundwater dependency. NVC mapping for the Site is shown on **Figure 8.3** and discussed further in **Chapter 8: Ecology and Biodiversity.**

66. GWDTE have been assessed separately; details are provided in **Technical Appendix 10.4**.

10.4.6 Hydrology

67. The Site lies across five watercourse catchments: the Burn of Rattar, the Burn of Horsegrow, the West Burn of Gills, the Gill Burn and the Burn of Lyth. The catchment areas are shown on **Figure 10.4.**

68. Most of the Site is located within the Burn of Rattar catchment. The Burn of Horsegrow catchment drains part of the north western Site, including the main access into the area. The West Burn of Gills catchment encompasses the north eastern Site. The Gill Burn and the Burn of Lyth catchments provide drainage for the south and south eastern Site. A small part of the northern Site is not within a mappable watercourse catchment; this area drains via minor watercourses and drainage ditches into the Loch of Mey or directly into the Pentland Firth.

69. The catchment wetness index (PROPWET) for the three main Site catchments is 0.500, indicating the Site is wet for 50% of the time. The area has a relatively low base flow index (BFI HOST19), indicating that groundwater contribution is of limited importance to Site watercourses. The standard percentage runoff (SPR HOST) is 50-55%, indicating that this percentage of Site rainfall is converted into surface runoff from rainfall events. This is a high runoff risk. Soils have a limited capacity to store rainfall or to allow water to infiltrate; thus, soils with a high SPR HOST will quickly saturate, leading to rapid runoff.

70. Catchment statistics are derived from the Flood Estimation Handbook Web Service (CEH, 2020). Full catchment statistics are provided in Error! Reference source not found. Catchment statistics have only been provided for the main catchments within the Site.

Table 10.13 Site catchment statistics

Catchment Name	Catchment Wetness Index (PROPWET)	Base Flow Index (BFI HOST19)	Standard Percentage Runoff (SPR HOST)	Area (%)
Burn of Rattar	0.500	0.307	50.06%	68.9
Burn of Horsegrow	0.500	0.301	50.11%	9.8
West Burn of Gills	0.500	0.272	54.77%	10.3
Gill Burn	Not available			5.7
Burn of Lyth	Not available			5.3

10.4.6.1 Watercourse Catchments

Burn of Rattar

71. The Burn of Rattar catchment has a total area of approximately 20 km^2 and drains 68.9% of the Site.

72. The upper catchment is primarily commercial forestry, and the lower catchment is a mix of peatland and mixed agricultural land used for crop production and grazing. There is significant evidence that tributaries within this catchment have been modified for agricultural purposes, through channel straightening and by the addition of an extensive network of land and forestry drainage ditches. Tributaries to the Burn of Rattar outline the perimeters of fields within and surrounding the Site.

73. The Burn of Hollandmey, Link Burn and Burn of Ormigill are all tributaries to the Burn of Rattar and provide the main drainage to the Site, draining the Site broadly north west and north into the Pentland Firth.

Burn of Horsegrow

74. Part of the north western section of the Site lies within the Burn of Horsegrow catchment; this catchment spans a total area of approximately 3.4 km^2 and covers 9.8% of the Site.

75. The catchment is a mix of agricultural land, commercial and native forestry, and peatland. The Site includes most of the upper (southern) part of the catchment, consisting of commercial and native forestry and agricultural land. Watercourses within the catchment show extensive modification by straightening and excavation of drainage channels.

76. The Burn of Horsegrow drains north west out of the Site into the Loch of Mey, one of the northernmost water features of mainland Britain. The Loch of Mey is a SSSI; further information is detailed in **Section 10.4.9**.

West Burn of Gills

77. The north easternmost part of the Site is drained north eastward into Gills Bay by the West Burn of Gills; this catchment covers a total area of approximately 3.1 km^2, and 10.3% of the total Site.

78. North east of the application boundary the West Burn of Gills appears to be interconnected with the East Burn of Gills/Burn of Miremuckle catchment by field drainage. As this catchment has been modified for agricultural purposes, drainage within the catchment will not necessarily be restricted to the natural catchment boundaries.

79. Within the Site the catchment is a mix of agricultural, commercial forestry, and peatland land uses. The Philips Mains Mire SSSI lies partly within this catchment (please see **Section 10.4.9**).

Gill Burn

80. The south western part of the Site is drained by the Gill Burn, which drains mainly eastwards to Freswick Bay on the North Sea. The Gill Burn has a catchment area of 9.8 km^2 to the confluence with Little Gill Burn and includes 5.7% of the Site.

81. Parts of the upper catchment are under forestry and agriculture, but the majority of the Gill Burn catchment is peatland, protected as the Stroupster Peatlands SSSI and Caithness & Sutherland Peatlands Special Area of Conservation (SAC) (see **Section 10.4.9**). This protected area covers a substantial part of the catchment between Brabstermire and Freswick. As with the other catchments, there has been significant modification of the catchment for land drainage.

Burn of Lyth

82. Two small parts of the southern Site fall in the Burn of Lyth catchment. This catchment drains south and south west into the North Sea at Sinclair's Bay. The Burn of Lyth has a catchment area of 36.2 km^2 to the confluence with the Burn of Bower/Black Burn and includes 5.3% of the Site.

83. Some sections of the catchment are under commercial forestry, with areas of agricultural and grazing land present in the north and west. The main body of the catchment is under peatland, also part of the Stroupster Peatlands SSSI and Caithness & Sutherland Peatlands SAC which cover over one third of the catchment area (please see **Section 10.4.9**). As with the other catchments, there has been significant modification of the catchment for land drainage, principally in the areas under agriculture and forestry.

84. The Burn of Slickly, Back Burn of Slickly, Kirk Burn, Burn of Alterwall, Little Burn of Alterwall and Burn of Reaster are all tributaries to the Burn of Lyth. The Burn of Slickly and Back Burn of Slickly provide the Site drainage within this catchment.

10.4.6.2 Water Quality

Surface Waterbodies

85. SEPA's Water Classification (SEPA, 2020a) and Water Environment Hubs (SEPA, 2020b) have been consulted to determine the existing baseline water quality for the main watercourses and waterbodies within the Site. The details are summarised in **Table 10.14**.

Table 10.14 Baseline surface water quality status, summarised

Waterbody Name	Status		Pressures
Link Burn (part of Burn of Rattar catchment) ID 20632	**Condition in 2014**	Overall: Good Water flows & levels: High Physical condition: Good	None
	Classification in 2018	Overall: Good Water chemistry: not recorded Biology (fish): High Hydromorphology: Good	
Gill Burn ID 20000	**Condition in 2014**	Overall: Good Water flows & levels: High Physical condition: High	None
	Classification in 2018	Overall: Good Water chemistry: Good Biology (fish): High Hydromorphology: High	
Kirk Burn (part of Burn of Lyth catchment) ID 20027	**Condition in 2014**	Overall: Moderate Water flows & levels: High Physical condition: Moderate	Modification to bed, banks and shores as a result of urban and rural land uses. This will be addressed in 2021-2027 by SEPA, other public bodies, voluntary organisations and land managers.
	Classification in 2018	Overall: Moderate Water chemistry: Good Biology (fish): High Hydromorphology: Moderate	

Groundwater

86. Scotland's environment groundwater classification map (2020) was also consulted for groundwater quality information. The Caithness groundwater body has been classified as 'Good'.

Receiving Waterbodies

87. SEPA's Water Classification (SEPA, 2020a) and Water Environment Hubs (SEPA, 2020b) have also been consulted to determine the existing baseline water quality for the Site's receiving waterbodies. The details are summarised in Error! Reference source not found.

88. The Burn of Rattar (including the Burn of Hollandmey, Link Burn and Burn of Ormigill) and the Burn of Horsegrow catchments drain north west into the sea, into the Dunnet Head to Duncansby Head coastal waterbody. The West Burn of Gills catchment drains north east into the same receiving waterbody.

89. The Gill Burn catchment drains east into the sea, into the Duncansby Head to Noss Head coastal waterbody. The Burn of Lyth catchment drains south east into the same receiving waterbody.

Table 10.15 Coastal waterbody quality status, summarised

Waterbody Name & ID	Status		Pressures
Dunnet Head to Duncansby Head ID 200225	**Condition in 2014**	Overall: Good Physical condition: High Water quality: Good	None
	Classification in 2018	Overall: Good Water chemistry: High Biology: Good Hydromorphology: High	
Duncansby Head to Noss Head ID 200219	**Condition in 2014**	Overall: Good Physical condition: High Water quality: Good	None
	Classification in 2018	Overall: Good Water chemistry: High Biology: Good Hydromorphology: High	

10.4.7 Private Water Supplies

90. The Environmental Health Department of THC was contacted to request any information that they hold with regard to private water supplies (PWS) within 5 km of the application boundary (**Table 10.5**). A response was received on 18 September 2020 confirming that their records do not indicate any PWS within this area.

91. The owners of Philips Mains Farm confirmed that their property is supplied by mains water.

92. A number of wells are indicated on Ordnance Survey mapping for the Site and its immediate surroundings. These wells are predominantly located near isolated houses or farms but may now be disused. It is possible that some remain in active use as water supplies for livestock. Wells identified within 2 km of the Site are provided in **Table 10.16** and shown on **Figure 10.5**. **Table 10.16** includes a preliminary risk assessment of the identified wells.

93. The indicated well at Hollandmey steading, within the Site, was visited on 25 August 2020. There was no indication of any well structure in the area. The landowner confirmed that there is no active well present.

94. It remains possible that some local properties rely on a PWS, although none have been identified within the Site or in the immediate area.

95. Attempts were made to contact the owner/occupier of Rose Cottage, Mey, to determine the status of the indicated well at this property. However, no response was made to enquiries.

Table 10.16 Wells within 2 km of the Site (source: OS 1:25,000 mapping)

No.	Name	Source Location	Distance from Site	Linkage?
1	Hollandmey	ND 2935 7052	0 km	Within Site, but upstream of most infrastructure. No indication of any well structure present at the Site and landowner confirmed no active well is present
2	Rose Cottage, Mey	ND 2842 7267	0.6 km north	Downstream of Site but is located within a separate sub-catchment from all development so no direct linkage is present.

No.	Name	Source Location	Distance from Site	Linkage?
3	Shean, Upper Gills	ND 3203 7155	0.4 km north east	None, within separate sub-catchment.
4	Erebor, Upper Gills	ND 3207 7174	0.45 km north east	None, within separate catchment.
5	Kandahar, Upper Gills	ND 3249 7108	0.8 km north east	None, within separate catchment.
6	Heather Moor, Upper Gills	ND 3288 7083	1.3 km east	None, within separate catchment.
7	Brabstermire	ND 3167 6894	0.2 km east	None, no infrastructure is within this catchment.
8	Slickly Croft	ND 3012 6627	1.6 km south	None, within separate sub-catchment.
9	Slickly 2	ND 2980 6675	1.45 km south	None, within separate sub-catchment.
10	Slickly Farm	ND 2960 6677	1.55 km south	None, within separate sub-catchment.
11	Slickly 1	ND 2932 6683	1.1 km south	None, within separate sub-catchment.
12	Lochend 2	ND 2711 6722	1.35 km south west	None, within separate sub-catchment.
13	Lochend 1	ND 2660 6827	1.5 km west	None, within separate catchment.
14	Clett Cottage, Barrock	ND 2625 7116	0.4 km west	None, upstream of all proposed works.

10.4.8 Flood Risk

96. SEPA's Indicative Flood Map (SEPA, 2020c) was consulted to gain an overview of the likelihood of flooding within the Site. Flood risk is shown to be relatively minimal within the Site, with some localised regions of surface water (pluvial) and river (fluvial) flood risk. No areas are shown as at risk from coastal flooding.

97. River flooding is largely confined to the main channel of the Link Burn and directly around the dubh lochans of the Philips Mains Mire SSSI. The main channel of the Link Burn and the area immediately surrounding the dubh lochans each have a high likelihood of flooding, defined as having a 10% chance of a flooding in a given year. Additionally, there are a few small, isolated locations of high fluvial flood risk scattered across the Site, mainly associated with small ponds or lochans.

98. There are small areas at high risk of surface water flooding scattered across the Site, particularly in the north eastern region of the Site within 0.5 km of the Philips Mains Mire SSSI. The northern part of Philips Mains Mire includes a slightly larger area at risk of pluvial flooding. Additionally, the agricultural fields just west of the south west Site are at high risk of surface water flooding.

10.4.9 Designated Sites

99. Designated sites of relevance to geology, hydrogeology and hydrology that are located within 5 km of the Site are identified within **Table 10.17.** Data was collated from NatureScot (2020) and Joint Nature Conservation Committee (JNCC) (2020). Designated sites reviewed include SSSIs, Special Protection Areas (SPA), SACs and Ramsar sites (internationally recognised wetlands). Geological Conservation Review (GCR) sites have also been included for completeness; these do not have a statutory designation but are considered to be important for geological understanding and many are also protected as SSSIs.

100. There are four main designated sites within 5 km of the Site. Details are provided in **Table 10.17.**

Table 10.17 Designated sites related to geology, hydrogeology, hydrology or peat within 5 km of the Site

Designated Site Name(s)		Qualifying Features Relating to Geology, Hydrogeology, Soils, Peat & Hydrology	Distance from Site	Linkage?
Philips Mains Mire SSSI		Nationally important blanket bog habitat and contains an extensive system of dubh lochans	0 km	Within the north eastern part of the Site
Caithness & Sutherland Peatlands SAC/ SPA/Ramsar site	Stroupster Peatlands SSSI	Nationally important blanket bog habitat and oligotrophic (low nutrient) lochs	0 km	Borders south eastern application boundary and extends north east, east and south east. Gill Burn catchment includes part of the Site, although does not include any proposed infrastructure
Caithness Lochs SPA/Ramsar site	Loch Heilen SSSI	Includes six lochs and a mire, covering a range from oligotrophic to eutrophic; supports a wide diversity of aquatic and wetland vegetation	2.0 km west	No hydrological linkage; however, it is geographically very close
	Loch of Mey SSSI		1.67 km north west	Burn of Horsegrow drains the northern Site and directly into the Loch of Mey.
Dunnet Links SSSI	Dunnet Bay GCR	Coastal geomorphology of Scotland and sand dunes; coastal dune ridge. General morphology and scale of this extensive beach-dune-links system is unique in Britain	3.0 km west	None

10.5 Influence on Design

101. The importance of hydrology, hydrogeology, geology and peat has been recognised throughout the design of the proposed Development. Key constraints that have had a considerable influence on design are:

- peatland and peat depth;
- watercourses and waterbodies;
- designated sites with a hydrological linkage; and
- potential GWDTE.

102. Other constraints that were considered but were not considered relevant for the proposed Development include PWS and public water supply infrastructure. There are no recorded PWS within the Site and no public water supply infrastructure has been identified within the Site where ground works would be required.

103. The scoping layout of turbines was identified as requiring changes following the first phase of peat depth surveys, as a number of the turbines were located in areas of deep peatland. Subsequent phases of design have made use of the detailed local peat depth data collected through the peat depth surveys to ensure that significant infrastructure (turbines, crane pads, solar array etc.) is located in areas with peat preferably less than 1.0 m and in no location with peat depth greater than 1.5 m. Tracks have for the most part been confined to areas of peat less than 1.2 m in depth with three small areas of floating track where crossing peat deeper than 1.2 m was necessitated by the balance of other environmental constraints.

104. Early advice provided by SEPA was also taken on board and efforts were made to avoid the deepest areas of peat by revising the route of the track from T3 leading to T1 and T2.

105. Watercourse crossings have been kept to a practical minimum, with only eight regulated crossings required for the proposed Development. Most of these are on relatively small headwaters channels, some of which have been significantly modified to improve local drainage. Two crossings are on the existing public road but would require upgrading to provide access.

106. All designated sites with a hydrological linkage have been avoided for any proposed infrastructure. Monitoring requirements to ensure protection for designated areas downstream of the proposed Development are set out in **Table 10.19**.

107. Potentially sensitive wetland habitats have been avoided where possible. The balance of constraints has meant that this has not been easy to accommodate, as peatland areas were considered to be of higher priority. Other constraints including ecology, forestry felling and visual impact were important considerations that required balancing with peatland, hydrology and wetland habitats.

108. Key infrastructure iterations of the proposed Development are shown on **Figure 10.6**.

10.6 Predicted Impacts

10.6.1 Development Characteristics

109. The construction phase of the proposed Development would involve a number of different elements. **Chapter 2: Site Description and Design Evolution** of the EIA Report describes this in detail. The elements with particular relevance to geology, hydrogeology, hydrology and soils are as follows:

- construction of access routes and watercourse crossings;
- excavation and construction of turbine foundations and associated crane pads;
- creation of construction compounds, laydown areas and a substation;
- excavation of borrow pits and processing of excavated rock;
- installation of permanent met masts;
- installation of drainage features around permanent infrastructure;
- batching of concrete (if required);
- temporary welfare facilities and site utilities including water supply and foul water disposal; and
- excavation, handling and temporary storage of peat and soils.

110. During operation of the proposed Development, activities with particular relevance to geology, hydrogeology, hydrology and soils are as follows:

- surface water drainage, including treatment and discharge of surface drainage;
- permanent welfare facilities including water supply and foul water disposal;
- maintenance of tracks and trackside drainage; and
- long term drainage around permanent infrastructure.

10.6.2 Effects During Construction

10.6.2.1 Physical Changes to Overland Drainage and Surface Water Flows

111. Changes to overland drainage patterns would arise principally from construction of the access track network with subsidiary effects from construction of the turbine foundations, crane pads and ancillary infrastructure.

112. The access track would require installation of trackside drainage and cross-drains to protect the track from water damage. In addition, the solar array would require installation of perimeter drainage, to provide flow management resulting from the impermeable surfaces of the solar panels. Constructed drains would be no longer and deeper than necessary to provide the required track drainage. Cross-drains would be installed at an appropriate frequency to minimise concentration of flows from above the track, where cross-slopes are present, and to prevent diversion of flows between sub-catchment areas, to minimise changes to the hydrological regime. All drainage infrastructure would be designed with suitable capacity for a rainfall intensity of a 1-in-200 year storm event, plus allowance for climate change.

113. All long-term and temporary drainage infrastructure would be established on a running basis ahead of excavation works. This includes temporary bunding and cut-off drains around turbine bases, hardstanding areas, solar array and borrow pits. Where possible, trackside drainage would be laid up to 100 m ahead of track construction works on a running basis. A number of watercourses would be crossed by the access track. Six crossings of regulated watercourses have been identified and details are provided in **Technical Appendix 10.5**. All crossings would be new structures.

114. Eight minor, unregulated watercourses would also require a crossing to be installed. These crossings would be designed with sufficient capacity for a rainfall intensity of a 1-in-200 year storm event, plus allowance for climate change.

115. All necessary permissions required for watercourse crossing works would be obtained prior to commencement of associated works.

116. The receptor, Site surface watercourses, is considered to be of '**Moderate'** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be of '**Slight'** magnitude. The likelihood of effect is considered to be '**Likely'**.

117. The effect of physical changes to overland drainage from construction works is assessed as '**Minor'**, long-term and adverse.

10.6.2.2 Particulates and Suspended Solids

118. All development work involving earthmoving operations would generate loose sediment, which could potentially gain access to surface watercourses and waterbodies through entrainment in surface runoff. This could potentially have an adverse effect on the downstream watercourses through damage to fish spawning habitat and changes to dissolved oxygen and nutrient levels in watercourses and waterbodies (please refer to **Chapter 8: Ecology and Biodiversity**). Surface water from the areas surrounding the turbine bases, all hardstanding areas (including crane pads, substation, construction compounds and laydown areas) and borrow pits would be prevented from entering the working areas by appropriate use of peripheral bunding and cut-off drains. These would help to divert clean water around and away from the working areas.

119. During excavation works for turbine foundations, cut sections of track, cut areas for hardstandings, borrow pits and solar panel foundations, silt fencing or appropriate alternative sediment control protection would be installed on the downhill side of the excavation to prevent inadvertent discharge of silty water into any Site watercourse. Pre-construction installation of long-term drainage would provide an additional level of sediment control.

120. All engineering work adjacent to watercourses, including track construction and installation of watercourse crossings, would have appropriate sediment control measures established prior to any groundworks. Vegetation would be retained along watercourse banks to act as additional protection. The main watercourses crossings for the proposed Development would not require any in-stream works.

121. Minor in-stream works would be required for the crossings of the minor watercourses noted above. This work would be undertaken using a temporary dam to control flow whilst the culvert pipes are installed. Over-pumping would only be used if flow conditions require this.

122. For areas of larger excavation, such as turbine bases and crane pads or borrow pit excavations, temporary water control measures may be used. These may include use of temporary settlement ponds or the use of proprietary treatment systems such as Siltbusters, as appropriate.

123. Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of identified deeper peat, to minimise mobilisation of sediment in heavy rainfall. **Table 10.18** provides details of the 'stop' conditions are recommended to guide construction activity (CH2M & Fairhurst, 2018):

Table 10.18 Recommended 'stop' conditions for earthmoving activities

'Stop' rule	Requirements
High intensity rainfall	Rainfall during construction greater than 10 mm per hour
Long duration rainfall	Rainfall in the preceding 24 hours greater than 25 mm
Seven-day cumulative rainfall (1)	Preceding seven days of rainfall greater than 50% of the monthly average
Seven-day cumulative rainfall (2)	Preceding seven days of rainfall greater than 50 mm

124. Any water collecting within excavations would be pumped out prior to further work in the excavation. This water may require treatment to remove suspended solids prior to discharge to ground.

125. Vegetation cover would be re-established as quickly as possible on track verges and cut slopes, by re-laying of excavated peat acrotelm (the vegetated upper layer of the peat), to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradable geotextile, would be considered if necessary, in specific areas and areas of particular sensitivity.

126. All necessary permissions relating to construction works, plus accompanying pollution prevention plans, would be obtained prior to any construction work beginning within the Site. All the management and control measures, including emergency response procedures, would be set out in a Construction Environment Management Plan (CEMP) produced by the appointed Contractor prior to any works beginning. This would be a live document and would be updated as required throughout construction. A draft of this document is included in **Technical Appendix 3.1: Outline Construction Environment Management Plan.**

127. A water quality monitoring programme would be established at key locations around the Site. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details are provided in **Table 10.19.**

128. The receptor, Site surface watercourses, is considered to be of '**Moderate'** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be '**Slight'**. The likelihood of effect is considered to be '**Likely'**.

129. The effect of particulates and suspended solids from construction works is assessed as '**Minor'**, temporary and adverse.

10.6.2.3 Water Contamination from Fuels, Oils, Concrete Batching or Foul Drainage

130. Spillage of fuels, oils, wet concrete or concrete washout water could have an adverse effect on surface water quality, and major spillages could have a potential influence on the Burn of Rattar system downstream of Site watercourses, with smaller potential influences on the Burn of Horsegrow and Burn of Lyth systems as a result of the smaller infrastructure footprint in these catchments.

131. Oil and fuel storage and handling within the proposed Development would be undertaken following published guidance, in particular *Guidance on Pollution Prevention 2 – Above ground oil storage tanks* (SEPA, 2018) and in compliance with the *Water Environment (Oil Storage) (Scotland) Regulations 2006*. The details would be contained in the CEMP, a draft of which is contained in **Technical Appendix 3.1: Outline Construction Environment Management Plan**, and are summarised as follows:

- risk assessments would be undertaken and all Hazardous Substances and Non-Hazardous Pollutants that would be used and/or stored within the Site would be identified. Hazardous substances likely to be within the Site include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be used within the Site. Herbicides would not be used;
- all deliveries of oils and fuels would be supervised;
- all storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank's capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank's capacity or 25% of the total capacity, whichever is the greater;
- any valve, filter, sight gauge, vent pipe or other ancillary equipment would be located within the containment area;
- waste oil would only be stored within the Site in a dedicated storage area prior to offsite disposal;
- management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms;
- maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant;
- servicing would be undertaken in a designated area or location with adequate precautions in place, such as a dedicated impermeable surface with lipped edges to contain any contaminants;
- where vehicle maintenance and refuelling are necessary in the field, owing to breakdown, additional precautions would be taken to contain contaminants, such as spill trays or absorbent mattresses;
- the access track would be designed and constructed to promote good visibility where possible and two-way access where visibility is restricted, to minimise risk of vehicle collisions; and
- if concrete batching within the Site is required, this would take place in one designated location within the Site construction compound. This location would be at least 100 m from the nearest watercourse. Protective bunding would be installed around the batching area to ensure that contaminated runoff is contained. Dedicated drainage would be installed to ensure that water from the batching area can be suitably treated to reduce alkalinity and suspended sediment load prior to discharge or removed from the Site by tanker for treatment and disposal offsite.

Foul Drainage Provision

132. It is anticipated that foul drainage provision would be provided via a septic tank during construction-phase activities.

Spillage and Emergency Procedures

133. The Spillage and Emergency Procedures would form part of the CEMP and would be prominently displayed at the development and staff would be trained in their application. A draft of this document is included in **Technical Appendix 3.1: Outline Construction Environment Management Plan.** The Procedures document would incorporate guidance from the relevant SEPA Guidance Notes.

134. In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water environment, all necessary measures would be taken to remedy the situation. These measures would include:

- identifying and stopping the source of the spillage;
- containing the spillage to prevent it spreading or entering watercourses, by means of suitable material and equipment;
- absorbent materials, including materials capable of absorbing oils, would be available within the Site to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials. Sand bags would also be readily available for use to prevent spread of spillages and create dams if appropriate;
- where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed from the Site by a licensed waste carrier to a suitable landfill facility;
- the emergency contact telephone number of a specialist oil pollution control company would be displayed within the Site; and
- sub-contractors would be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the Development.

135. SEPA would be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident would be forwarded to SEPA no later than 14 days after the incident, in line with SEPA's requirements.

136. A water quality monitoring programme would be established at key locations around the proposed Development. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details are provided **in Table 10.19**.

137. The receptor, Site surface watercourses, is considered to be of '**Moderate'** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be '**Moderate'**. The likelihood of effect is considered to be '**Unlikely'**.

138. The effect of water contamination from fuels, oils, concrete batching or foul drainage from construction works is assessed as '**Minor'**, temporary and adverse.

10.6.2.4 Changes in or Contamination of Water Supply to Vulnerable Receptors

139. Vulnerable receptors that have the potential to be affected by development works have been identified. These include three designated sites and a number of potential GWDTE. No PWSs have been identified in the area, although one well indicated on OS mapping has been identified as potentially at risk and has been included in this assessment.

Designated Sites

140. Three designated sites have potential links to the Site and proposed works:

- Philips Mains Mire SSSI is located within the project boundary and is partly within the Burn of Rattar catchment. The integrity of the SSSI has been protected by careful siting of project infrastructure, with the nearest infrastructure (T10) located more than 300 m from the SSSI boundary. The SSSI occupies comparatively high ground, so there is minimal risk of sediment transfer from the turbine area to the SSSI. As an area of blanket bog, Philips Mains Mire is rainwater-fed and, as a result, would **not be affected** by any localised changes to hydrology and hydrogeology around the turbine and hardstanding excavations.

- The Caithness and Sutherland Peatlands SAC and Stroupster Peatlands SSSI is located adjacent to the application boundary. The relevant peatland areas lie within the Gill Burn and Burn of Lyth catchment areas. There is no infrastructure proposed within the Gill Burn catchment. Within the Burn of Lyth catchment, one turbine (T4) and hardstanding are proposed, with no other infrastructure. T1 is located over 80 m from the nearest watercourse within the Burn of Lyth catchment. Precautions would be taken during construction to ensure that any potentially contaminating materials would not be permitted to enter the watercourse. A water monitoring location downstream of T4 would be included in the project water quality monitoring. With adherence to good practice surface water and sediment management, the Caithness and Sutherland Peatlands SAC and Stroupster Peatlands SSSI would **not be affected** by any localised changes to hydrology and hydrogeology around the turbine and hardstanding excavations.
- The Loch of Mey SSSI and part of the Caithness Lochs SPA is located downstream of the Site, in the Burn of Horsegrow catchment. Most of the infrastructure proposed for this catchment would involve upgrading of existing tracks. Approximately 326 m of new track would be required, plus the solar panel array, compound for the solar array and proposed Battery Energy Storage System. Groundworks required for solar panel installation would be considerably less than that required for turbine construction. Precautions would be taken during construction to ensure that any potentially contaminating materials would not be permitted to enter the watercourse. A water monitoring location downstream of all proposed works in the catchment would be included in the project water quality monitoring. Two unregulated watercourse crossings in the Burn of Horsegrow catchment would require upgrading. Additional precautions would be established prior to the upgrading works beginning, to manage water that may include entrained sediment from the construction works. It is anticipated that the crossing upgrades would involve temporary dams to isolate the crossing, with over-pumping of water undertaken only if required by flow levels. All crossings would be designed to accept a 1-in-200 year storm event plus allowance for climate change. With adherence to the mitigation measures set out above, the Loch of Mey SSSI and Caithness Lochs SPA would **not be affected** by the limited development proposed within the Burn of Horsegrow catchment.

Groundwater-Dependent Terrestrial Ecosystems

141. A detailed assessment of the interaction between the works required for the proposed Development and potential GWDTE has been undertaken. Two potentially groundwater-dependent NVC communities have been identified within the Site:

- M15 wet heath; and
- M23 rush-pasture.

M15 wet heath has potential moderate groundwater dependency in Scottish situations and M23 rush-pasture has a potential high groundwater dependency. Information from the ecology surveyors indicated that both habitat types were of relatively low quality in all parts of the Site.

142. A total of eight areas of potentially groundwater-dependent wetland habitats have been identified within 100 m of excavations less than 1 m in depth or within 250 m of excavations deeper than 1 m. The potentially groundwater-dependent habitats have been assessed specifically within the context of the proposed Development, taking into account the local bedrock and superficial geology, peat distribution and site observations. No groundwater discharges were identified at any location within the Site. The superficial deposits, consisting of peat and clay-dominated diamicton till, would act to insulate the groundwater in the bedrock from the ground surface, effectively preventing groundwater discharge at surface. It is determined as a result that neither of the two potentially groundwater-dependent communities within the Site are actually groundwater-dependent in this area but rely on a mix of surface water, shallow throughflow in surface vegetation and rainwater.

143. Details of the GWDTE assessment are provided in **Technical Appendix 10.4**.

144. The designated sites with hydrological linkage are considered to be of '**High'** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be '**Slight'**. The likelihood of effect is considered to be '**Unlikely'**.

145. The potential GWDTE within the Site are considered to be of '**Low'** sensitivity as a result of the absence of any hydrogeological linkage and the low quality of the habitats. With appropriate mitigation measures in place, as described, the magnitude of works is considered to be '**Moderate'**. The likelihood of effect is considered to be '**Likely'**.

146. The effect of changes in or contamination of water supply to vulnerable receptors from construction works is assessed as '**Minor'**, temporary and adverse.

10.6.2.5 Increased Flood Risk

147. The Development infrastructure is not at risk of flooding from any source.

148. The drainage infrastructure installed around long-term windfarm infrastructure would be designed to minimise concentration of flows. This would be achieved by:

- use of cut-off drains to divert runoff around necessary 'hard' infrastructure such as turbine bases and hardstanding areas.
- use of regular cross-drains underneath access tracks. These would be installed in line with the natural terrain, making use of low points where runoff would naturally be focused.
- use of a slight gradient on installed 'hard' infrastructure to encourage drainage into a filter drain or swale, for infiltration into vegetated areas and as shallow through-flow.

149. Long-term drainage would be installed ahead of related construction works or excavations taking place, to ensure that site drainage can be controlled appropriately. For tracks, the required trackside drainage would be put in place ahead of access track construction, on a rolling basis as the track development progresses.

150. Any areas which have to be left unvegetated during the construction phase, such as turbine foundations, hardstanding areas and borrow pits, would have settlement ponds put in place to attenuate flow until vegetation can be re-established at the end of the construction period.

151. In line with best practice guidance, site runoff would not be greater than natural pre-development runoff. Details are provided in **Technical Appendix 10.5**.

152. The receptors, infrastructure and property downstream of the Development, are considered to be of '**High'** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of any increased flood risk is considered to be '**Negligible'**. The likelihood of effect is considered to be '**Unlikely'**.

153. The effect of increase in flood risk resulting from the construction works is assessed as '**Negligible'**.

10.6.2.6 Physical Removal of Bedrock

154. Bedrock and superficial materials would require to be removed to form turbine foundations, platforms for construction of hardstanding areas and, particularly, to facilitate development of borrow pits in order to provide aggregate for the project construction works.

155. These works would require permanent modification to the natural geology at the Site. As the footprint of the works within the overall site area is small, overall changes to the geological character of the area would be limited. There are no areas designated for geological characteristics within or adjacent to the Site.

156. Rock testing would be undertaken on appropriate samples from the three borrow pit areas to determine their suitability for unbound track and hardstanding construction. This would include testing to determine likely degradation patterns during the lifespan of the development. Should the tests identify problems with parts of the rock within the borrow pit footprints, care would be taken to ensure that unsuitable material is not used for construction but would be retained for use in borrow pit restoration.

157. The Site bedrock receptor is considered to be of '**Low'** sensitivity. The magnitude of the works is considered to be '**Slight'**. The likelihood of effect is considered to be '**Likely'**.

158. The effect of physical removal of bedrock from construction works is assessed as '**Minor'**, long-term and adverse.

10.6.2.7 Modification to Groundwater Flow Paths

159. Physical changes to the shallow subsurface as a result of all excavation work have potential to interrupt shallow groundwater flow paths. This would include cut-and-fill track sections, turbine foundations, hardstanding areas, met masts, substation, laydown area, construction compounds and cable trenches.

160. Physical changes to the deeper subsurface (>5 m below ground surface) have potential to interrupt deeper groundwater flow paths. This would include borrow pit excavations, some turbine foundation areas and the proposed water abstraction borehole to provide water to the welfare facilities.

161. The superficial deposits are noted to be largely without groundwater, although some groundwater would be present within the peat bodies and occasionally in parts of the glacial till. There is likely to be some groundwater flow via fracture networks within the bedrock.

162. Groundwater monitoring boreholes would be established within the two borrow pit areas prior to any construction work beginning, to a depth at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken to determine whether groundwater is present within the borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit area would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing.

163. Excavation of cable trenches could lead to groundwater flow between catchments if the trenches act as preferential flow paths. This can be avoided by laying cables in disturbed ground adjacent to access tracks. In areas where cable routes cross up or down notable slopes, clay bunds or alternative impermeable barrier would be placed for every 0.5 m change in elevation along the length of the trench to minimise in-trench groundwater flow. As the Site is comparatively flat, this is not anticipated to be a frequent requirement.

164. Any groundwater abstraction would be subject to appropriate authorisation under CAR. It is anticipated that the abstraction would fall either under General Binding Rule (for abstractions <10 m^3/day) or Registration (for abstractions between 10 and 50 m^3/day). Test pumping would be required to ensure that the abstraction rate is sufficient and that water quality is acceptable for a potable supply. The abstraction would be compliant with all relevant regulatory systems, including any ongoing monitoring and reporting requirements.

165. The Site groundwater receptor is considered to be of '**Moderate'** sensitivity. With appropriate design constraints and mitigation measures in place, as described, the magnitude of the works is considered to be '**Slight'**. The likelihood of effect is considered to be '**Likely'**.

166. The effect of modification to groundwater flow paths from construction works is assessed as '**Minor'**, long-term and adverse.

10.6.2.8 Soil Erosion and Compaction

167. Construction activity, particularly plant and vehicle movements, soil stripping and stockpiling, would affect the nature of the Site soils. Plant movements would act to compact soils through movements over unstripped ground. All activity requiring removal, transport and stockpiling of soils would have potential to lead to soil erosion and loss of structure, resulting in overall soil degradation.

168. All traffic routes would be clearly demarcated and vehicles would not be permitted access outwith these areas.

169. Only tracked or low ground pressure vehicles would be permitted access to unstripped ground.

170. Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2 m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate stockpiles for separate soil types in order to preserve the soil quality.

171. For work within areas of peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging. The underlying catotelmic peat would be stored in bunds up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelmic peat has been limited by careful infrastructure design and use of floating road construction on areas of deeper peat.

172. Limited smoothing or 'blading' of stockpiled soils and catotelmic peat would be undertaken to help shed rainwater and prevent ponding of water on the stockpile. Bunds on notably sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall.

173. Excavated soil and peat would be used in site restoration and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare soil or peat that are not required for the operational phase of the development. Some of the excavated peat would be reserved for peatland restoration in parts of the Site. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.

174. The receptor, Site soils and peat, is considered to be of '**Moderate'** sensitivity. The magnitude of the works is considered to be '**Slight'**. The likelihood of effect is considered to be '**Likely'**.

175. The effect of soil erosion and compaction from construction works is considered to be '**Minor'**, temporary and adverse.

10.6.2.9 Peat Instability

176. Construction activity on peatland can affect the natural stability of the peat deposits in areas near to or associated with construction works. Particular risk areas are associated with works at or near breaks in slope, areas where natural peat instability has been recorded and locations where the peat has degraded through, for example, erosion processes, drying out or overgrazing.

177. A detailed Peat Slide Risk Assessment (PSRA) has been undertaken for the proposed Development and is provided in **Technical Appendix 10.1**. The key effects assessment findings are provided below.

178. The PSRA found that the majority of the Site has a negligible or low risk of natural or induced peat landslide. One area within the Site, and two areas within the wider application boundary, were identified as potentially having a moderate or high risk of peat instability. The areas were appraised in greater detail, taking into account location-specific details including information gathered from the reconnaissance survey. Mitigation measures have been recommended to control the peat landslide hazard. For these areas, the peat landslide hazard can be controlled by use of good construction practice and micrositing.

179. The receptors for peat landslide hazard are the peatland habitat, the water environment including surface water and groundwater, the development infrastructure, and the construction personnel.

180. The peatland habitat, water environment and Development infrastructure receptors are considered to be of '**High'** sensitivity. Construction personnel are considered to be a '**Very High'** sensitivity receptor.

181. With appropriate design constraints and mitigation measures in place, as described in **Technical Appendix 9.1**, the magnitude of works is considered to be '**Slight'**. The likelihood of effect is considered to be '**Unlikely'**.

182. For all receptors, the effect of peat instability is assessed as '**Minor'**, long-term and adverse.

10.6.3 Effects during Operation

10.6.3.1 Physical Changes to Overland Drainage and Surface Water Flows

183. No additional changes to overland drainage and surface water flows are anticipated during the operational phase. Trackside and infrastructure drainage would remain in place during the proposed Development's operation. A monitoring and maintenance programme would be put in place for the drainage infrastructure, to include regular visual inspection of drainage ditches, crossing structures and cross-drains to check for blockages, debris or damage that might impede water flow. Any identified blockage, including build-up of sediment that may lead to future blockage, or damage to structures would be remediated immediately. Where practicable, routine maintenance would be undertaken during dry weather; where this is not practicable, additional sediment control measures may need to be established to manage silty water arising from the work.

184. The receptor, Site surface watercourses, is considered to be of '**Moderate'** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be of '**Negligible'** magnitude. The likelihood of effect is considered to be '**Unlikely'**.

185. The effect of physical changes to overland drainage from operational works is assessed as '**Negligible'**.

10.6.3.2 Particulates and Suspended Solids

186. The main operational phase work would involve track and hardstanding maintenance and repair. Regular monitoring of the track and hardstanding condition would be undertaken, particularly following periods of heavy or prolonged rainfall and after snowfall and clearance, if relevant. Any sections of the track showing signs of excessive wear would be repaired as necessary with suitable rock from external sources.

187. The drainage network would also be subject to regular monitoring to ensure that it remains fully operational, as water build-up can cause considerable damage to unbound track construction.

188. All bridge structures would have appropriate splash control measures as part of their design, to prevent silty water splashing into the watercourse from vehicle movements. These splash controls would be monitored regularly to ensure they remain effective and have not become damaged in any way.

189. The receptor, Site surface watercourses, is considered to be of '**Moderate'** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be '**Slight'**. The likelihood of effect is considered to be '**Possible'**.

190. The effect of particulates or suspended solids from operational works is assessed as '**Minor'**, temporary and adverse.

10.6.3.3 Water Contamination from Fuels, Oils or Foul Drainage

191. The risk of water contamination from fuels or oils is considerably lower during operation than during construction as there are significantly decreased levels of activity on the Site. The majority of potential pollutants would no longer be present on the Site. Lubricants for turbine gearboxes, transformer oils and maintenance vehicle fuels would remain present in small quantities. There are no plans for herbicide use during operation; physical cutting of vegetation would be the preferred form of management, where required.

192. The pollution prevention plan and site spillage and emergency procedures, as set out above, would remain in force throughout the operational phase. It is anticipated that foul drainage from the control building would be provided by a septic tank or a dedicated waste treatment plant with optional reedbed.

193. The receptor, Site surface watercourses, is considered to be of '**Moderate'** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be '**Negligible'**. The likelihood of effect is considered to be '**Unlikely'**.

194. The effect of water contamination from fuels or oils from operational works is assessed as '**Negligible'**.

10.6.3.4 Changes in or Contamination of Water Supply to Vulnerable Receptors

195. Only minor works would take place within the proposed Development during the operational phase, to allow necessary maintenance activities. Works within the Burn of Horsegrow (for the Loch of Mey SSSI) and Burn of Lyth (for Caithness and Sutherland Peatlands SAC/Stroupster Peatlands SSSI) catchments would be minimal, as there would be very little infrastructure in either catchment. Although the majority of the proposed Development infrastructure would be located in the Burn of Rattar catchment, Philips Mains Mire SSSI is located upslope of all nearby proposed infrastructure and would be protected by the natural ground slope.

196. Additional works affecting the identified wetland habitats would also be of minor scale.

197. The designated sites with hydrological linkage are considered to be of '**High'** sensitivity. The potential GWDTE within the Site are considered to be of **Low** sensitivity. The magnitude of effect is considered to be '**Negligible'.** The likelihood of effect is considered to be '**Unlikely'**.

198. The effect of changes in or contamination of water supply to vulnerable receptors, from operational works is assessed as **'Negligible'**.

10.6.3.5 Increased Flood Risk

199. Infrastructure drainage would remain in place during the proposed Development's operational phase. A regular monitoring and maintenance programme for the drainage infrastructure would be implemented to ensure that it remains fully operational and in good condition. Where practicable, routine maintenance would be undertaken during dry weather, to help ensure that drainage operation during wet weather is fully functional.

200. Post-development runoff would be designed such that there is no change from natural pre-development runoff.

201. The receptors, infrastructure and property downstream of the development, are considered to be of '**High'** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of any increased flood risk is considered to be '**Negligible'**. The likelihood of effect is considered to be '**Unlikely'**.

202. The effect of increase in flood risk resulting from the operational works is assessed as '**Negligible'**.

10.6.3.6 Physical Removal of Bedrock

203. Although most physical removal of bedrock would have occurred during construction, the ongoing requirement for track and hardstanding maintenance would require some extraction of rock from the borrow pit sites during the operational phase of the development. These operations would be very limited in nature.

204. The bedrock receptor is considered to be of '**Low'** sensitivity. The magnitude of the works is considered to be '**Negligible'**. The likelihood of effect is considered to be '**Likely'**.

205. The effect of physical removal of bedrock from operational works is assessed as '**Negligible'**.

10.6.3.7 Modification to Groundwater Flow Paths

206. There is a minor ongoing requirement for additional rock extraction at the borrow pit sites during operation, for track and hardstanding maintenance. These operations would be limited in nature.

207. There would be an ongoing requirement for water provision at the site welfare facilities. It is anticipated that this would be provided by a water abstraction borehole put in place during the construction phase of works.

208. Any groundwater abstraction would be subject to appropriate authorisation under CAR. It is anticipated that the abstraction would fall either under General Binding Rule (for abstractions <10 m^3/day) or Registration (for abstractions between 10 and 50 m^3/day). The abstraction would be compliant with all relevant regulatory systems, including any ongoing monitoring and reporting requirements. The Site groundwater receptor is considered to be of '**Moderate'** sensitivity. The magnitude of the works is considered to be '**Slight'**. The likelihood of effect is assessed as '**Likely'**.

209. The effect of modification to groundwater flow paths from operational works is assessed as '**Minor**, long-term and adverse.

10.6.3.8 Soil Erosion and Compaction

210. There are no soil stripping or stockpiling activities planned for the operational phase.

211. Ongoing monitoring and maintenance work at the development would require vehicle activity onsite. This would be much reduced from the construction phase and would mostly involve significantly lighter vehicles than heavy construction plant. The ongoing vehicle activity would have some effect on soil and peat compaction below access tracks, although at a significantly lower level than during construction.

212. The receptor, Site soils and peat, is considered to be of '**Moderate'** sensitivity. The magnitude of the works is considered to be '**Slight'**. The likelihood of effect is considered to be '**Possible'**.

213. The effect of soil erosion and compaction from operational works is considered to be '**Minor'**, temporary and adverse.

10.6.3.9 Peat Instability

214. No changes to the infrastructure are anticipated during the operational phase of works. Therefore, the effect of natural or induced peat instability during the operational works is assessed as '**No change'**.

10.6.4 Indirect and Secondary Effects

215. No indirect or secondary effects relating to site hydrology, hydrogeology, geology or peat have been identified.

10.6.5 Cumulative Effects

216. There is one development in the nearby area that has been identified as requiring consideration for cumulative effects. The Slickly Wind Farm is a development in planning for an 11 turbine windfarm approximately 2.5 km southeast across the C1037 road.

217. The Slickly Wind Farm effects on hydrology, hydrogeology, geology and soils are considered to be additive rather than synergistic.

10.6.5.1 Geology

218. Effects on geology are very localised. As a result, there are no cumulative effects relating to geology from this development.

10.6.5.2 Hydrogeology

219. The current layout for Slickly Wind Farm indicates that it is located primarily within the Burn of Lyth catchment, including all of the planned turbines. T4 of the proposed Development is located on the very western edge of this catchment area. All works are located on the opposite side of the C1037 road and on the adjacent side of the Hill of Slickly. The groundwater would be expected to flow in different directions for each development, following the topography of Slickly hill. As a result, there are no cumulative effects relating to hydrogeology from this Development.

10.6.5.3 Soils

220. Effects on soil and peat are fairly localised and rarely extend much beyond the Development footprint. Assuming that all construction, operation and decommissioning works at both developments abide by good works practices with relation to soil and peat handling and storage, there are no cumulative effects relating to soils and peat.

10.6.5.4 Hydrology

Potential Hydrological Cumulative Effects during Construction

221. It is assumed that best practice construction methods would be used for the Slickly Wind Farm.

222. Both the proposed Development and Slickly Wind Farm would have a footprint in the Burn of Lyth catchment. The majority of Slickly Wind Farm is within the Burn of Lyth with a large footprint; however, the proposed Development has a very small footprint with only one turbine within the edge of the catchment area. Although construction for both developments may be undertaken in parallel, given the small footprint of the proposed Development within the Burn of Lyth catchment it is very unlikely that the small section of the proposed Development would be occurring simultaneously with the Slickly construction or have a noticeable effect on the Burn of Lyth catchment. Assuming that appropriate sediment management controls are used at both Developments, cumulative effects on the watercourse at Slickly Wind Farm are considered to be '**Minor**', temporary and adverse.

Potential Hydrological Cumulative Effects during Operation

223. Operational activity at both the proposed Development and Slickly Wind Farm would be very much reduced from the construction phase. The footprint of the proposed Development within the Burn of Lyth catchment is very small and only minor access tracks or water crossing effect the Burn of Lyth catchment. Assuming that operation-phase monitoring and maintenance for both developments are undertaken in line with best practice, the cumulative effects on the watercourse would be '**Negligible**'.

10.6.6 Mitigation

224. Whilst outlined and accounted for within the assessment above, this section provides a detailed summary of the mitigation that would be adopted for the proposed Development.

10.6.6.1 Mitigation by Design

225. All excavation works requiring removal of bedrock or superficial deposits have been kept to a practical minimum by good site design.

226. Careful and informed infrastructure design forms a key measure for prevention of induced instability in peat. The collated peat depth information has been used to inform the proposed infrastructure layout throughout the design process. Incursion into areas of deeper peat has been kept to a practical minimum by careful design and would be further reduced by local micrositing, in order to minimise disruption to peatland ecosystems and hydrology, and to avoid the risk of induced peat instability. Where crossing of deeper peat has been required, floating road construction is proposed for these areas.

227. Access tracks are anticipated to be constructed using established cut-and-fill and floating road construction methods. Any peat present along the route would be excavated and stored for use in reinstatement of trackside verges and other elements of project infrastructure where appropriate.

10.6.6.2 Mitigation Commitments

Soils and Peat

228. Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2 m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate bunds for separate soil types in order to preserve the soil quality.

229. For work within areas of peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging. The underlying catotelmic peat would be stored in bunds up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelmic peat has been limited by careful infrastructure design.

230. All soil and peat storage bunds would be left with rough, unsmoothed surfaces to minimise soil loss from rainfall erosion. Bunds on sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall.

231. Excavated soil and peat would be used in site restoration and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare soil or peat that are not required for the operational phase of the development. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.

232. Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat bunds. This would help to maintain vegetation growth in the turfs and to retain the soil structure.

233. Construction work would make use of current best practice guidance relating to developments in peatland areas. A risk management system, such as a geotechnical risk register, would be compiled and maintained at all stages of the project and developed as part of the post-consent detailed design works, and would be updated as new information becomes available.

234. Micrositing would be used to avoid possible problem areas identified during ground investigation or other detailed design works. This would be assisted by additional verification of peat depths, to full depth, in any highlighted areas where construction work is required. Track drainage would be installed in accordance with published good practice documentation and would be minimised in terms of length and depth in order to minimise concentration of flows.

235. Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of identified deeper peat. Careful track design would ensure that the volume and storage timescale for excavated materials would be minimised as far as practicable during construction works.

236. Vegetation cover would be re-established as quickly as possible on track and infrastructure verges and cut slopes, by re-laying of excavated peat acrotelm, to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradable geotextile, would be considered if necessary, in specific areas.

237. During construction members of project staff would undertake advance inspections and carry out regular monitoring for signs of peat landslide indicators. A geotechnical specialist would be on call to provide advice if required by Site conditions.

238. Construction staff would be made aware of peat slide indicators and emergency procedures. Emergency procedures would include measures to be taken in the event that an incipient peat slide is detected.

Surface Watercourses and Groundwater

239. Silt fencing or appropriate alternative sediment control protection would be installed on the downhill side of excavations to prevent inadvertent discharge of silty water into or towards any site watercourse.

240. All engineering works adjacent to watercourses, including access tracks and watercourse crossing structures, would have appropriate sediment control measures established prior to any groundworks.

241. Vegetation would be retained along watercourse banks to act as additional protection to the watercourses.

242. A water quality monitoring programme would be established. Details would be agreed with SEPA but are anticipated to include at least the following:

- visual checks for entrained sediment; and
- in situ measurements of pH, temperature, specific conductivity if any visual discolouration is identified.

243. In situ measurement of turbidity and dissolved oxygen may be recommended for locations with particular sensitivity, such as upstream of designated areas.

244. Pre-construction monitoring would be undertaken on a monthly basis for a period of three months prior to any work taking place within the Site.

245. During construction, the monitoring would be undertaken by the Environmental Clerk of Works or suitably experienced alternative individual. Any change from baseline conditions of pH and/or specific conductivity would potentially indicate an incident and additional investigation would be required in order to identify the origin of the change. Control locations (WQ2, 4 and 8) are intended to help differentiate between incidents arising within the Site and incidents that are unrelated to the Development.

246. Recommended frequency of monitoring for the different locations are provided in **Table 10.19**. Monitoring locations are shown in **Figure 10.7**. In all cases, monitoring will initially be visual with follow-up in situ measurements of pH, temperature and specific conductivity if any visual discolouration is identified. Laboratory sampling would be undertaken if an incident is identified, to help pin down the source.

Table 10.19 Water quality monitoring locations and recommended monitoring frequency by phase of development

ID	Location	Monitoring schedule
WQ1	Burn of Horsegrow adjacent to northern application boundary	**Baseline:** Monthly, min. 3 months **Construction:** Daily during all construction work at solar array; otherwise, monthly.
WQ2	Burn of Ormigill adjacent to western application boundary	**Baseline:** Monthly, min. 3 months **Construction:** Daily during all construction work at T1; otherwise, monthly.
WQ3	Burn of Hollandmey upstream of WC01 (control)	**Baseline:** Monthly, min. 3 months **Construction:** Daily during all construction work at T2, T5 & T7; weekly during all BP operations; otherwise, monthly.
WQ4	Link Burn downstream of WC06	**Baseline:** Monthly, min. 3 months **Construction:** Daily during all construction work at T2, T3, T5, T6, T8 & T9; weekly during all BP operations; otherwise, monthly.
WQ5	Burn of Slickly tributary near southern application boundary	**Baseline:** Monthly, min. 3 months **Construction:** Daily during all construction work at T4; otherwise, monthly.

247. Groundwater monitoring boreholes would be established within the three borrow pit areas prior to any construction work beginning, to a depth at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken to determine whether groundwater is present within the borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit area would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing.

248. All works through and adjacent to wetland areas would be supervised by the Environmental Clerk of Works.

Drainage Infrastructure

249. Trackside drainage would be no longer or deeper than necessary to provide the required track drainage.

250. Cross-drains under tracks would be installed at an appropriate frequency to mimic natural drainage patterns and to minimise concentration of flows.

251. All drainage infrastructure would be designed with a capacity suitable for a rainfall intensity of a 1-in-200 year storm event plus allowance for climate change.

252. Where track sections cross wetland or bog areas, cross-drainage would be provided within the track construction to ensure continuity of flow. This may take the form of a drainage layer within the track, suitably closely-spaced drainage pipes, or both as appropriate. These would be determined on a case-by-case basis to suit each individual area.

253. All required licences for watercourse crossings and construction site works would be in place prior to works on site beginning.

254. All long-term and temporary drainage infrastructure would be established on a running-basis ahead of excavation works. This includes temporary bunding and cut-off drains around turbine bases, hardstanding areas and borrow pits. Where possible, trackside drainage would be laid up to 100 m ahead of track construction works on a running basis.

255. Temporary water control measures would be implemented as necessary adjacent to areas of larger excavation. These would include borrow pit sites and may also include turbine base excavations and hardstanding areas. These measures would take the form of temporary settlement ponds, filter drains or proprietary treatment measures such as Silt Busters. Detail would be provided within the Pollution Prevention Plan(s) required for the Construction Site Licence and suitability would be determined following appropriate onsite soil tests.

256. All earthmoving activity would be restricted during periods of wet weather, particularly for work occurring within 20 m of a watercourse or within areas of peat deeper than 1.5 m, to minimise mobilisation of sediment in heavy rainfall. The 'stop' conditions provided in **Table 10.18** are recommended to guide all earthmoving activity at all stages of the project.

257. Long-term drainage infrastructure would have a monitoring and maintenance programme established, to include regular visual inspection of drainage infrastructure to check for blockages, debris or damage that may impede flow. Remediation would be undertaken immediately. Routine maintenance would be scheduled where possible for dry weather.

Excavations

258. Any water collecting within excavations would be pumped out prior to further work within the excavation. The water is likely to require treatment to remove suspended solids prior to discharge to ground.

259. Cable trenches would be laid in disturbed trackside material. There are no areas with steep slopes within the Site, so groundwater flow along trenches is likely to be limited.

260. Vegetation cover would be re-established as quickly as possible on all areas of stripped ground, once activity involving these areas is complete. This would include track verges, screening bunds, cut slopes and much of the Site during decommissioning and restoration works. Where possible this would be achieved using excavated peat acrotelm. Additional measures including hydroseeding and/or use of a biodegradable geotextile would be considered if insufficient peat turf is available and for areas of particular sensitivity that require immediate protection.

261. Rock testing would be undertaken on appropriate samples from the borrow pit areas to determine its suitability for unbound track and hardstanding construction. This would include testing to determine likely degradation patterns during the lifespan of the development. Should the tests identify problems with parts of the rock within the borrow pit footprints, care would be taken to ensure that unsuitable material is not used for construction but would be retained for use in borrow pit restoration.

262. Any unused or remaining unsuitable aggregate material, plus any spare rock material arising from hardstanding or track reinstatement, may be used to reinstate the borrow pits to a suitable profile, and capped with soil or turf to promote re-establishment of natural vegetation cover.

263. Only tracked or low ground pressure vehicles would be permitted access to unstripped ground.

Site Traffic

264. Tracks and hardstanding areas would be monitored on a regular basis, particularly following periods of heavy or prolonged rainfall or after snow clearance. Any sections of track or hardstanding showing signs of excessive wear would be repaired as necessary with suitable rock from the borrow pit or external sources.

265. All bridge structures would have appropriate splash control measures as part of their design, to prevent silty water splashing into the watercourse from vehicle movements. The splash controls would be monitored regularly to ensure they remain effective and have not become damaged in any way.

266. Routine monitoring checks of project infrastructure, including track and hardstanding surfaces and all drainage infrastructure, would be undertaken on a quarterly basis throughout project operation. Monitoring would involve visiting all aspects of the infrastructure and undertaking a visual inspection to identify the following:

- areas where track surfaces or hardstanding areas were showing evidence of erosion or surface damage;
- any areas where surface water was ponding or collecting on tracks or hardstanding areas; and
- any areas where drainage infrastructure was damaged, blocked or inadequate.

267. Any areas of track or hardstanding surface showing signs of damage, erosion or excessive wear would be repaired as necessary. Drainage features would be repaired, reinstated or replaced as necessary to ensure continued efficient operation.

268. Site-specific mitigation, including track drainage segregation to avoid ‘flushing’ from excavation works, and micrositing to avoid specific higher sensitivity areas, would be identified and established where appropriate.

269. All traffic routes would be clearly demarcated and vehicles would not be permitted access outwith these areas.

Pollution Prevention

270. Oil and fuel storage and handling onsite would be undertaken in compliance with SEPA’s Guidance on Pollution Prevention 2 – Above ground oil storage tanks and with the Water Environment (Oil Storage) (Scotland) Regulations 2006.

271. Risk assessments would be undertaken and all Hazardous Substances and Non-Hazardous Pollutants that would be used and/or stored onsite would be identified. Hazardous substances likely to be onsite include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be used onsite. Herbicides would not be used.

272. All deliveries of oils and fuels would be supervised.

273. All storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank’s capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank’s capacity or 25% of the total capacity, whichever is the greater.

274. Any valve, filter, sight gauge, vent pipe or other ancillary equipment would be located within the containment area.

275. Waste oil would not be stored onsite but would be removed to dedicated storage or disposal facilities.

276. Management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms.

277. Maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant.

278. Servicing would be undertaken in a designated area or location with adequate precautions in place, such as a dedicated impermeable surface with lipped edges to contain any contaminants.

279. Where vehicle maintenance and refuelling are necessary in the field, owing to breakdown, additional precautions would be taken to contain contaminants, such as spill trays or absorbent mattresses.

280. The access track would be designed and constructed to promote good visibility where possible and two-way access where visibility is restricted, to minimise risk of vehicle collisions.

281. If required, concrete batching would take place in one designated location within the site construction compound. This location would be at least 100 m from the nearest watercourse. Protective bunding would be installed around the batching area to ensure that contaminated runoff is contained. Dedicated drainage would be installed to ensure that water from the batching area can be suitably treated to reduce alkalinity and suspended sediment load prior to discharge or removed from site by tanker for treatment and disposal offsite.

282. Foul drainage provision would be provided by a septic tank or suitable waste treatment facility with optional reedbed.

283. The Site Spillage and Emergency Procedures would be prominently displayed at the Site and staff would be trained in their application. The Procedures document would incorporate guidance from the relevant SEPA Guidance Notes.

284. In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water environment, all necessary measures would be taken to remedy the situation. These measures would include:

- identifying and stopping the source of the spillage;
- containing the spillage to prevent it spreading or entering watercourses by means of suitable material and equipment;
- absorbent materials, including materials capable of absorbing oils, would be available onsite to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials; and
- sandbags would also be readily available for use to prevent spread of spillages and create dams if appropriate.

285. Where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed from site by a licensed waste carrier to a suitable landfill facility.

286. The emergency contact telephone number of a specialist oil pollution control company would be displayed onsite.

287. Sub-contractors would be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the Site.

10.7 Summary of Effects

288. This assessment is based on a site-specific risk assessment method following recommended environmental impact assessment techniques. Potential effects, both positive and negative, long-term or temporary, adverse or beneficial, to the geological, hydrogeological and hydrological regime have been considered. These effects are summarised in **Table 10.20**.

Table 10.20 Summary of effects

Effect	Phase	Assessment consequence	Effect significance
Physical changes to overland drainage and surface water flows	Construction	Minor, long-term, adverse	Not significant
	Operation	Negligible	Not significant
Particulates and suspended solids	Construction	Minor, temporary, adverse	Not significant
	Operation	Minor, temporary, adverse	Not significant

Effect	Phase	Assessment consequence	Effect significance
Water contamination from fuels, oils, concrete batching or foul drainage	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant
Changes in or contamination of water supply to vulnerable receptors	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant
Increased flood risk	Construction	Negligible	Not significant
	Operation	Negligible	Not significant
Physical removal of bedrock	Construction	Minor, long-term, adverse	Not significant
	Operation	Negligible	Not significant
Modification to groundwater flow paths	Construction	Minor, long-term, adverse	Not significant
	Operation	Minor, long-term, adverse	Not significant
Soil erosion and compaction	Construction	Minor, temporary, adverse	Not significant
	Operation	Minor, temporary, adverse	Not significant
Peat instability	Construction	Minor, long-term, adverse	Not significant
	Operation	No change	Not significant
Hydrology, hydrogeology, geology and soils cumulative effects	Construction	Minor, temporary, adverse	Not significant
	Operation	Negligible	Not significant

10.8 References

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