# 10 Geology, Peat, Hydrology & Hydrogeology

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# 10 Geology, Peat, Hydrology & Hydrogeology

## 10.1 Introduction

10.1.1 This chapter has been undertaken by Fluid Environmental Consulting (Fluid) and assesses the potential hydrogeological, hydrological and geological impacts of the Proposed Development at Yell, Shetland, Scotland.

10.1.2 The chapter presents the current environmental setting (baseline) for the related environmental topics and associated links to other chapters such as terrestrial and aquatic ecology (Chapters 7 and 8) due to their potential dependence on the water environment and also consultee responses. Desktop and site-based surveys, including peat surveys, have been carried out to inspect and identify all hydrogeological, hydrological and geological features.

10.1.3 The assessment identifies the potential effects of the Proposed Development and assesses the significance of these effects based on the magnitude of the impacts and the sensitivity of the receptor(s). Effects are assessed based on the risk of: sedimentation and erosion; pollution; alteration of natural drainage patterns, runoff volumes and rates; flood risk and alteration of the geological environment through the dewatering, disturbance and excavation of peat. Mitigation, management and monitoring measures are then discussed and the residual effects relevant to geology, hydrology and hydrogeology determined.

10.1.4 The Proposed Development is based on 29 wind turbines and their associated infrastructure (Figure 1.2a-e) and is located in the north eastern area of Yell, Shetland, Scotland. Access to site is via the Dalsetter Hill Road (known locally as the Old Cullivoe Road) which connects the new access tracks to the A968 public road. The site covers 1,679 hectares and has a proposed infrastructure footprint of approximately 48.3 hectares which also includes up to nine borrow pit search areas, four construction compounds and a substation, or approx. 62.4 hectares including land take for slopes and drains around infrastructure. The access tracks will be a combination of approximately 19.325 km of new floating track, approximately 1.75 km of new excavated tracks and approximately 0.525 km of existing track that will require widening. Aggregate will be sourced from on-site borrow pits.

10.1.5 Further detail on the current Proposed Development is provided in Chapter 3 of this EIA Report. This chapter is supported by the following Technical Appendices:

- Appendix 10.1: Good practice and Standard Mitigation Methods;
- Appendix 10.2: Peat Survey Report;
- Appendix 10.3: Outline Peat Management and Restoration Plan
- Appendix 10.4: Peat Slide Risk Assessment
- Appendix 10.5: Watercourse Crossing Inventory
- Appendix 10.6: Scottish Water Contingency Plan
- Appendix 10.7: Scottish Water Consultation

## 10.2 Legislation, Policy and Guidelines

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

### *Legislation*

10.2.2 There is a range of environmental legislation that any development must adhere to throughout the development life cycle. Relevant legislation and guidance documents have been reviewed and taken into account as part of this geological, hydrogeological and hydrological assessment.

10.2.3 Key legislative drivers relating to the water environment which have been considered within this assessment are listed below:

- Control of Pollution Act 1974;
- Environmental Protection Act 1990;
- Environment Act 1995;
- Water Framework Directive 2000/60/EC (WFD) 2000;
- Groundwater Daughter Directive 2006/118/EC;
- Water Environment and Water Services (Scotland) Act (WEWS Act) 2003;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended in 2018 (CAR);
- The Environmental Liability (Scotland) Regulations 2009;
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 (amends and revokes the Private Water Supplies (Scotland) Regulations 2006);
- The Public Water Supplies (Scotland) Amendment Regulations 2017 (amends the Public Water Supplies (Scotland) Regulations 2014;
- The Flood Risk Management (Scotland) Act 2009;
- The Waste Management Licensing (Scotland) Regulations 2011, and
- Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017

10.2.4 The Water Framework Directive (WFD) has been implemented in Scotland through the Water Environment and Water Services (Scotland) Act 2003 (WEWs Act) and the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended in 2018) (CAR). The primary objective of the Directive is for all surface and coastal water bodies to achieve good chemical and ecological status, and ground water bodies to achieve good quantitative and chemical status, by 2015 or 2021. This required assessment of a much wider set of water quality parameters than had previously been used. SEPA have published River Basin Management Plans (RBMPs) which detail the current and target status of water bodies, and the means of achieving these targets (as last assessed in 2008 and 2014).

### *Planning Policy*

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

- effects on hydrology, the water environment and flood risk;
- impacts on carbon rich soils, using the carbon calculator;
- it also states: 'that the planning system should 'promote protection and improvement of the water environment, including rivers, lochs, estuaries, wetlands, coastal waters and groundwater, in a sustainable and co-ordinated way' (paragraph 194); and

- ‘Development management decisions should take account of potential effects on landscapes and the natural and water environment, including cumulative effects’ (paragraph 202).

10.2.6 SPP June 2014 also includes the site in Group 2: Areas of significant protection due to the presence of carbon rich soils, deep peat and priority peatland habitat.

10.2.7 The following Planning Advice Notes are also relevant to the assessments made in this chapter:

- Planning Advice Note 61: Planning and SUDS, 2001; and
- Planning Advice Note 79: Water and Drainage, 2006.

### *Guidance*

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

10.2.9 The Pollution Prevention Guidelines (PPGs) and Guidance for Pollution Prevention (GPPs), include the documents referred to below, which are the principal documents used for guidance on preventing contamination of surface water from construction activities. Those relevant to this wind farm development include:

- PPG1: General guide to the prevention of pollution (EA, SEPA & EHSNI, 2013);
- GPP2: Above ground oil storage tanks (EA, SEPA & EHSNI, January 2018);
- GPP4: Treatment and disposal of sewage where no foul sewer is available (EA, SEPA & EHSNI, November 2017);
- GPP5: Works and maintenance in or near water (EA, SEPA & EHSNI, January 2017);
- PPG6: Working at construction and demolition sites (EA, SEPA & EHSNI, 2012);
- GPP8: Safe storage and disposal of used oils (EA, SEPA & EHSNI, July 2017);
- GPP21: Pollution incidence response planning (EA, SEPA & EHSNI, 2017); and
- PPG26: Storage and handling of drums and intermediate bulk containers (EA, SEPA & EHSNI, 2006).

10.2.10 The following SEPA Guidelines are also relevant:

- Managing River Habitats for Fisheries (SEPA 2002).
- Indicative River & Coastal Flood Map (Scotland) (SEPA January 2014, updated April 2018).
- Regulatory Position Statement: Waste Water Drainage. (SEPA, 2008).
- Regulatory Position Statement – Developments on peat (SEPA, 2010)
- Temporary Construction Methods, WAT-SG-29 (SEPA, 2009)
- Flood Risk and Planning Briefing Note (SEPA, 2014)
- Position Statement: The role of SEPA in natural flood management (SEPA, Feb, 2012).
- Technical flood risk guidance for stakeholders, version 10 (SEPA, July 2018).
- Environmental Standards for River Morphology, WAT-SG-21 (SEPA, July 2012).
- Land Use Planning System Guidance Note 4 (LUPS GU4) - Planning guidance on on-shore windfarm developments (SEPA, September 2017).

- Land Use Planning System Guidance Note 31 (LUPS-GU31)- Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (SEPA, 2014).
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended in 2018 - A practical guide (SEPA, 2011 as amended in 2018).
- River Crossings, Engineering in the water environment: good practice guide (SEPA,2010).
- Methodology for the Water Framework Directive, Scotland and Northern Ireland Forum for Environmental Research, Project WFD 28 Final Report (SEPA, 2004).
- The River Basin Planning Strategy for the Scotland River Basin District (SEPA, 2009/2015).

10.2.11 Other relevant guidance includes:

- Control of water pollution from constructions sites. Guidance for consultants and contractors C532 (CIRIA, 2001);
- Environmental good practice on site C650 (CIRIA, 2010);
- Control of water pollution from linear construction projects: technical guidance C648 (CIRIA, 2006);
- SUDS Manual C697 (CIRIA, 697);
- Groundwater Control – design and practice C515 (CIRIA 2016);
- Good practice during windfarm construction (Scottish Renewables, SNH, SEPA & Forestry Commission Scotland, 4th Edition 2019);
- Code of Practice for the sustainable use of soils on construction sites (DEFRA, 2009);
- Guidance on Road Construction and Maintenance Forests and Water Guidelines Fifth Edition (Forestry Commission, 2011);
- A Handbook of Environmental Impact Assessment, 5th Edition (SNH, 2018);
- Design Guidance on River Crossings and Migratory Fish, Scottish Executive, 2000;
- Shetland Local Development Plan 2014 – Natural Heritage Soils and Water
- Peatland Survey. Guidance on Developments on Peatland. Scottish Government, Scottish Natural Heritage, SEPA 2017;
- Peat Landslide Hazard and Risk Assessments: Good practice Guide for Proposed Electricity Generation Developments, Scottish Government, Second Edition, 2017;
- Private Water Supplies: Technical Manual, Scottish Executive, 2006;
- Special Requirements for Civil Engineering Contracts for the Prevention of Pollution, Version 2, SEPA, 2006;
- UK Technical Advisory Group on the WFD, UK Environmental Standards and Conditions Final Report, November 2013; and
- SNH Carbon and Peatland Map (2016).

## 10.3 Consultation

10.3.1 Consultation was under at various stages of the planning phase of the Proposed Development and fed back into the design. The consultations are summarised in Table 10.1. Those consulted include SEPA, Scottish Water, Scottish National Heritage and Marine Scotland.

10.3.2 The details of who has been consulted, when and the responses they have provided is summarised in Table 10.1.

**Table 10.1 – Consultations in Relation to Hydrology, Hydrogeology, Geology and Peat**

| Consultation | Comments / Information Provided | Section where comments are addressed |
|---|---|---|
| Scoping Opinion<br>SNH<br>8th February 2018 | The proposed development area is dominated by areas of carbon rich soils, deep peat and priority peat habitat. Scottish Planning Policy identifies these as nationally important interests and that "further consideration will be required to demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation."<br><br>We consider that it will be very difficult to build a wind farm of the scale proposed without significant effects on deep peat and priority peatland habitat, and that opportunities to mitigate this through siting, design and other measures will be very limited.<br><br>However, on the basis of the existing proposal, SNH welcome the commitment to a Peat Slide Risk Assessment and to drafting a Peat Management Plan. These would almost certainly be necessary for any wind farm development proposal in this area. Our advice is that a Habitat Management Plan is also required, particularly to ensure that there is no overall loss of peatland habitat or the services that delivers, but also to take account of other habitats subject to loss and damage. | Appendix 10.2, 10.3 and throughout main chapter<br><br>Appendix 10.3 and 10.4 |
| | Otters - proposed survey along watercourses as an initial assessment of the level of otter activity in the area. As the layout of turbines, tracks and other infrastructure is finalised, a corridor extending at least 100 metres on each side of the proposed access tracks and the area within 250 metres of each turbine base should be surveyed for otters to allow impacts on any otter holts within the site to be mitigated by micrositing (or a species protection plan to be drawn up and license applied for, if disturbance will occur) | Chapter 7: Ecology |
| Scoping Opinion<br>Marine Scotland<br>Ref FL/59-7<br>Dr Emily E. Bridcut<br>15th December 2017 | Fish - A number of watercourses drain the proposed development site in which salmon and trout populations have been recorded. These salmonids are important for both economic and conservation interests, salmon is listed in the EU Habitat's Directive as a species of European importance and both salmon and trout are listed in the Scottish Biodiversity list as priority species for conservation. Both species should therefore be carefully considered throughout the proposed development.<br><br>Water Quality - an integrated water quality and biotic (macroinvertebrate and fish populations) monitoring programme. For the latter, we suggest pre-construction baseline surveys to be carried out at least 12 months prior to construction commencing, during construction and for at least one year after construction is complete. Further sampling may be required one to two years prior to decommissioning, details of which can be outlined in a decommissioning plan. | Chapter 7: Ecology and section 10.5<br><br>Section 10.7 |

| Consultation | Comments / Information Provided | Section where comments are addressed |
|---|---|---|
| | The presence of salmon and trout populations within the proposed development area necessitates appropriate mitigation and monitoring programmes to be established as a means of avoiding and/or minimising the potential impacts of the proposed development on these valuable fish stocks and to ensure the water quality does not deteriorate, the latter is a requirement of the Water Framework Directive. | Section 10.7 |
| Scottish Water<br><br>Rebecca Williams<br><br>20th December 2017 | Part of the site falls within a drinking water catchment, and a Scottish Water abstraction point is situated in Gossa Water (see attached drinking water catchment map). Scottish Water abstractions are designated as Drinking Water Protected Areas (DWPA) under Article 7 of the Water Framework Directive. Gossa Water supplies Yell Water Treatment Works (WTW), which is an important supply for the local area providing drinking water to approximately 1000 customers. It is essential, therefore, that water quality and water quantity in the area are protected.<br><br>Request that turbines, infrastructure and other associated activities, including access routes, are located outside of the catchment to prevent any potential impacts to source water quality. If impractical precautions must be taken into account (Annex I) and an assessment of site-specific risk and mitigation measures require to ensure there will be no deterioration in Quality and quantity.<br><br>Scottish Water has significant concerns regarding the impact of this wind farm development on water quality. Yell WTW has been designed to work within certain water quality criteria and any changes to water quality may seriously impact the ability to provide compliant drinking water to customers. This WTW already experiences high concentrations of natural organic matter in the water, and if these were to increase, it could exceed the capability of the asset and our regulatory requirements. There is a high risk that any activities within the catchment that disturbs this peat, will increase the concentrations of natural organic matter in the watercourses and at our abstraction point.<br><br>If this work were to go ahead, an assessment will be required to determine alternative water supplies. This will be in the event of deterioration in water quality, as a result of the development as a whole or a pollution event, that renders the public water supply un-potable. Please be aware that there are limited feasible options for an alternative supply and therefore there is a significant risk at this site to maintain supplies to customers. Scottish Water request that a contingency fund is put in place to address any impacts on water quality and quantity during and post construction.<br><br>There is a 250mm raw water main within the site location of Scottish Water assets (including water supply and sewer pipes, water and waste treatment works etc.) | Figure 10.1 and Appendix 10.6<br><br>Figure 10.6a |

| Consultation | Comments / Information Provided | Section where comments are addressed |
|---|---|---|
| | Scottish Water assets should be confirmed through obtaining detailed plans from our Asset Plan Providers particular consideration being given to access roads and pipe crossings. | |
| RSPB<br>Martin Schofield<br>9th February 2018 | Much of the application area is covered in blanket bog, much of which is likely to be active (i.e. still peat forming). This is a Priority Habitat in Annex 1 of the EU Habitats Directive, and a UK Priority Habitat. The quality and extent of peat should be considered in a local and national context. It is sometimes possible to accommodate wind farms in some areas of blanket bog and deep peat where deep peat can be avoided, disturbance minimised and commitments made to restoration. However, given the extent and quality of blanket bog and deep peat on this site, the RSBP are concerned that it will be very challenging, if possible at all, to accommodate the scale of development proposed at this site without unacceptable peat impacts.<br><br>Damage to peatland habitat goes against The Scottish Government Peatland Action Scheme and National Peatland Plan.<br><br>The presence of blanket bog, of which most is likely to be active (i.e. currently peat forming). The potential for the release of stored carbon from the deep peat during construction works and storage and disposal of excavated peat | Appendix 10.2 and 10.3<br><br>Section 10.6, 10.7 and 10.8 |
| Scoping Response<br>Scottish Government Energy Consents Unit<br>16th April 2018 | *Peat* - The proposed wind farm is located largely on Class 1 nationally important carbon rich soils, deep peat and priority peatland habitat. Class 1 soils are included within Group 2 - Areas of Significant Protection in Scottish Planning Policy 2014 table of Spatial Frameworks. It also Priority Habitat in Annex 1 of the EU Habitats Directive, and a UK Priority Habitat.<br><br>Paragraph 205 of Scottish Planning Policy 2014 states "Where peat and other carbon rich soils are present, applicants must assess the likely effects of development on carbon dioxide (CO2) emissions. Where peatland is drained or otherwise disturbed, there is liable to be a release of CO2 to the atmosphere. Developments must aim to minimise this release".<br><br>Peat slides can have a direct impact on fisheries and peat disturbance can have indirect effects on water quality, therefore all construction should avoid areas of deep peat, where this is not possible appropriate mitigation measures should be put in place. Natural peat drainage channels should be preserved throughout the development; excavated material should not be stock piled in areas of unstable peat; concentrated water flows onto peat slopes should also be avoided.<br><br>The EIA report will be required assess whether there will be any significant effects on the qualities of this area and if so, it will be required to demonstrate that they can be substantially overcome by siting, design or other mitigation. It will also be required to demonstrate how the disturbance of peat and consequential release | Figure 10.3<br><br>Appendix 10.4<br><br>Figure 10.10a, 10.10b, 10.11, Appendix 3.1<br><br>Section 10.6, 10.7 and 10.8 |

| Consultation | Comments / Information Provided | Section where comments are addressed |
|---|---|---|
| | of carbon dioxide has been minimised and detail the preventative/mitigation measures to avoid significant drying or oxidation of peat. As recommended by RSPB Scotland it should also include:<br>• The mapped extent of active peat bog within the proposed site;<br>• Description of vegetation communities and structural features of the bog surface;<br>• Identification of the basic hydrological units of the peatland area;<br>• Peat-depth data for both the site of wind farm infrastructure (tracks and turbines and other infrastructure) and also any transmission lines.<br>A site-specific Peat Management Plan as recommended by SEPA should be included in the EIA report as should a Habitat Management Plan as recommended by SNH and RSPB Scotland.<br>How excavated peat will be dealt with to prevent damage blanket bog and other semi-natural habitats should also be detailed.<br>As recommended by Shetland Island Council's Planning Services the hydromorphological approach as endorsed by The Joint Nature Conservation Committee should be used to assess the existing blanket bog habitat resource and impacts upon it. | Appendix 10.3 |
| | *Drinking Water Protected Areas* - In the event that turbines, associated infrastructure and other associated activities including access routes cannot be located outside the drinking water catchment area as requested by Scottish Water, a site-specific assessment of the site-specific risks and mitigation measures required to ensure there will be no deterioration in water quality and quantity should be undertaken and included in the EIA report. As also advised by Scottish Water, an assessment which determines alternative water supplies should be included in the EIA report as should a notice of commitment from the Applicant to the setting up of a contingency fund to address any impacts on water quality and quantity during post construction. | *Appendix 10.6*<br>Section 10.6, 10.7 and 10.8 |
| | Fish -The EIA report should contain a section which specifically considers fish – especially salmon and trout - and fisheries concerns and details steps to be taken to ensure that adequate mitigation measures are in place to safeguard watercourses and fish populations therein. | Section 10.5 and Section 10.6, 10.7 and 10.8 |
| SEPA GateCheck 1<br>PCS/162434<br>Alison Wilson | SEPA note and welcome the proposal has gone through several design reiterations, taking into consideration issues such as avoidance of peat and adequate buffers between the built infrastructure and watercourses. We welcome that as further environmental baseline information is gathered this will be further used to inform the layout. | |

| Consultation | Comments / Information Provided | Section where comments are addressed |
|---|---|---|
| 10th December 2018 | Borrow Pits – SEPA requested Site Management Plan to be included within the EIAR however "The EIAR will contain the locations of the proposed borrow pit search areas. Detailed ground investigations and assessment of these borrow pit search areas will be undertaken post-consent and information requested by SEPA submitted prior to construction."<br><br>SEPA advise the information detailed in Section 6 of Appendix 1 of our letter of 12 January 2018 (our reference PCS/156282) must be provided in the EIAR in regard to the borrow pits post consent. | |
| | Flood risk - SEPA requested that it should be ensured that any new/temporary access roads are designed in such a way to maintain the existing ground levels and not result in an elevation of the land as far as is reasonably achievable. This will ensure that no flood plain storage is lost as a result of the roads development. The response indicates that "Areas of floating tracks will result in raised track. This will be assessed for each catchment in terms of any impact on flooding". We welcome this approach and we will be happy to assess any future flood risk assessments. | Section 10.5 and Section 10.6, 10.7 and 10.8 |
| SEPA<br><br>February 2019 | Initial discussion with SEPA regarding the peat depth surveys being undertaken and the potential for peat reuse and peat restoration on Yell. | |
| SEPA<br><br>7th March 2019 | Peat Restoration - Discussion with SEPA to discuss potential peat restoration plan options and proposals for the appropriate reuse of excavated peat on and off site. | Appendix 10.3 |
| Scottish Water<br><br>5th January 2019 | Initial meeting with Scottish Water to discuss the Proposed Development proposal and take on board their concerns regarding their infrastructure and the public water supply. Scottish Water provided infrastructure plans and some records of water quality monitoring. Scottish Water requested that an outline plan for appropriate mitigation including a contingency fund was developed and provide to Scottish Water. | |
| Scottish Water<br><br>21st March 2019 | Subsequent to various meetings and discussions Scottish Water have agreed to the proposed mitigation measures presented both in terms of the reduction of infrastructure in the Gossa Water drinking water supply catchment and the additional mitigation measures including water monitoring and a contingency fund. | Appendix 10.6 |

## 10.4 Assessment Methodology and Significance Criteria

### *Design Iteration*

10.4.1 As described in Chapter 2: Design Iteration, the Proposed Development has gone through ten iterative design changes, from July 2017 to January 2019. Design development has included reduction of the site boundary to avoid of the majority of the north-eastern and south-western lochs

and lochans and routing of the site tracks and turbine locations to minimise impacts to the deeper peat deposits and limit the number of watercourse crossings.

### *Impact Assessment Methodology*

10.4.2 The assessment has been undertaken primarily using a qualitative assessment based on professional judgement and statutory and general guidance, but also a quantitative assessment using site specific data in terms of peat depth. It incorporates:

- a review of the relevant legislation, guidelines and policy;
- a desk study to identify any existing information;
- site visits to confirm information obtained through the desk study and define particular site characteristics such as surface water catchments, the drainage network and the extent and characteristics of peat land habitat;
- a review of the ecological information and mapping undertaken by ITPE ecologists;
- definition of the likely effects of the project on the hydrological, hydrogeological and geological environment;
- assessment of the likely significance (as described in the EIA regulations) of those effects based on the sensitivity of the receiving environment and the likely magnitude of the impact;
- discussion of the proposed mitigation measures to reduce or remove any significant effect; and
- determination of the residual effects of the development subsequent to the implementation of the recommended mitigation measures; and
- any cumulative effects.

### *Study Area*

10.4.3 The Study Area for this assessment encompasses the whole of the site and a wider area essentially related to the surface water catchments connected to the site as this is the area of potential hydrological connection.

10.4.4 Within this chapter the site boundary, within which all infrastructure is to be located, is referred to as the 'site'. Further detail on the current Proposed Development is provided in Chapter 3 of this EIA Report

### *Desk Study*

10.4.5 The assessment was predominantly based on a desk study with site visits for verification and additional information. The desk study involved collating and assessing the relevant information from the following sources summarised in Table 10.2.

**Table 10.2 – Hydrology, Hydrogeology, Geology, Soils and Peat Data Sources**

| Topic | Source of Data and Information |
|---|---|
| Climate<br><br>Rainfall | Centre for Ecology and Hydrology (CEH): National River Flow Archive (NRFA) website for river flow data (accessed January 2019 http://www.ceh.ac.uk/data/nrfa/data/search.html;<br><br>Meteorological Office website for rainfall data (accessed January 2019): http://www.metoffice.gov.uk/climate/uk/averages/<br><br>Weather Underground, wunderground.com – local weather stations |

| Topic | Source of Data and Information |
|---|---|
| Topography<br><br>Elevation, Relief | Ordnance Survey Mapping 1:50,000 scale old and current, 1:25,000scale.<br><br>Google Maps aerial images |
| Geology<br><br>Solid and Drift | British Geological Survey Geology mapping 1:63,360 scale map for Solid Sheet 130 Northern Shetland (1968).<br><br>British Geological Society Geological Mapping and Interactive Map and Boreholes database http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html<br><br>SNH website (www.snh.org.uk) |
| Soil | Scotland's Soils website http://www.soils-scotland.gov.uk/ accessed January 2019<br><br>SNH Carbon and Peatland Map 2016.<br><br>The James Hutton Institute Soil Information For Scottish Soils accessed January 2019 http://sifss.hutton.ac.uk/SSKIB_Stats.php |
| Groundwater<br><br>Hydrogeology, Aquifer Properties, Source Protection Zones and Groundwater Levels | SEPA - Consultation and published sources on their website (www.sepa.org.uk)<br><br>SEPA Water Environment Hub Interactive Map for Water Framework Directive classifications (accessed January 2019): https://www.sepa.org.uk/data-visualisation/water-environment-hub/<br><br>Baseline Scotland Groundwater Chemistry Data<br><br>http://www.bgs.ac.uk/research/groundwater/quality/baselineScotland/southernScotlandData.html accessed January 2019<br><br>SEPA groundwater monitoring sites<br><br>Hydrogeological Map of Scotland (Scale 1:625,000) (Institute of Geological Sciences, 1988)<br><br>Scottish Aquifer Properties Interim Report (BGS, NERC and Sniffer, June 2006).<br><br>A GIS of aquifer productivity in Scotland explanatory notes (BGS, 2004).<br><br>Groundwater Vulnerability Map of Scotland (http://data.gov.uk/dataset/groundwater-vulnerability-map-of-scotland accessed January 2019) |
| Surface Water<br><br>Surface Water Features, Flood Risk, Water Quality, Recreational Waters and Fisheries | SEPA - Consultation and published sources on their website (www.sepa.org.uk)<br><br>SEPA Indicative River and Coastal Flood Map http://map.sepa.org.uk/floodmap/map.htm accessed January 2019<br><br>Scotland Drinking Water Protected Area for surface water, Scottish Government Website Maps https://www2.gov.scot/Publications/2008/03/Maps accessed January 2019 |
| Designated Areas | Multi-Agency Geographic Information for the Countryside (MAGIC) website http://magic.defra.gov.uk/ accessed January 2019 |

## *Site Visits and Field Surveys*

**Hydrology**

10.4.6 Site visits for baseline inspection was undertaken by Lucy Parker of Fluid Environmental Consulting Ltd between 5th to 10th November 2017 to inspect the overall site water features and determine construction constraints through the identification of major hydrological and hydrogeological receptors (Figures 10.6a to 10.6i). The site visit included an assessment of site drainage patterns, identification of sensitive hydrological receptors and identification of potential source to receptor pathways. The weather conditions varied during the site visit from sunny and dry to heavy rainfall and high winds. Generally, temperatures through the site visit were relatively mild for Scotland influenced by Yell's Marine climate.

10.4.7 A subsequent site walkover was undertaken as part of the additional peat probing programme undertaken in January 2019 and additional hydrological data was collected by the Field Technicians.

**Peat**

10.4.8 The peat slide risk assessment (Appendix 10.4 Peat Slide Hazard Risk Assessment) was undertaken by East Point Geo Ltd. Dr Andy Mills undertook the site reconnaissance for peat slide risk and identification of potential peat restoration areas between 6th to 8th November 2018 in accordance with Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, Scottish Government, Second Edition, 2017.

10.4.9 Four main phases of peat depth and distribution surveys have been undertaken:

- Phase 1: in October 2018 a first round of depth of penetration (peat) probing was carried out based on 100m grid across the original site to identify an initial distribution and depth of peat across the site by Fluid Consulting Limited;
- Phase 2: in November 2018 subsequent to the initial design freeze further peat probing was undertaken on 10m grid around the infrastructure layout and every 50m along access track with 10m offsets either side by Fluid Consulting Limited;
- Phase 3: in January 2019 subsequent to the final design freeze further peat probing was undertaken on 10m grid around the infrastructure layout and every 50m along access track with 10m offsets either side by Fluid Consulting Limited;
- Phase 4: in February 2019 additional peat probing was undertaken in the compound area at the site entrance by ITPE.

10.4.10 A GPS linked photographic record of over 1,000 photos of hydrological, hydrogeological, geological, topographical and ecological features has also been obtained.

## *Assessment of Potential Effect Significance*

10.4.11 The sensitivity and magnitude of potential effect criteria described in this section were considered appropriate for the conditions and environments prevailing at the Proposed Development site.

10.4.12 Sensitivity criteria are based on both the likely effect on a receptor due to a particular activity, as well as the designated value of the receptor (e.g. an area of international significance has a higher value and therefore higher sensitivity than other area of lower status). The sensitivity criteria used for this site are presented in Table 10.3.

**Table 10.3 – Sensitivity Criteria**

| Sensitivity of Environment | Definition |
|---|---|
| Very High | Environment is very sensitive and would respond in a major way to impacts. |

| Sensitivity of Environment | Definition |
|---|---|
| | Private water supply abstraction for human or stock consumption (surface water or groundwater).<br>Public drinking water supply abstraction (surface water or groundwater).<br>Surface water classified under the WFD as 'high' (or equivalent older chemical or biological monitoring designation).<br>Groundwater classified under the WFD as 'good'.<br>Watercourse designated under the Freshwater Fish Directive, or known to have fish spawning grounds.<br>Groundwater vulnerability to pollution class 5.<br>Internationally or nationally designated sites (e.g. Ramsar, SPA, SAC, SSSI, National Nature Reserves, Marine Nature Reserves).<br>Habitats listed in Regional Biodiversity Action Plans or Annex I habitats.<br>Internationally important species. |
| High | Environment is sensitive and would respond in a moderate way to impacts.<br>Private water supply abstraction not for human or stock consumption (surface water or groundwater).<br>Public non-drinking water supply abstraction (surface water or groundwater).<br>Surface water classified under the WFD as 'good' (or equivalent older chemical or biological monitoring designation).<br>Watercourse known to support important fishery population.<br>Groundwater vulnerability to pollution class 4.<br>Sites designated at a regional level.<br>Other water dependent habitats |
| Medium | Environment is not very sensitive and responds in a minimum way to impacts.<br>Surface water classified under the WFD as 'moderate' (or equivalent older chemical or biological monitoring designation).<br>Sites designated at a local level.<br>Groundwater vulnerability to pollution class 3 or 2. |
| Low | Environment is not sensitive and responds in a negligible way to impacts.<br>Surface water classified under the WFD as 'poor or bad' (or equivalent older chemical or biological monitoring designation).<br>Groundwater classified under the WFD as 'poor'.<br>Groundwater vulnerability to pollution class 1.<br>No private or public supply abstractions (surface water or groundwater).<br>No designated fisheries. |

10.4.13 The magnitude of potential impact criteria is presented in Table 10.4.

**Table 10.4 – Magnitude Criteria**

| Magnitude of Potential Impacts | Definition |
|---|---|
| Very High | Impact resulting in loss of feature or use.<br>Fundamental (long-term or permanent) changes to surface water, groundwater and geology (in terms of quantity, quality and morphology). |
| High | Impact resulting in integrity of feature or use being impacted, or loss of part of feature or use.<br>Substantial but non-fundamental and short to medium term changes to the surface water, groundwater and geology (in terms of quantity, quality and morphology). |
| Medium | Impact on feature or use.<br>Detectable but non-substantial or temporary changes to the surface water, groundwater and geology (in terms of quantity, quality and morphology). |
| Low | Impact but of insufficient magnitude to affect feature or use.<br>No perceptible changes to the surface water, groundwater and geology (in terms of quantity, quality and morphology). |

10.4.14 The combination of the sensitivity and magnitude of potential impact combine to provide a matrix categorisation of significance of effect (major, moderate, minor and negligible). These are presented in Table 10.5.

**Table 10.5 – Significance of Effect Matrix**

| Magnitude of Potential Impact | Sensitivity | | | |
|---|---|---|---|---|
| | **Very High** | **High** | **Medium** | **Low** |
| **Very High** | Major | Major | Major | Moderate |
| **High** | Major | Major | Moderate | Minor |
| **Medium** | Moderate | Moderate | Minor | Minor |
| **Low** | Minor / Moderate | Minor | Minor | Negligible |

10.4.15 To assess the likely effects of the Proposed Development it is considered that good practice techniques are standard. A description of some examples of the good practice methods that will be employed are presented in Appendix 10.1. This appendix does not present mitigation measures specific to the Proposed Development.

10.4.16 The levels of significance determined therefore assume these standard practices will be implemented and that only those activities that result in a Major or Moderate effect significance are considered to require additional management or mitigation. These standards are in accordance with

EIA regulations, however it should be recognised that the tables are a guide and that professional judgement must also be used in the assessment.

10.4.17 The effects presented in the chapter are considered to be adverse unless stated otherwise.

### *Assessment of Residual Effect Significance*

10.4.18 The residual effect significance is assessed to determine the overall significance of the Proposed Development after good practice methods and site specific mitigation are put in place.

### *Limitations to Assessment*

10.4.19 The fieldwork was undertaken in a range of weather conditions from clear and dry condition to heavy rainfall and strong winds; however, the nature of some hydrological features may not manifest themselves at all times and may be a result of extreme weather conditions. Whilst the best care has been undertaken to visit the site in different weather conditions, there is a potential that some small, minor features may be missed as a result of their ephemeral or temporary nature.

10.4.20 It should be noted that the geomorphology site walk over and hydrology site walkover were undertaken in November 2018 based on the design layout at the time. Any subsequent changes in the design have not been verified in detail by further geomorphological or hydrological walkovers and therefore some features have been determined from desk based reviews alone and not verified on-site.

10.4.21 However, all of these locations were visited by the field technicians undertaking the peat probing and photographic records of any adjusted watercourse crossings along with associated measurements and notes were undertaken. It is therefore considered that the assessment is robust and all water features have been assessed appropriately.

## 10.5 Baseline Conditions

10.5.1 The following section describes the baseline hydrological, hydrogeological and geological conditions contained within the Study Area. This includes the physical characteristics as well as designated water bodies, water dependent habitats, their quality and their use.

10.5.2 The hydrological context of the site is shown in Figure 10.1 Hydrological Setting and the main hydrological features are shown on Figure 10.6 Hydrological Features.

### *Topography*

10.5.3 Access to the site is from the A968 public highway which runs around the Basta Voe inlet near Sellafirth. The site comprises undulating open moorland with plateau summits with numerous waterbodies (from bog pools to small lochs) and deep valleys with small burns. The lowest elevation on the site is approximately 0m AOD or sea level at the inlet margins along the northern and southern site boundary. The highest elevation is around 112m AOD in the north-north-eastern section of the site, just south of the trig point. Other high points of the site include the Hill of Vigon at approximately 110m AOD in the north west, an un-named summit in the north east at 110mAOD, the western slope of Moss Moul at 100m along the eastern site boundary. Several smaller summits are present in the centre of the site, these include Flongna Field, Fugla Field and Tonga Field all at approximately 80m AOD.

10.5.4 The site is generally highest in the north and the east with two main valleys; one draining to the north east (Burn of Tongland, becoming the Burn of Firth) discharging to the Gloup Voe inlet and the other draining generally to the south west (the River /Burn of Gossa Water) to discharge into the Basta Voe inlet. A smaller section of the site drains to the north west into the North Burn of Vigon and a smaller area again drains into the Burn of Hildigil that discharges into the Gloup Voe inlet.

10.5.5 Hillsides are generally slightly convex or rectilinear with the exception of the steep hillsides above Gloup Voe. Slope angles are generally low, typically <5° on summits to <10° on most hillsides. Exceptions are localised areas of steep slopes associated with watercourses, such as Burn of

Rulesgill, Burn of Osmad's Dale, Burn of Tongaland, Burn of Firth and Burn of Hildigill, and the steep northern hillsides of the Hill of Vigon in the north and the hillsides over Gossa Water and associated with its primary tributaries.

10.5.6 A number of small watercourses and drains were recorded throughout the Study Area of both the Proposed Development site and access track route. These watercourses are oligotrophic to dystrophic. They are small (up to 1m wide); prone to drought and spates; and widely lost from view within slits and pipes in the peat of the blanket bog; otherwise, they are associated with shallow valleys with acid flush, and acid and marshy grassland habitats.

10.5.7 Summit bog pool complexes are located on most of the flatter less steep hill summits. The pools that make up these complexes can range from a few meters in length to over 100m in length and their depths can range from a few centimetres deep showing evidence of desiccation cracks on the base surface where they have dried out in the dry 2018 summer, to over a metre in depth in places. Those that are over 25m in length are generally shown on the Ordnance survey base mapping as water features and those generally bigger than 200m in length are named lochs, lochans or waters on the Ordnance Survey mapping. These water features are presented in Figures 10.6a-i.

### *Land Cover and Land Use*

10.5.8 The land cover for the site predominantly comprises of undulating open moorland. The vegetation is upland in character, waterlogged and dominated by blanket bog and other mire types, with areas of grassland in the more sheltered valleys and on better-drained slopes.

10.5.9 The peatland areas are natural organic, dystrophic and oligiotrophic blanket peat mostly intact and relatively untouched with some evidence of very localised disturbance in and around occasional drainage grips and the Old Cullivoe Road, including historical peat cuttings and small borrow pits along the Old Cullivoe Road.

10.5.10 Active land use is limited to rough grazing for sheep, with localised cutting just outside the northern site boundary on Sandwater Hill and adjacent to the existing track on the southwest side of Tittynans Hill. Sheep pens, fencing and gates are present in various locations across the site. There is little evidence of burning. The primary function of the area is associated with water supply in the Gossa Water catchment. Infrastructure connecting Gossa Water to a water treatment works in the south of the site near the A968 is visible as a series of concrete monuments and metalled covers running alongside the Burn of Gossawater.

10.5.11 Despite the low intensity of land use, the site has undergone artificial drainage in the form of grips (or moor drains). These are relatively widespread across the site, typically on the midslopes feeding local watercourses (Figure 10.6a to 10.6e).

10.5.12 In the southern section of the site along the Old Cullivoe Road is the recently built and operational Scottish Water Treatment Works and car park. Scottish Water abstracts water from the Gossa Water, pipes it to the treatment works for treatment before being distributed along the Old Cullivoe Road to the north and along the A968 road to the south-west for mains water distribution.

10.5.13 There is some hagging locally, mainly in the east central area north of Gossa Water, and Scottish Water notes that the Gossa watershed is partly degraded, with the water quality being characterised by a high amount of organic material as a consequence of hags and erosion gullies being present (Scottish Water, *personal communication*, meeting on 9 January 2019).

10.5.14 The southern boundary of the site is the A968 public road. As part of the Proposed Development a new junction will be constructed with the A968 specifically for the delivery of the abnormal loads. Along this section of the A968 road are underground cables and Scottish Water mains pipeline.

### *Meteorological Summary*

10.5.15 There are no MET Office or Centre of Ecology and Hydrology rainfall records for the site or the island of Yell. The nearest Centre of Ecology and Hydrology National River Flow Archive records located as Weisdale Mill (station 108001, approximately 10km to the south of the site) indicates that the annual rainfall for Weisdale Burn catchment is 1,320mm (SAAR 1961 to 1990) and for the site is

approximately between 1,000mm and 1,100mm in the northern section of the site and between 1,100mm and 1,200mm in the southern section of the site.

10.5.16 Average annual rainfall is c.1,150mm / year (1931-2014, Shetland Islands Council, 2014), concentrated in the winter months.

10.5.17 There is considered to be moderate annual rainfall in comparison to the rest of Scotland.

### *Geomorphology*

10.5.18 Digital aerial photography with a ground resolution of 0.25m was used to interpret and map peatland geomorphological features as part of the Peat Slide Risk Assessment (Appendix 10.4) undertaken by East Point Geo Ltd. Additional imagery from different epochs available on both Google EarthTM and bing.com/maps was also referred to in order to validate the air photo interpretation. This interpretation and the resulting geomorphological map were subsequently verified during a site walkover undertaken by Dr Andy Mills, an experienced peatland geomorphologist, in November 2018.

10.5.19 The highest elevations are characterised by summit mires with extensive pool complexes. Pools range in size from small features >1.0m across to extensive water bodies (up to 90m long and 50m wide). The majority of pools larger than $10m^2$ in area have been mapped and are shown on Figure 6 of Appendix 10.4 PSHRA. Most of the pools observed on site were shallow, with bare peat visible under the water surface often showing evidence of desiccation cracking from drier periods. There was some indication of slow downslope creep of pools, with bulging on the downslope sides and in some areas, sequences of interconnected former pools that had been drained following collapse of the sidewall of the lowest pool.

10.5.20 The summit pool complexes (the main areas are shown on Figure 10.6a) are drained by a combination of dendritic, linear and anastomosing drainage channels. These channels are frequently small in scale and well vegetated or only visible at the surface as sinuous corridors of sphagnum. Peat pipes are audible and visible across the site as collapsed pipe ceilings. Some of these subsurface drainage pathways appear to be significant in scale and connected over relatively long distances downslope. Occasionally, surface watercourses are seen crossing over subsurface drainage pathways showing two different 'layers' of water flow within the blanket peat. Where hillsides do not show evidence of natural drainage features, the peat surface is planar and often very wet. Areas without peat or where organic soils are thin typically comprise grassland. Flush zones were observed in some areas and were both wet and soft, however, no areas of quaking bog were identified.

10.5.21 In general, peat erosion is fairly limited and there is very little hagged peat on site. The most pronounced erosion is limited to the margins of the blanket peat along watercourses or drains. Particularly severe erosion is visible along the unnamed watercourse draining Kedills Mires with at least 2m thickness of peat undergoing active fluvial incision and undermining.

10.5.22 There is no evidence of large scale peat instability visible on aerial imagery and no peat landslides were observed during site walkovers for both this study and during hydrology and peat depth probing surveys during which all parts of the site were traversed or were visible from opposing slopes. However, there is evidence of localised minor instability in some parts of the site.

10.5.23 The majority of 'instability' features appear to relate to small-scale downslope creep of peat deposits on moderate slopes. In these areas, small crescentic headscarps and tension cracks are visible (typically a few metres in dimension), but there is generally little evidence of downslope deposits such as blocks, rafts or slurry. These forms of instability are focused in the following areas:

- North-east flank of Hill of Vigon above the North Burn of Vigon (tension cracks, tearing and pool collapses, also a number of collapsed pipes, e.g. Photo 7).
- West flank of Muckle Bratt-houll above unnamed tributary to Gloup Voe (minor cracking and localised evidence of pipes.

10.5.24 Areas of bare ground (with exposed mineral substrate) were observed in some gully floors and on some summits, usually in areas of pools and are interpreted to be the dried out footprints of former pool systems.

10.5.25 Further information on the peat geomorphology and peat slide risks are presented within Appendix 10.4 Peat Slide Hazard Risk Assessment PLHRA. Figure 6 of the Appendix 10.4 PSLHRA shows the key features and peatland geomorphology of the site. The presence, characteristics and distribution of these features are helpful in understanding the hydrological function of a peatland, the balance of erosion and peat accumulation (or condition), and the sensitivity of a peatland to potential land-use changes.

### *Soils*

10.5.26 The distribution of soils over the site is generally controlled by the underlying geology, the topography and the drainage regime. The majority of the site is shown to be underlain by organic, dystrophic, blanket peat based on the National Soil Map of Scotland.

10.5.27 The soils observed across the site appear to be natural soil deposits and there was no visual evidence of made ground or contaminative uses across the majority of the site. Some disturbed ground was observed along the existing access track, borrow pit search areas, around the Scottish Water Treatment Works and along the Scottish Water infrastructure routes. The disturbed ground observed appeared to be of natural local materials and not of significant concern. A sheep pen and livestock wash area was observed by the existing track at NGR HP 51840 00031 and NGR HP 52017 01703 and in the northern section of the site near the Burn of Rulesgill and Burn of Firth at NGR HP 5048 0284. Sheep dipping has the potential to use contaminative chemicals. Overall, it is not expected that there will be any significant soil contamination issues with the Proposed Development area.

10.5.28 The Soil Survey Map of Scotland indicates that the majority of the Proposed Development area is underlain by dystrophic blanket peat deposits (Figure 10.2). The exception to this is the northern section of the site associated with the steep valley sides of the Burn of Firth draining into the Gloup Voe inlet. These steep valley side areas are characterised by peaty podsol soil type. To the northwest of the site the soils in these areas are recorded to be peaty gleyey podzols derived from drift deposits derived from schists, gneisses, granulites and quartzites principally of the Moine Series. The soil mapping is presented in Figure 10.2.

10.5.29 The majority of the site is shown to be located on Class 1 peatland (Nationally important carbon-rich soils, deep peat and priority peatland habitat, areas likely to be of high conservation value) on the SNH carbon and peatlands map 2016 (Figure 10.3).

10.5.30 Small sections of the site are shown as Class 5 Peatland (Soils are carbon-rich and deep peat. No peatland habitat recorded. May also include areas of bare soil. Soil information takes precedence over vegetation data.) on the upper reaches of the Burn of Rulesgill valley sides and the valley sides of the Burn of Tongafield.

10.5.31 The lower reaches of the Burn of Rulesgill valley, Burn of Hildigill valley and Burn of Firth and Burn of Tongafield show no carbon rich soils or peatland being present on the SHN Carbon and Peatland Map 2016.

10.5.32 The SNH Carbon and Peatland Map 2016 is shown in Figure 10.3 shows peat distribution similar to that determined through the detailed peat survey presented in Appendix 10.2.

### *Peat*

10.5.33 The peat probing and peat coring investigations further confirmed the peat distribution, peat depth, peat characteristics and underlying geological conditions across the site. These data have also been used to develop the Peat Slide Risk Assessment as presented in Appendix 10.2.

10.5.34 Full results of the peat surveys are described within the Peat Survey Report, Outline Peat Management and Restoration Plan and Peat Slide Risk Assessment presented in Appendix 10.2,

10.3, and 10.4 respectively. Figures 1 and 2 of the Peat Survey Report in Appendix 10.2 shows the peat depth distribution across the site.

10.5.35 The spatial occurrence and depth distribution of peat across the site has been examined extensively based on guidance Developments on Peatland: Site Surveys SNH, SEPA, Scottish Government and The James Hutton Institute and high-density probing has taken place at infrastructure locations to determine peat depth and permit appropriate and accurate avoidance and minimal disturbance in the design process.

10.5.36 To obtain this detailed understanding of the spatial and depth distribution of peat and its properties, a series of tasks have been completed which include:

- Peatland habitat mapping (By ITPE and detailed within the Chapter 7: Ecology).
- Depth penetration probing in a 100m grid system across the entire site, except where other constraints restricted access.
- Depth of penetration probing at infrastructure and track locations at appropriate spacing:
  - track – every 50m with 10m offset to either side of track;
  - turbine bases and crane hardstanding – at all 29 turbine bases and associated crane hardstanding areas on a 10m grid along with probing on a 20m grid within the 20m micrositing area;
  - at the four construction compound areas on a 10m grid or 20m grid ; and
  - at the substation on a 10m grid along with probing on a 20m grid within the 20m micrositing area.
- Development of a maximum depth of peat contour map to indicate the deepest areas of potential peat based on the depth penetration probing results and verified by coring.
- Examination of the variability of the depth of the acrotelm, the thickness of the catotelm and the thickness of amorphous peat.
- Calculation of the maximum potential peat volumes that will be removed due to excavation for infrastructure based on the depth penetration probing results.
- Examination of areas where peat will be reused to allow calculation of reuse volumes.

10.5.37 The following summarises the results of the various phases of the peat survey campaign and subsequent interpreted peat depth contouring across the site:

- Phase 1: A first phase of peat depth probing was undertaken in October 2018 a first round of depth of penetration (peat) probing was carried out based on 100m grid across the original site to identify an initial distribution and depth of peat across the site by Fluid. A total of 1,338 peat probes and 40 cores were undertaken.
- Phase 2: A second phase of probing and coring was undertaken in November 2018 subsequent to the initial design freeze further peat probing was undertaken on 10m grid around the infrastructure layout and every 50m along access track with 10m offsets either side by Fluid to inform micro-siting requirements. An additional 9,622 peat depth probes and 119 cores were undertaken to verify the probe penetration depths to assess whether they were representative of the peat depth.
- Phase 3: To assess peat depth across this revised design layout extensive probing was carried out where a probe has been used to ascertain the depth of penetration to 0.1m accuracy. In January 2019 subsequent to the final design freeze further peat probing was undertaken on 10m grid around the infrastructure layout and every 50m along access track with 10m offsets

either side by Fluid. An additional 2070 peat depth probes and 15 cores were undertaken to verify the probe penetration depths to assess whether they were representative of the peat depth.

- Phase 4: in February 2019 an additional 31 peat probes were undertaken by ITPE in the southern construction compound near the site entrance.

10.5.38 Penetrable substrate depth plans were constructed to show probe locations in relation to the infrastructure (Figure 1 of Appendix 10.2 Peat Survey Report) and were used to inform design changes including track amendments, construction compound locations and substation locations throughout the design iterations. The probing depths were extrapolated and modelled to develop a penetrable substrate depth contour plot for the proposed development area using all the existing data (Figure 2 of Appendix 10.2 Peat Survey Report).

10.5.39 A total of 13,061 peat probes with measured depths recorded and 174 cores were undertaken across the four campaigns undertaken in 2018 and 2019 with a high concentration at known infrastructure locations. Each probe recorded the depth of penetration and the potential substrate below the peat layer, dominant vegetation types at the surface, ground firmness and any geomorphological or hydrological features of significance.

10.5.40 The initial peat survey campaign (2018) provided a 100m grid coverage across the initial Study Area to determine constraints and inform the initial design process.

10.5.41 Peat has subsequently been determined to be present up to a maximum depth of 6.15m and an average depth of 1.0 to 2.0m based on 13,061 depth of penetration probes across the site and 174 cores undertaken near to proposed infrastructure.

10.5.42 The data indicates that peat (>1.0m depth) is present across 65.4% of the proposed infrastructure and no peat (0 – 0.5m depth) is present across 6.6% of the proposed infrastructure.

10.5.43 Acrotelm thickness ranges from 0.00m to 0.30m with an average depth of 0.15m.

10.5.44 The coring results have verified the depth of penetration probing to be representative of peat depth in most cases, with one core demonstrating that the peat probing over estimated peat depth slightly where a softer sediment was present below the peat.

10.5.45 The average peat depth across the original Study Area is calculated to be approximately 1.45m. The average peat depth within the infrastructure footprint is calculated to be 1.25m.

10.5.46 Surface vegetation over the open moorland areas can vary up to 30cm in height between top of tussocks and their base.

10.5.47 The peat is fibrous and moist in nature at the surface with a large acrotelmic layer up to 30cm in thickness where vegetation at the surface was present. The catotelmic peat was up to a maximum of 6m in thickness, with well-preserved cotton grass, sphagnum moss and wood in places within the soil profile. No clear basal layer of amorphous peat (H9/H10) was observed. The peat characterisation studies concluded that the site comprises active peatland across much of the open moorland with some degradation/modification from very localised historical peat extraction near the A968 road, which mostly shows some good recovery.

10.5.48 Coring also provided verification of the probe depth and in nearly all cases the peat is overlying bedrock or sand and grit (glacial till with significant rock content).

10.5.49 All infrastructure is located on peat with the exception of:

- the majority of T4;
- some of T2 and T28;
- the majority of borrow pit search area A;
- some of borrow pit search area E,G and I;
- some of the construction compound 1;

- some of track: T2 to T3, T2 to T7 and the bellmouth site entrance.

10.5.50 The peat surveys and results are presented in more detail within Appendix 10.2 Peat Survey Report and the peat depth at each infrastructure location is summarised in Tables 10.14, 10.15 and 10.16 of this assessment chapter.

### *Geology*

10.5.51 Digital solid and drift geological maps were sourced from the British Geological Survey Digimap (1:50,000 scale) website and reviewed to provide geological information on the Proposed Development site. The geology was further reviewed using the British Geological Survey Bedrock Deposits 1:63,360 scale map for Solid Sheet 130 Northern Shetland (1968).

**Drift Geology**

10.5.52 The drift or superficial geology underlying the site comprises of peat overlying glacial till, with occasional localised hummocky glacial deposits, glaciofluival deposits or no drift deposits around the main watercourse channels.

10.5.53 Drift geology mapping (as shown on the BGS website accessed February, 2019) shows the majority of the site to be covered by peat deposits.

10.5.54 An area of hummocky glacial deposits is shown to be present in the eastern section of the site around the Grud Waters lochans.

10.5.55 The glacial fluvial deposits are very localised and limited to the valleys of the Burn of Amframires and River Burn in the centre of the site.

10.5.56 Glacial till is present below most of the peat deposits, however glacial till with no peat deposits above occurs on the eastern slope of the Burn of Tongafield valley and in the extreme southern section of the site. Drift deposits are not present along sections of the Burn of Gossa Water, the Burn of Amframires, the Burn of Tongafield the Burn of Firth and the Burn of Rulesgill. This was confirmed by observations during the site walkover.

10.5.57 Peat and glacial till substrate were observed to be present in some of the watercourse channels and erosional gully edges and substrate.

10.5.58 The British Geological Survey (BGS) digital 1:50,000 scale mapping showed no records of artificial ground.

10.5.59 The superficial geology is show on Figure 10.4.

**Solid Geology**

10.5.60 The British Geological Survey Bedrock 1:63,360 scale map for Solid Sheet 130 Northern Shetland (1968) show the majority of the site to be underlain by the Gneiss of Yell.

10.5.61 This bedrock comprises a coarsely foliated mica-plagioclase gneiss with much pegmatite across the majority of the site. A section of planar foliated mica-plagioclase-gneiss is present within the site roughly north to south between the inlets of Basta Voe and Gloup Voe. The steepest valleys with the site and the inlets with this planar foliated gneiss indicating it may be a weaker rock with regards to weathering and erosion than the coarsely foliated gneiss. There are two localised areas of quartzite on the site near the bend on the River Burn in the centre of the site and the bend on the Burn of Gilpapund in the eastern section of the site. There are two localised mapped areas calcareous shist banded granulite, shist and limestone and calisilicate bands on the Burn of Gilpapund in the eastern section of the site. Also, localised areas of quartzite, foliated gneiss and intrusive amphibolite mapped exposures in the Burn of Gossa Water downstream of the Lochan, Gossa Water. A minor lamprophyr microdiorite dyke is shown in the southern section of the site exposed by the Burn of Dalsetter.

10.5.62 The digital geological mapping indicates the site is underlain by the Moine Supergroup comprising Gneissose Psammite and Gneissose Semipelite, metamorphic bedrock formed approximately 542 to 1000 million years ago, originally sedimentary rocks, later altered by high grade regional

metamorphism. The north eastern section of the site on the upper section of the eastern valley of the Burn of Firth and the eastern section of the Gossa Water lochan comprises the Yell Sound 'division' Psammite, Gneissose. The eastern section of the site around the Burn of Gilpapund is shown as Yell Sound 'division' Quartzite. The extreme north eastern section of the site comprises of granodiorite igneous intrusion.

10.5.63 The digital geological mapping and sheet mapping show slightly different interpretations of the solid geology. In summary, the bed rock comprises of the Moine supergroup comprising heavily metamorphosed sedimentary rocks forming Gneisses with of different crystal size, composition, fabric and foliation. There is some evidence of localised igneous intrusions.

10.5.64 Given the variable nature of the metamorphic and igneous rock deposits there may be some variability in their engineering properties, their porosity to groundwater and weathered zones. Typically, more foliated high mica content gneiss is less competent as aggregate material due to the softness and friability of the mica planes within the gneiss.

10.5.65 Outcrops of bedrock were observed in sections of the site walkover including: the Burn of Gossa Water, the River Burn, the Burn of Rulesgill, Burn of Hildigill, Burn of Tongafield, the cutting for the Scottish Water Treatment Works, borrow pits along the Old Cullivoe Road and sections of erosion on steep slopes.

10.5.66 There are no known existing BGS borehole records available to view within 0.5km of the site.

10.5.67 The bedrock geology is shown on Figure 10.5.

**Structural Geology**

10.5.68 The dip of the Yell Gneiss is generally gently inclined to the southwest across the site.

10.5.69 There are no known geological faults within the site.

**Quarries and Mining**

10.5.70 No evidence of mining is known in the Proposed Development site or was observed during the site visits.

10.5.71 Evidence of small-scale quarrying or borrow pits were observed along the Old Cullivoe Road in the east of the site at NGR HP 52631 01967, NGR HP 52117 01354, NGR HP 52101 00521 and NGR HU 51174 99559. It is likely that these borrow pits were used for the aggregate source for the Old Cullivoe Road.

10.5.72 These quarries have the potential to have been back filled with man-made materials, although no significant man-made material was observed during the site walkover. As these sites are located at distance from the Proposed Development infrastructure it is considered unlikely that these sites present any potential contamination risk in relation to the Proposed Development area.

### *Hydrogeology*

10.5.73 The peat deposits have the potential to act as a localised perched aquifer where located above relatively impermeable glacial till deposits.

10.5.74 The Moine Group Gneiss bedrock below the site is classified by the BGS and Scotland's Environment as a low productivity or non-aquifer with limited groundwater potential/ regions without significant groundwater. The Pre- Cambrian Gneiss bedrock is generally impermeable strata generally without groundwater except at shallow depths within the weathered, fractured or heavily foliated zones. The crystalline basement offers little potential for groundwater storage and transport except in cracks and joints or near surface weathering.

10.5.75 Local glaciofluvial deposits associated with watercourse channels and floodplains are likely to provide more permeable routes for aquifer recharge, however, these are highly localised drift deposits.

10.5.76 The underlying geology is unlikely to provide groundwater in exploitable quantities. Overall the groundwater is considered to be of low sensitivity.

**Peat Hydrogeology**

10.5.77 Peat does not form part of the aquifer classification, but the upper layer (acrotelm) can act as a porous and relatively permeable layer, storing and transmitting water.

10.5.78 It was found that the only the acrotelmic peat deposits on site were fibrous and wet in nature. Diffuse wet areas were noted on the surface of the peat where the peat surface vegetation was intact. Where the vegetation had eroded away surface water flowed within bare peat channels or on bedrock substrate. Evidence of perched sub-terrain groundwater flow in the form of peat pipes, sink holes and watercourses appearing and disappearing under the surface of the peat. Groundwater flow was observed within the peat deposits in the northwest of the site in the upper reaches of the Burn of Vigon, in the centre of the site where the Fugla Water discharges and the upper reaches of the Burn of Osmand's Dale (as shown on Figure 10.6 hydrological features). A series of drainage grips have also been historically constructed within the peat deposits to redirect runoff and to reduce deep erosion. Occasional man-made drain grips were observed to the north east of the Gossa Water, up gradient of the sinkholes in the north western section of the site and on the steep valley sides above the Burn of Tongafield and Burn of Keddillmires. The combination of these drainage channels and the extensive frequency of erosional gullies across the site are likely to have contributed to a general lowering of groundwater levels and degree of peat saturation in these areas.

10.5.79 It is likely that most groundwater flow takes place in the shallow subsurface (acrotelmic layer of peat) and that catotelm layer, glacial drift deposits or bedrock may form a relatively "impermeable" floor to this shallow groundwater system.

10.5.80 Although there are a number of studies detailing the effect on the hydrology of peatland disturbance from drain cutting (e.g. Boelter 1972; Gilman 1994; Armstrong 2000), little research is apparent within systems due to be disturbed that have already undergone significant historical disturbance. Nayak et al. (2008) provide a useful summary of research on impacts of drainage on peat hydrology (Table 10.6) across varying hydraulic conductivity.

**Table 10.6 – Reported extents of drainage effect for peats with different hydraulic conductivity**

| Extent of drainage around site of disturbance (m) | Saturated hydraulic conductivity (mm/d) | Literature Source |
|---|---|---|
| 1.5 | 9.0 | Coulson et al. 1990 |
| 2.0 | 10.3 | Burke 1961 |
| 2.0 | 9.0 | Stewart and Lance 1991 |
| 2.3 | 9.0 | Stewart and Lance 1991 |
| 5.0 | 6.0 | Boelter 1972 |
| 3.0-9.0 | - | Scottish Government (2011) |
| 15.0 | 810 | Prevost et al. 1997 |
| 30.0 | 1,500 | Gilman 1994 |
| 50.0 | 34,560 | Boelter 1972 |
| 50.0 | - | Godwin & Bharucha 1932 |

10.5.81 The vertical and lateral variations of hydraulic conductivity within peat deposits are highly variable as the material is very heterogeneous.

10.5.82 The impacts of drainage within peatland habitats is related to the depth of the drain, distance from the drain and hydraulic conductivity of the peat at that location (Boelter 1972; Armstrong 2000). Although the drains, or other vertical cuttings (e.g. tracks) allow both increased surface and subsurface movement of water, drainage on a horizontal axis is limited. Degree of drying out is greatest at the edge of the cutting with rapidly decreasing impacts as distance from the edge increases with hydraulic conductivity of the peat also playing an important role.

10.5.83 A publication by the Scottish Government (2011) undertaken by a collaboration of Aberdeen University, Glasgow University, The University of Edinburgh, The James Hutton Institute and Forest Research presents research in to the permeability and potential drawdown effects of drainage and excavations associated with wind farm developments applicable for the carbon calculator (Carbon Implications Of Windfarms Located On Peatlands - Update Of The Scottish Government Carbon Calculator Tool, page 26, 30 September 2011). The report assessed the potential drawdown of shallow groundwater levels by drainage in peat using data from the existing Cross Lochs, Farr and Exe Head Wind Farms. The total extent in drainage from all three wind farms ranged from an average of 3m to 9m. Consultation with two of the authors of the report, S. Waldron and Graves indicated that the drawdown of groundwater in peat from drainage is generally less than 10m taking a conservative approach.

10.5.84 For the purposes of this environmental impact assessment, as peat is removed around excavated areas in 2 in 1 slopes it is unlikely that much additional dewatering occurs beyond this cutting based on the drawdown figures presented. The impact beyond this cut area is considered in the ecology chapter 7 where an additional 5m of habitat impact is assumed dur to dewatering effects and vehicle movements and in the carbon calculator chapter 16.

**Classification**

10.5.85 A search of the SEPA Water Environment Hub (https://www.sepa.org.uk/data-visualisation/water-environment-hub/, accessed February 2019) Database was undertaken to provide information on the groundwater body in the region of the site. The database indicates that the site is underlain by the Yell groundwater body, part of the Orkney and Shetland sub-basin which has been classified by SEPA as Good.

**Vulnerability to Pollution**

10.5.86 The BGS Hydrogeological Map of Scotland shows that the majority of the site and the surrounding area are underlain by Yell Sound 'division' of the Moine Group, which is classified as relatively impermeable gneiss or a low productivity aquifer. The gneiss may be able locally yield small amounts of groundwater within fracture, joints or the shallow weather zone.

10.5.87 The vulnerability of the Moine Group Gneiss is classified as 4b (moderately vulnerable based on a scale of 5 being the highest vulnerability and 1 the least vulnerable) equating to being Vulnerable to those pollutants not readily adsorbed or transformed and that pollution incidents will have a rapid travel time through or over the rocks if a pathway is available.

10.5.88 The vulnerability classification can be attributed to the transmission of rainfall and runoff from the surface to groundwater and the subsequent ease of movement of pollutants through the fracture dominated rocks. This assessment is based on the generic consideration of soil and rock types and does not indicate that the risks to local groundwaters are high. As the underlying bedrock is likely to have low fracturing and low to no intergranular permeability there is assumed a low attenuation capacity below the soil layer. However, it is likely to have a low permeability clay and peat overlying the bedrock affording some protection to the groundwater.

10.5.89 The SEPA web based interactive map indicates the Proposed Development area is on the Yell bedrock and localised sand and gravel aquifers which is a SEPA Drinking Water Protected Area (DWPA). It should be noted that the whole of Scotland is classified as a groundwater DWPA.

### *Ground Water Dependent Terrestrial Ecosystems*

10.5.90 The site has been mapped based on the National Vegetation Classification (Chapter 7: Ecology). These categories allow those habitats that are assessed as Ground Water Dependent Terrestrial Habitats (GWDTE) on site to be identified and their actual dependency of groundwater to be subsequently determined.

10.5.91 The Proposed Development layout has been designed to avoid all potentially highly groundwater dependent terrestrial ecosystems and minimise infrastructure on the potentially moderately groundwater dependent habitats identified where possible taking into account other design constraints.

10.5.92 Blanket bog dominates the site with approx. 75% cover (M17b, M17c, M1, M2 and M3). Bare peat habitat is rare across the site and confined to moderate slopes and vertical faces within areas of peat hag and erosional gullies. Acid/neutral flush (M6a, M6c, M29 and M32a) is associated with the flanks and bases of the small valleys of the watercourses, or the edges of lochs and lochans. Some influence from base-rich substrates (Flush and spring: basic – M10a) is evident in the south-western coastal area, in the occurrence of basic flushes, just beyond the site boundary.

10.5.93 Potential GWDTEs were identified through an analysis of the NVC results (Chapter 7: Ecology Section 7.5), using current guidance (SEPA, 2017). Seven of the NVC communities recorded within the Study Area are classified as being potentially groundwater dependent (see Figure 7.4a-e and Appendix 7.2):

- CG10 Festuca-Agrostis-Thymus praecox grassland, Trifolium repens-Luzula campestris sub-community;
- M6: Carex echinata-Sphagnum fallax mire, Carex nigra-Nardus stricta sub-community and Juncus effusus sub-community;
- M10: Carex dioica-Pinguicula vulgaris mire, Carex demissa-Juncus bulbosus/kochii sub-community;
- M23: Juncus effusus/acutiflorus-Galium palustre rush-pasture, Juncus effusus sub-community;
- M29: Hypericum elodes-Potamogeton polygonifolius soakway;
- M32: Philonotis fontana-Saxifraga stellaris spring, Sphagnum denticulatum sub-community; and
- U6: Juncus squarrosus-Festuca ovina grassland, Agrostis capillaris-Luzula multiflora sub-community.

10.5.94 Of these, six (CG10, M6, M10, M23, M29 and M32) are of potentially high groundwater dependence; the U6 sub-community is potentially of moderate groundwater dependence. The six high-dependence communities represent 14 areas of various size, primarily on the watercourse valley sides (Figure 10.7 Potential GWDTEs).

10.5.95 The dominance of blanket bog across the site clearly demonstrates the influence of a high precipitation/evaporation ratio across the site, and blanket bog communities are by their nature not groundwater dependent. Significant volumes of surface water are stored within pools, lochans and lochs; and yet more water moving across the mire within rills and burns. The minor rills of the headwaters are associated with the wettest depressions and saddles within the blanket bog covered areas; and they drain from M1, M2 & M3 bog pools along narrow channels (<2m wide) lined with M29, to small burns flanked by M6, M23 & U6. As such, the majority of the potential GWDTEs have low to no groundwater dependency, being dependent instead upon precipitation and surface waters.

10.5.96 Dependency upon groundwater is only attributed to:

- the M32 springhead community in one of its locations (from NGR 450791 1202095 to NGR 450857 1202055), by the Burn of Tongafield (>450m from nearest Proposed Development

infrastructure). Here it is associated with the M10 mire community where the M32's acid/neutral waters irrigate a base-rich substrate; and

- a second, very small area of M32 and M10 springhead community, located NGR 450465 1203012 at the south-western end of Gloup Voe was also determined to be groundwater dependent (>700m from the nearest Proposed Development infrastructure on the same side of the catchment).

**Potentially Groundwater Dependent Habitats within the Infrastructure Footprint**

10.5.97 There is no Proposed Development infrastructure located within the relevant distance (100m or 250m) of the potential GWDTE that have been classified as being truly groundwater dependent as assessed with Chapter 7 Ecology. The three truly groundwater dependent habitats are: M32 springhead community by Burn of Tongafield and M32 and M10 spring head community at south western end of Gloup Voe. GWDTE are therefore not considered further in the assessment.

10.5.98 Hawksweed, of rare ecological importance, was located at NGR 450717 1202989 near the Burn of Hildigill, at the head of Gloup Voe. These identified plants are in excess of 150m from the indicative access track to T29. This is considered sufficient distance from the working area (including final micro-siting allowance) to ensure they are not disturbed.

**Hydrogeological Context**

10.5.99 The hydrogeological regime comprises of a low productivity or relatively impermeable aquifer bedrock (gneissose) overlain by glacial till and /or peat which are both can be relatively impermeable superficial deposits. These have a very limited potential to provide a significant groundwater resource.

10.5.100 Small localised areas of glacio-fluvial or fluvial deposits are recorded within the valleys of some of the more established and larger watercourses. These have the potential to act as small, very localised and perched aquifers associated with the watercourses, however they will not have a significant resource of water compared to the surface water and precipitation.

10.5.101 Based on the hydrogeological regime and the assessment with the findings contained in the Ecology Chapter 7, the majority of the identified potential GWDTEs within the Study Area based on the NVC survey are not truly groundwater dependent but more reliant on surface water and precipitation. The three GWDTEs that were identified are further than the buffer distance from the Proposed Development infrastructure and therefore can be ruled out of further assessment.

## *Hydrology*

**Catchments**

10.5.102 There are two major catchments within the site, one occupying much of the southern half and draining to the Burn of Gossawater in the south and the other occupying the east and draining to Gloup Voe in the north. The western part of the Burn of Gossawater catchment is also the catchment for Gossa Water (Figure 10.1 Hydrological Setting and Figure 10.6 Hydrological Features) which provides the drinking water supply to the island.

10.5.103 In the north and west of the site, smaller catchments drain out to sea via a number of watercourses. The Hill of Vigon in the northwest of the site is drained to the north by the North and South Burns of Vigon and in the east by the Burn of Riggadale. The Hill of Markamouth in the mid-west of the site is drained to the west by the Burns of Midge Glen and Blackies Glen.

10.5.104 Fugla Field overlooking Gossa Water in the south of the site is drained to the south by the Burn of Rimminamartha and to the east by the Burn of Amframires (which also drains Flongna Field to the north and Tonga Field to the east). The Burn of Rimminamartha is the primary watercourse entering Gossa Water, which is the only public water supply on Yell. Gossa Water drains east via the Burn of Gossawater into Basta Voe, passing the Scottish Water treatment works at Dalsetter. The intake for the treatment works is located within Gossa Water.

10.5.105 Several minor watercourses converge on Gloup Voe in the centre north of the site – the Burn of Rulesgill in the west, the Burns of Hildigill and Thistledale in the east and the Burn of Firth in the south. Tittynans Hill in the southeast of the site is drained to the north by the Burn of Kedillsmires and to the south by the Burn of Dalsetter.

10.5.106 There are numerous artificial drains (or grips) across the site although their locations and density appear to be the result of ad-hoc local attempts to improve drainage rather than systematic attempts to lower water tables.

10.5.107 The receiving coastal waters, watercourses and sub-catchments are summarised in Table 10.7 and the main catchments are presented on Figure 10.1 Hydrological Setting and all the hydrological catchments are shown on Figure 10.6 Hydrological features.

**Table 10.7 – Surface Water Catchments and Receiving Coastal Waters Summary**

| Coastal Water | Main Catchment | Sub-Catchment 1 | Sub- catchment 2 | Sub-Catchment 3 |
|---|---|---|---|---|
| Basta Voe Inlet | Burn of Gossa Water (580Ha) | River Burn | Burn of Amframires | |
| | | Gossa Water | Burn of Rimminamartha | |
| | | Burn of Dalsetter | | |
| Gloup Voe Inlet | Burn of Firth (993ha) | Burn of Tongafield | Burn of Kedillsmires | |
| | | | Burn of Gilpapund | Burn of North Swartatous |
| | | | | Burn of South Swartatous |
| | | Burn of Thistle Dale | | |
| | | Burn of Osmand's Dale | | |
| | | Burn of Rulesgill | | |
| | Burn of Hildigill (50ha) | | | |
| | Burn of Laekdale | | | |
| Northeast Coast | North Burn of Vigon (173ha) | Burn of Riggadale | | |
| | South Burn of Vigon (130ha) | | | |
| | Burn of Midge Glen (98Ha) | | | |
| | Burn of Blackie Glen | | | |
| | Burn of Wirwick Glen | | | |

Note: Each section of coast also receives water from direct runoff and from minor unnamed watercourses

10.5.108 All of these catchments have Proposed Development infrastructure located within them, with the exception of the Burn of Wirwick Glen catchment draining to the northwest and the Burn of

Laekdale catchment draining to the north. These catchments will not be assessed further as there is no hydrological connectivity between the Proposed Development and the catchments.

10.5.109 In upper reaches most watercourses start as a series on minor drains, rills or erosional gullies on steep slopes or from bog pools nearer the surface water catchment boundary. These drains flow on the surface of the peat on top of the vegetation layer or on bare peat surfaces in erosional gullies. In places the larger drains can alternate between flowing on the surface of the peat to within the peat under the vegetative surface as peat pipes which were observed as sinkholes. In one location, there was evidence of drains flowing perpendicular to each other, one underground in a peat pipe and the other an overland drain going over the peat pipe in a different direction. The detail of the drains is quite complex and for the purposes of this chapter the main features have been mapped and summarised (see Figure 10.6 Water Features).

10.5.110 The minor drains congregate to form minor watercourses generally perpendicular to the hillslopes, often incising through the peat deposits onto bedrock or gravel substrate. These minor watercourse channels were observed to often be surrounded by over-hanging or collapsed peat hag and have bare peat faces in the immediate flood channels.

10.5.111 The minor watercourses congregate in the valley head or the valley floor. Those from the valley head become steep deeply incised main watercourses through bedrock buttresses and over small bedrock waterfalls or gravel (for example, Burn of Hildigill or Burn of Rulesgill in the north). In the northeast, some of the watercourses reach a flat low energy area of peat and become a maze of drains within the peat before finding the sea.

10.5.112 The main watercourses in the valley floors comprise of wider channels mostly on gravel and cobble substrate which are relatively shallow in depth unless in spate. These have the occasional slight meander where an erosional scarp can be noted on the outside and valley sides comprise of Glaciofluvial deposits, glacial till and bedrock, much of which is rounded and overgrown with grassland vegetation. As the watercourses approach the sea the channels become wider and shallower as they are on flatter gradients.

**Waterbodies**

10.5.113 A number of oligotrophic and dystrophic waterbodies are to be found, concentrated in the north-east and south of the site, varying from small 'dubh lochans', based in peat, to larger lochs, based on rock. However, design iterations have reduced the number of these waterbodies within the Proposed Development boundary (i.e. the majority of the Kussa Waters, to the north-east, and the open waters south of Gossa Water.

10.5.114 Sinuous bog pools on saddles near surface water catchment boundaries particularly between the Burn of Riggadale and the Burn of Rulesgill in the north were observed.

10.5.115 "Oligotrophic to mesotrophic standing waters" are Annex I habitats, also included in the SBL as "Oligotrophic and dystrophic lakes"; they also come under the LBAP "Freshwater" action plan. These G1.3 and G1.4 standing waters (G1.3 and G1.4 Ecological habitat categories) are widespread across the site, are moderately species-poor (a feature of nutrient poor waterbodies), but unusual in being relatively untouched by human activity. Many showing relic dessication cracks on the surface. The locations of the main bog pool complexes areas are shown on Figure 10.6.

10.5.116 The largest waterbody is the Gossa Water located in the southwest of the site.

**Coastal Waters**

10.5.117 The coastal waters to the south of the site, including the Basta Voe which the eastern and south eastern sections drains to is a designated as the Fetlar to Haroldswick Marine Protection Area (MPA) for Circalittoral sand and coarse sediment communities; horse mussel beds; kelp and seaweed communities on sublittoral sediment; maerl beds; and shallow tide-swept coarse sands with burrowing bivalves.

**Water Quality**

10.5.118 SEPA has introduced water monitoring and classification systems that will provide the data to support the aim of the WFD (2000/60/EC): "that all water bodies are of good ecological status, or similar objective, by 2015, or by 2027 if earlier achievement would be disproportionately costly".

10.5.119 The classification system covers all rivers, lochs, transitional, coastal and groundwater bodies, and is based on a new ecological classification system with five quality classes (High, Good, Moderate, Poor and Bad). The classification system has been devised following EU and UK guidance and is underpinned by a range of biological quality elements, supported by measurements of chemistry, hydrology (changes to levels and flows) and morphology (changes to the shape and function of water bodies). Small water bodies (rivers with <10km² catchment, lochs <0.5km²) are not classified under the WFD and, therefore, do not have target objectives under the River Basin Management Plan.

10.5.120 SEPA's online Water Environment Hub was consulted to find further information on current hydrological conditions. It should be noted that the online SEPA River Basin Management Plan interactive map and results gathered in 2014 have since been replaced by SEPA's Water Environment Hub.

10.5.121 All catchments within the site are less than 10km$^2$ in area and therefore are not classified under SEPA's RBMP.

10.5.122 SEPA have no water quality information available on the individual watercourses within the Proposed Development area readily available via online searches.

10.5.123 It is likely that the water quality within the site catchments is of high quality as a result of the natural unaltered landscape and geomorphology, current land uses that have minimal impact and catchments that link to sheltered inlets of the sea to the north and south of the site.

10.5.124 Field water quality measurements were recorded during the site visits in November 2019 and are presented in Table 10.8 and the locations shown on Figure 10.6. The water quality results generally exhibit good water quality which is acidic in nature and has some colouration, typical of drainage in peatlands.

**Table 10.8 - Field Water Quality Measurements Summary**

| ID | Grid Reference | Description | pH | EC (µS/cm) | TDS (ppm) | Temp (°C) | Turbidity (NTU) | Comments |
|---|---|---|---|---|---|---|---|---|
| WQ1 | 451543 1200576 | Kedillsmires Burn<br>5 Nov, 2018, moderate rain | 5.11 | 146 | 73 | 7.8 | 0.00 | Yellow, Medium level, Medium flow |
| WQ2 | 450512 1200109 | River Burn<br>5 Nov, 2018, Moderate rain | 4.95 | 87 | 42 | 7.6 | 0.00 | Yellow, Medium to high level, Medium to High flow |
| WQ3 | 450290 1200718 | River Burn<br>6 Nov, 2018, Light rain | 4.85 | 166 | 83 | 9 | 0.00 | Brown, Medium to high level, Medium to High flow |
| WQ4 | 448516 1203279 | Tributary of South Burn of Vigon | 4.71 | 103 | 87 | 9.2 | 0.00 | Brown, Medium level, Medium flow |

| ID | Grid Reference | Description | pH | EC (µS/cm) | TDS (ppm) | Temp (°C) | Turbidity (NTU) | Comments |
|---|---|---|---|---|---|---|---|---|
| | | 7 Nov, 2018, light drizzle | | | | | | |
| WQ5 | 448241 1202780 | Burn of Midge Glen<br>7 Nov, 2018, light drizzle | 5.01 | 103 | 63 | 9.1 | 0.00 | Brown, Medium level, medium flow |
| WQ6 | 450364 1201543 | Burn of Osmand's Dale<br>8 Nov, 2018, no rain | 4.80 | 102 | 97 | 8.3 | 0.00 | Brown, low to medium level |
| WQ7 | 449831 1202519 | Burn of Rulesgill<br>Upper reaches<br>8 Nov, 2018, no rain | 5.02 | 97 | 113 | 8.2 | 0.00 | Slightly Orange, low level, low flow |
| WQ8 | 449647 1203024 | Burn of Riggadale<br>8 Nov, 2018, no rain | 5.01 | 89 | 107 | 8.4 | 0.00 | Orange, very low level, very low flow |
| WQ9 | 449862 1202839 | Unnamed tributary of Burn of Rulesgill<br>8 Nov, 2018, no rain | 4.52 | 172 | 87 | 9 | 0.00 | Yellow, medium level, low flow |
| WQ10 | 449567 1201662 | River Burn near T9 track<br>8 Nov, 2018, light drizzle | 4.68 | 107 | 92 | 9.1 | 0.00 | Dark yellow, medium level, medium flow |
| WQ11 | 450639 1199796 | The Burn of Gossa Water downgradient of River Burn confluence<br>9 Nov, 2018, no rain | 5.38 | 261 | 128 | 8.4 | 0.00 | Yellow, medium level, low flow |
| WQ12 | 450635 1199830 | The River Burn upgradient of | 5.29 | 171 | 86 | 8.7 | 0.00 | Dark Yellow, medium level, |

| ID | Grid Reference | Description | pH | EC (µS/cm) | TDS (ppm) | Temp (°C) | Turbidity (NTU) | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Burn of Gossa Water confluence<br>9 Nov, 2018, no rain | | | | | | low to medium flow |
| WQ13 | 450618 1199829 | The Burn of Gossa upgradient of River Burn confluence<br>9 Nov, 2018, no rain | 5.24 | 270 | 135 | 7.9 | 0.00 | Slightly Yellow, medium level, low to medium flow |
| WQ14 | 450949 1200897 | Burn of Kedillsmires at meander 9 Nov, 2018, no rain | 5.47 | 156 | 78 | 8.5 | 0.00 | Yellow, medium level, low to medium flow |
| WQ15 | 451812 1201758 | Burn of Gilpapund<br>10 Nov, 2018, moderate rain | 5.70 | 152 | 78 | 8.2 | 0.00 | Yellow, medium level, low to medium flow |
| WQ16 | 451593 1202103 | Unnamed tributary of Gilpapund near T26<br>10 Nov, 2018, heavy rain | 5.28 | 140 | 77 | 8.2 | 0.00 | Yellow, medium level, medium flow |
| WQ17 | 451562 1202125 | Unnamed tributary of Gilpapund near T26<br>10 Nov, 2018, heavy drizzle | 5.17 | 168 | 85 | 8.1 | 0.52 | Brown, high level, medium to high flow |

EC = Electrical Conductivity. TDS = Total Dissolved Solids.

10.5.125 The field monitoring results indicates catchment of good water quality which is acidic in nature due to being the runoff from peatland. Very little turbidity or particles were observed in the watercourses, however the water colour was often yellow to brown in colour and some watercourses demonstrated some ferrous deposition.

10.5.126 The Gossa Water catchment draining a section of the site and to the west and southwest of the site is within a Scotland Surface Drinking Water Protected Area according to the Scottish Government Website Maps (Map 7). This is shown in Figure 10.1 and Figure 10.6. This catchment is considered to be of very high sensitivity. The remainder of the site and catchments within Yell are not classified as a Scotland Surface Drinking Water Protected Area.

10.5.127 Further information on the local water quality has been provided by Scottish Water and a summary of their water quality records are presented in the Private and Public Water Supplies and Abstractions Section.

10.5.128 To the east the Esha Ness to Gloup Holm Coastal waters, to the north the Gloup Holm to Herma Ness coastal waters and to the south the Basta Voe coastal waters are classified by SEPA as good quality.

10.5.129 The sensitivity of the water quality in these catchments is considered to be of high sensitivity given, where information is available, that they support high status water quality conditions and discharge into the Gloup Voe and Basta Voe coastal water inlets.

**Fish and Other Water Dependent Species**

10.5.130 A search of freely available datasets from the Biological Records Centre (Database for the Atlas of Freshwater Fish) held within the National Biodiversity Network (NBN) gateway undertaken. There are existing records of: Atlantic salmon (*Salmo salar*) being recorded in the River Osmand's Dale mouth and River Gossa Water mouth in 1990; European Eel Anguilla Anguilla) being recorded in the River Osmand's Dale mouth, River Gossa Water mouth and the North Burn of Vigon mouth in 1990.; and, Otter (*Lutra lutra*) being recorded within and around the site at National Grid references HP4900, HP5204, HU4996 and HP5302 in 1979, 1991 and 2015.

Fish

10.5.131 The habitats throughout the survey area provide suitable areas of moderate to good quality habitat for salmonids and areas of suitable spawning habitat. In some instances, upstream habitats become unsuitable and inaccessible, due to barriers.

10.5.132 An electro fishing survey has been undertaken for the Proposed Development (refer to Appendix 7.6) and a summary of the findings is provided below:

- Burn of Gossawater catchment area: brown trout (*Salmo trutta*) fry and parr were present and eel (*Anguilla anguilla*) were widespread and most abundant in the lower reaches of the burn. Most of the productive habitat is located in Burn of Gossawater itself or in River Burn/Burn of Amframires. These watercourses are accessible to migratory fish.
- The Burn of Firth catchment area had trout in almost all reaches accessible from the sea and eel were present at two sites. Trout were found to be widespread in all accessible and suitable habitats, including headwater areas, but are absent upstream of waterfalls on the Burn of Glipapund and the Burn of Rulesgill.
- North Burn of Vigon and South Burn of Vigon: no fish were seen during the habitat survey and none were captured by electric fishing. Access from the sea is difficult, due to the presence of obstacles. It was concluded that the catchment may be fishless.
- Burn of Hildigill migratory habitat is restricted to the lower 150m by a waterfall and habitat quality for salmonids, or other fish in the accessible reach, is very poor.

10.5.133 Atlantic salmon are listed on Annex II of the Habitats and Species Directive; Atlantic salmon, brown trout and European eel are all listed as priority species on the Scottish Biodiversity list; and due to population declines, European eel is considered of increasing conservation concern and therefore protected under both EU and Scottish legislation.

Freshwater Pearl Mussel

10.5.134 Alba Ecology Ltd undertook a Freshwater Pearl Mussel Survey of North Yell in October 2018 (presented in Appendix 7.5). Twelve watercourses were surveyed by experienced and licensed freshwater pearl mussel surveyors in September 2018 led by Dr Peter Cosgrove of Alba Ecology Ltd. No evidence of freshwater pearl mussels was found in any Study Area watercourses. Some patches of potentially suitable, partly stable, substrate habitat were recorded within Study Area

watercourses. The report provides survey evidence that no freshwater pearl mussels were present within the Study Area. Consequently, there are no special freshwater pearl mussel sensitivities that need to be considered. Nevertheless, freshwater pearl mussels are highly sensitive to changes in water quality, and if present and undetected (and there is no evidence for this) it will be important to avoid any sources of pollution or runoff from the site during proposed works by following good practice measures when working around watercourses. The ecology chapter also states There is therefore no evidence that freshwater pearl mussels are present within the study area. Consequently, there are no particular freshwater pearl mussel sensitivities that need to be considered. Given the absence of any evidence of FWPM they are scoped out of the assessment, however water quality impacts on watercourses are assessed assuming high and very high sensitivity receptors due to other sensitivities which afford a high level of protection.

Otter

10.5.135 Signs of otter presence were recorded throughout the site (see Chapter 7: Figure 7.5a-e), including spraints, holts, runs, tracks (footprints) and feeding evidence. The majority of evidence was noted to the south-west and north-east of the site (associated with the Gossa Water and Kussa Waters/Burn of Firth catchments, respectively), though spraints were also recorded in the centre of the Study Area (Burn of Amframires/River Burn, part of the Burn of Gossawater catchment). Details and locations can be found in Chapter 7: Appendix 7.4 and Figure 7.5.

10.5.136 Three potential otter holt records are within the site boundary: one to the west of the area, north-west of Gossa Water and close to the western boundary of the site; one on the Burn of Gossawater, on the southern edge of the site; and one on the Burn of Kedillsmires/Burn of Tongafield, east of the site centre.

10.5.137 Chapter 7 (Ecology) provides further detail on the habitats present on and adjacent to the site.

**River Flows**

10.5.138 There are no flow records for the watercourses on the site as all the catchments on the site are less than 10km$^2$ in area.

10.5.139 The size, topography, land use and geology of the area suggest that the catchments on site have the potential to be flashy. This means that flow in them will respond rapidly to rainfall and flood conditions could potentially occur with very little, or no, warning. Base flows in the watercourses are unlikely to dry up as the peatlands will sustain them due to steady seepage from the low permeability deposits and there may be some potential for very localised groundwater influence to the base flow from the underlying bedrock weathered zone of the low productivity aquifer bedrock.

**Flooding**

10.5.140 The Proposed Development infrastructure, is not located within or in close proximity to a SEPA flood risk area. A review of the SEPA Flood Risk Management Mapping indicates that the Burn of Gossa Water and the Burn of Firth have small associated areas of medium to high risk fluvial flood zones along the alignment of the watercourse within the site. Surface water flooding areas are also shown in association with the larger lochans within the site.

10.5.141 The SEPA Flood Maps indicate there are small areas of potential surface water flooding within the Proposed Development site. These are mainly located in clusters around the small lochans or bog pool complexes.

10.5.142 There are several small watercourses and lochs within the Proposed Development site which may be a source of flood risk. The SEPA Flood Maps have been produced following a consistent, nationally-applied methodology for catchment areas equal to or greater than 3km$^2$ using a Digital Terrain Model (DTM) to define river corridors and low-lying coastal land. The maps are indicative and designed to be used as a strategic tool to assess flood risk at the community level and to support planning policy and flood risk management in Scotland.

10.5.143 During the site visits the watercourses were observed in spate during a high rain fall event or storm. The majority of the main watercourses and minor watercourses broke their main channel banks

however the flood waters stayed mostly within the immediate steep channel valleys getting significantly deeper and faster flowing rather than significantly wider. During storm events many of the minor or ephemeral drains acted like small watercourses with fast runoff through numerous rills. The catchments were observed to be very flashy and no widespread flooding occurred.

10.5.144 The Proposed Development is unlikely to materially increase the probability of flooding elsewhere or significantly increase surface runoff rates providing appropriate drainage is installed. The proportion of total land take for each main catchment is less than 5 percent of each catchment area (Burn of Firth 3.1%, Burn of Gossa Water 1.8%, Gossa Water DWPA 0.5% (catchment 4.0km$^2$, infrastructure in catchment 0.2km$^2$), Burn of Hildigill 3.0%, North Burn of Vigon 4.3% and South Burn of Vigon 4.3%). The majority of the land take will be semi-permeable hard standing for access tracks, crane pads, construction areas and remain as peat for the temporary laydown areas and reinstated borrow pits. The only permanent impermeable surfaces within each main catchment will be the turbine bases and the substation area and therefore the total proportion of impermeable land take for each catchment is calculated to be less than 0.18%.

10.5.145 A Flood Risk Assessment may be required for bridge design for the main watercourse crossings shown on the 1:50,000 scale Ordnance Survey mapping particularly if structures within the flood plain cannot be avoided. Watercourse crossings will be in accordance with SEPA guidance and allow the conveyance of a 0.5% AP (200 year) flow event. Main watercourse crossings will allow fish, eel and otter passage.

10.5.146 Flood risk sensitivity is considered low as the Proposed Development infrastructure will not be positioned within or near a flood plain, with the exception of an access track crossings of watercourses, and the Proposed Development design has minimised the amount of land take and hard surfacing as far as reasonably practicable. Additionally, mitigation will put in place to control and attenuate runoff during all phases of the proposed development.

10.5.147 No properties (receptors) in the vicinity of the site have been identified at risk of flooding based on SEPA's mapping. SEPA mapping does not include any mapping of catchments of less than 3km$^2$ and as such there may be potential for some minor localised flooding to occur around these small watercourses, particularly in areas where confluences with other burns are located.

10.5.148 From OS maps, there are no known sensitive receptors in close vicinity and given that the site has steep gradients, it is unlikely that the Proposed Development would have an adverse impact on local fluvial flood risk.

**Watercourse and Drain Crossings**

10.5.149 A total of 41 new watercourse crossings will be constructed on site. Of the 41 new watercourse crossings, 14 of the crossings required are over main watercourses (shown on 1:50,000 scale OS Mapping) and 27 are required over watercourses shown on 1:25,000 scale OS mapping or watercourse that were observed on site and not shown on OS mapping.

10.5.150 Two main watercourse crossings (shown on 1:50,000 OS mapping) are existing and may require replacement crossings as part of the widening of Old Cullivoe Road. This will be determined through the detailed design process post-consent. These are located at NGR HU 51053 99255 and HU 51052 99375.

10.5.151 The site is characterised by numerous minor drains, rills and erosional gullies within the peat substrate. The locations of these minor drains are shown on Figure 10.6a to 10.6e Water Features. There are approximately 200 known new crossings of minor man-made drains, natural ephemeral drains and diffuse drainage areas or ephemeral flows crossing the site. These crossings will comprise of culverts or where the drainage area is wide a series of culverts.

10.5.152 A total of 5 watercourse diversions are required around borrow pit areas, construction compound areas and turbine and crane pad areas. One diversion is of a main watercourse (as shown on 1:50,000-scale OS mapping) and four of the diversions are of minor watercourses (not shown on 1:50,000-scale mapping and confirmed onsite as being watercourses). These watercourses are not considered to be of importance for migratory fish where diverted as they are in the upper reaches of the catchment.

10.5.153 The watercourse crossing locations are shown on Figures 10.6a to 10.6e Water Features with 1:50,000 scale crossings shown as orange circles and 1:25,000 scale and other watercourse crossing shown as green circles. The details of the crossings are presented within Appendix 10.5.

**Private and Public Water Supplies and Abstractions**

Public Water Supply

10.5.154 Scottish Water was consulted in 2017, 2018 and 2019 with regards to the Proposed Development. The consultation is summarised in Section 10.1, Table 10.1 of this Chapter and the agreement for mitigation and continency plans is presented in Appendix 10.6.

10.5.155 Scottish Water have a surface drinking water catchment, a potable water supply abstraction, a water treatment works and associated piping and infrastructure within the site. The Gossa Water lochan and its catchment is used for the extraction of surface water by Scottish Water for public drinking water supply. The Scottish Water drinking water abstraction location is known to be from the Gossa Water waterbody at approximately NGR HP 49324 00041. The underground raw water pipeline runs roughly parallel with the Burn of Gossawater, marked by concrete posts, to the Scottish Water Treatment Works at approx. NGR HU 51133 99229. The existing access track in the eastern section of the site crosses the raw pipeline at approx. NGR HU 51060 99383.

10.5.156 Treated water or mains water supply is piped northwards along the Old Cullivoe Road to an underground reservoir at NGR HP 53030 03382 before supplying the Gloup area. Treated or mains water supply is also piped to the southeast along the existing track to the A968 main road where the mains water pipeline heads southeast and southwest along the main road to supply the rest of the island.

10.5.157 The known Scottish Water infrastructure, based on Scottish Water plans and on-site observations, is shown in Figures 10.6a to 10.6i Water Features.

10.5.158 Scottish Water undertake monthly water quality monitoring of the raw water supply from the Gossa Water and analysis samples for colour, pH, iron, manganese, total organic carbon and turbidity. They provided the results from January 2015 to December 2018.

10.5.159 There is some hagging locally, mainly in the east central area north of Gossa Water, and Scottish Water notes that the Gossa watershed is partly degraded, with the water quality being characterised by a high amount of organic material as a consequence of hags and erosion gullies being present (Scottish Water, personal communication, meeting on 9 January 2019).

10.5.160 There are no other known public water supply sources within the site or within 250m of any infrastructure.

10.5.161 The Gossa Water Scottish Water Public Water Supply is the mains water supply source for the whole island of Yell after a recent closing down of smaller water supply sources and water treatment works and the construction of a new water treatment works North of Sellafirth at approximate NGR HU 51133 99229. The Gossa Water lochan is therefore a very high sensitivity catchment receptor which is extremely vulnerable to changes in water quality and run off alterations.

Licenced Abstractions

10.5.162 In Scotland, water abstractions between $10m^3$/day and $50m^3$/day are required to be registered. Abstractions that have the potential to cause a significant impact or larger abstractions require an abstraction licence.

10.5.163 Other than the Scottish Water Public Water supply surface water extraction from the Gossa Water lochan, there are no known groundwater or surface water abstractions within the Study Area (catchments potentially linked to the site).

Private Water Supplies

10.5.164 There are no residential properties within the proximity of the site and therefore no known private water supplies within the site used for potable supply.

10.5.165 The nearest observed potential private water supply (PWS) was located approximately 0.5km to the north of the site, south of Gloup village and within a separate hydrological catchment to the Proposed Development infrastructure. The PWS if still used, is likely to be used for drinking water for nearby livestock troughs. This potential PWS is not assessed further as it is within a separate catchment and a sufficient distance from the Proposed Development not to be affected.

10.5.166 Properties adjacent to the A968 to the south and B9083 to the north east are known to mostly be on mains water supply.

10.5.167 There are no known risks from the Proposed Development on any private water supplies as there is no evidence to indicate the nearest properties are reliant on a private water supply within the catchment of the Proposed Development area.

### *Designated Sites*

10.5.168 The relevant designated sites are shown on figure 10.1 Hydrological Setting.

10.5.169 There are no international or national designations located within the Proposed Development site or within 0.5km of the Proposed Development infrastructure.

10.5.170 There are a number of designated sites within the vicinity of the Proposed Development site which are listed below:

- Fetlar to Haroldswick Marine Protection Area (MPA) immediately south of the site.
- RSPB Reserve located approximately 1.85km southwest of the site.
- East Mires and Lumbister Site of Special Scientific Interest (SSSI) and Special Protection Area (SPA) located over 2.0km southwest of the site;
- Breckon SSSI approximately 2.18km northwest of the site;
- Otterswick and Graveland SPA and Graveland SSSI located over 3.17km southwest of the site.

10.5.171 Further information on the designations is provided in Chapter 3: Ecology.

10.5.172 The sensitivity of these designated areas is low as there is no hydrological link between the site and these receptors.

### *General Site Conceptualisation*

10.5.173 The site is characterised by low permeability superficial deposits (peat and glacial till) over low permeability bedrock, Yell Gniess. The peat and glacial till are generally saturated as evidenced by the wide presence of blanket bog, wet heath and mire habitats. The low permeability of both the superficial deposits and the low permeability of the bedrock will allow very limited infiltration of rainfall and therefore runoff rates will be relatively high and flashy for this hilly site with steep valleys.

10.5.174 Active peatland habitat covers the majority of the site with peat depths ranging from not present to a maximum of 6.15m. The average peat depth across the site is 1.44m and the average peat depth within the infrastructure footprint is 1.25m.

10.5.175 The site is mainly divided into two main surface water catchments: the Burn of Gossawater in the central and south eastern section of the site draining to the Basta Voe to the south, which is part of the Fetlar to Haroldswick MPA, and the Burn of Firth draining the eastern and central area to the Gloup Voe in the northern.

10.5.176 Many of the larger watercourses support brown trout and European eel and have the potential to support Atlantic salmon although no salmon were recorded in recent surveys. The lower reaches of the larger watercourses (Burn of Gossawater, Burn of Firth and North Burn of Vigon) are considered to be salmonid waters. Smaller ephemeral drains are through vegetation or eroded into the peat deposits

10.5.177 The majority of the hill summits are characterised by oligotrophic and dystrophic summit bog pool complexes with pools ranging from 1m to 30m in diameters and 0.05m to 1.3m deep. The bog pools are noted to in particularly good natural condition without being altered anthropogenically or by livestock grazing and poaching.

10.5.178 The Gossa Water lochan is used by Scottish Water as a public water supply abstraction for the mains drinking water supply for the island of Yell. The Gossa Water and its catchment are therefore highly sensitive and associated Scottish Water infrastructure is also present within the site.

### *Site Sensitivities*

10.5.179 The assessment of significance of effects is based on the magnitude and sensitivity criteria described above. Sensitive receptors identified for the site are:

- peatland habitats;
- surface watercourses, summit pool bog complexes and waterbodies, including:
  - The Gossa Water Lochan Catchment – a public drinking water supply for the island of Yell; and
  - The Burn of Gossawater and the Basta Voe that it discharges to, which is part of the Fetlar to Haroldswick MPA, and Burn of Firth catchment and watercourses for trout, eel and otter;
- drinking water supplies – the Gossa Water Lochan Catchment;
- coastal waters; and,
- water dependent habitats.

10.5.180 Based on the assessment criteria defined in Table 10.1, a summary of the site sensitivities is presented in Table 10.9.

**Table 10.9 -Site Sensitivity Summary**

| Hydrologically Sensitive Receptors | | Sensitivity | Rationale/Designations |
|---|---|---|---|
| Terrestrial | Mire<br>Peat | High | UK BAP, Habitat Regs, Section 42 |
| | Active Blanket Bog<br>Upland Heathland | Very High | Annex I Habitats under EU habitats directive |
| | Shallow Peat (>0.5m to 1.0m) | Medium | Guidance on Developments on Peatland - Site Surveys |
| | Deep Peat (>1.0m) | High | Guidance on Developments on Peatland - Site Surveys |
| | Very Deep Peat (>2.0m) | Very high | Guidance on Developments on Peatland - Site Surveys |
| Groundwater | Shallow Groundwater | High | Maintains water dependent habitats and peat saturation |

| Hydrologically Sensitive Receptors | | Sensitivity | Rationale/Designations |
|---|---|---|---|
| | Deep Groundwater | Low | Limited resource and no identified dependent users |
| Surface Watercourses and waterbodies | Gossa Water Lochan | Very high | Scottish Water Public Drinking Water supply for the island of Yell. |
| | Burn of Gossawater and the Basta Voe coastal inlet (part of the Fetlar to Haroldswick MPA) | High | High value for Atlantic salmon, brown trout, eel and otter with useful habitat in accessible reaches.<br>Drains to Basta Voe coastal inlet |
| | Burn of Firth | High | High value for Atlantic salmon, brown trout, eel and otter with useful habitat in accessible reaches.<br>Site drains to Gloup Voe coastal inlet |
| | North Burn of Vigon | Medium | Limited value to fish due to accessibility. Moderate value for otter. Site drains to coastal waters |
| | South Burn of Vigon | Medium | Limited value to fish due to accessibility. Medium value for otter. Site drains to coastal waters |
| | Northeast catchments | Medium | Limited value to fish due to accessibility. Medium value for otter. Site drains to coastal waters |
| | Bog pool complexes | Medium to high | Oligotrophic and dystrophic standing waters, widespread feature, but unusual in lack of human impacts; SBL and LBAP habitat.<br>Medium value for otter. |

Note: although the various habitat classifications of peat, mire and blanket bog have high to very high sensitivity as habitats this chapter assesses peat as a material or resource so the sensitivity is determined by the Guidance of Developments on Peatland – Site Surveys 2017. The effects on habitat are assessed with the ecology chapter 7.

10.5.181 In the design phase, wherever possible, all the Proposed Development infrastructure has been sited with an objective to maintain at least a 50m 'buffer zone' between turbine locations and natural main watercourses (shown on 1:50,000 scale OS mapping) and to avoid deep active peatland where possible taking into account other constraints.

10.5.182 Further detailed ground investigation will be undertaken post consent to develop the detailed design and to assess potential options for alternative foundation designs to further reduce the disturbance of peat. During the detailed design and construction phase, sections of track will be surveyed and micro-sited to optimise the distance where possible from water features and minimise peat disturbance and peat slide hazard.

## 10.6 Potential Effects

10.6.1 This section describes the potential effects of the Proposed Development based upon an assessment of the activities which will occur during the construction, operation and decommissioning phases of the Proposed Development, in relation to the sensitive areas of the site, prior to mitigation and management, and assuming that best practise methods are employed (refer to Appendix 10.1). The purpose of this assessment is to identify likely significant adverse effects on the environment and whether specific mitigation and management measures can reduce these effects.

### *Potential Impacts*

10.6.2 The assessment of potential effects considers the magnitude of the potential impacts and the sensitivity of the receptors. Possible hydrological, hydrogeological and geological impacts resulting from the construction, operation and decommissioning of wind farms are related to five main factors:

- **Erosion and Sediment Transport** – Unmanaged erosion/sediment deposition and suspended solids generated from ground disturbance and new infrastructure could travel directly by surface run-off or cause modification to stream channel morphology, with resulting smothering of habitats/effect on both terrestrial and aquatic flora and fauna, especially fish. Unacceptable levels of sediment could also affect water abstracted for drinking supply. This could result from:
  - slides of incorrectly stored excavated materials;
  - direct disturbance of the banks and bed of watercourses during watercourse crossing construction, repair and/or upgrade works or during cable installation within the watercourse bed;
  - pumping of standing water required for dewatering of excavations such as turbine bases, borrow pits or as required for drainage management purposes;
  - runoff from exposed ground, excavations and material stockpiles (aggregate and excavated/overburden peat and soil), cable trenches and tracks;
  - runoff from tracks, bridges and culverts crossings at watercourse and drain crossings;
  - runoff from recently reinstated areas (road verges, borrow pits etc); and
  - movement of stockpiled material.
- **Potential Polluting events affecting Groundwater and Surface Water Quality** – Oil/Fuel/Chemical pollution (from for instance, accidental spillage or incorrect transport or storage during concrete preparation and refuelling procedures, or from leaching of concrete from turbine bases and installations) could affect both terrestrial and aquatic flora and fauna and also on human activities such as water abstracted for drinking supply. These could include:
  - Cement wash out areas, storage areas and other areas where cement grout or concrete is being applied;
  - Plant washing and vehicle wheel wash areas;
  - fuel and chemical storage/refuelling areas;
  - leaking/vandalised plant and equipment; and
  - sewage and waste water from construction compound and permanent control building amenities.

- **Alteration of Natural Drainage Patterns/Runoff Volumes and Rates** – Any alteration of natural drainage could disturb natural surface and subsurface water flows to either water dependent habitats or to water supply abstraction points, unless properly managed. Tracks and other hardstand areas could provide new preferential pathways and interfere with the retention of flows within catchments. Inappropriate water crossings could result in blockages and flooding, with the potential to exacerbate erosion. Storage of peat or other excavated material in inappropriate locations could result in an alteration to water flows and in an increase in peat slide risk in hazard prone areas;
- **Increase in the Magnitude or Frequency of Flood Events** – the alteration of areas on floodplains may result in flood waters extending further or deeper elsewhere and/or increase the frequency of such events. In some cases, this could result in risk to human life/health, damage to infrastructure, devaluing of land and change to ecological systems; and,
- **Alteration of the geological environment** – The excavation of the subsoil required to build the site infrastructure such as turbine bases and access roads and will result in an alteration of the geological environment; in particular any underlying peat may be removed and will need to be managed appropriately. Peatland habitats take 1,000s of years to develop and appropriate restoration plans are required to ensure the net balance is positive.

10.6.3 The potential impacts of the Proposed Development are summarised below in Table 10.10. It is noted that the impacts listed in Table 10.10 are only potential and their inclusion does not necessarily indicate that they will occur.

10.6.4 Specific advice on the potential impacts at the site as received from consultees is presented in Table 10.4. More detailed discussion on the specific effects which may arise within the site is presented further in Section 10.15 of this Chapter.

**Table 10.10 Summary of potential impacts on hydrology/hydrogeology and peatlands arising from wind farm developments**

| Potential Receptors | Activities and Potential Impacts | | |
|---|---|---|---|
| | **Construction Phase** | **Operation Phase** | **Decommissioning Phase** |
| Surface water hydrology and channel morphology | Works next to or near watercourses or diversion of watercourses:<br>change in flow velocities<br>increased erosion and subsequent changes in bed and bank stability<br>increased flood risk | Use of vehicles and machinery:<br>increase in surface runoff from soil compaction<br>run off from access roads | Earthworks:<br>pollution from suspended material<br>disturbance of contaminated soil and subsequent pollution of water courses<br>peat slide and bog burst |
| | Use of vehicles and machinery:<br>increase in surface runoff from soil compaction | Site drainage:<br>rapid transfer of rainwater to | Use of vehicles and machinery to remove turbines and associated infrastructure: |

| Potential Receptors | Activities and Potential Impacts | | |
|---|---|---|---|
| | **Construction Phase** | **Operation Phase** | **Decommissioning Phase** |
| | Earthworks:<br>increased sedimentation of watercourses<br>peat slide and bog burst | watercourses via drains | temporary increase in surface runoff from soil compaction |
| Surface water quality | Earthworks:<br>pollution from suspended material<br>disturbance of contaminated soil and subsequent pollution of water courses<br>peat slide and bog burst | Materials management:<br>pollution from maintenance work spills or leaks of fuel or oil | Earthworks:<br>pollution from suspended material<br>disturbance of contaminated soil and subsequent pollution of water courses<br>peat slide and bog burst |
| | Materials management:<br>pollution from spills or leaks of fuel, oil and construction material | Use of machinery:<br>sediment-loading of watercourses | Use of vehicles and machinery to remove turbines and associated infrastructure:<br>contamination from spills or leaks of fuel or oil |
| Groundwater hydrology | Earthworks and site drainage:<br>reduction in water table<br>changes to groundwater distribution and flow | Physical presence of turbine foundations:<br>possible minimal alteration of groundwater flow | Earthworks and site drainage:<br>reduction in water table<br>changes to groundwater distribution and flow |
| | | | Physical presence of turbine foundations:<br>possible minimal alteration of groundwater flow |
| Groundwater quality | Earthworks and site drainage:<br>disturbance of contaminated soil and subsequent pollution of watercourses | Materials management:<br>contamination from spills or leaks of fuel and oil | Earthworks and site drainage:<br>disturbance of contaminated soil and subsequent pollution of watercourses |
| | Materials management: | | |

| Potential Receptors | Activities and Potential Impacts | | |
|---|---|---|---|
| | **Construction Phase** | **Operation Phase** | **Decommissioning Phase** |
| | Pollution from spills or leaks of fuel, oil and construction material | | Use of vehicles and machinery to remove turbines and associated infrastructure:<br>contamination from spills or leaks of fuel or oil |
| Geological Environment | Earthworks and site drainage:<br>reduction in water table resulting in the drying out of peat<br>excavation and removal of peat<br>loading and destabilisation of peat and peat slide/bog burst | Site drainage:<br>Continued dewatering of peat<br>Peat slide | Earthworks and site drainage:<br>reduction in water table resulting in the drying out of peat<br>excavation and removal of peat<br>loading and destabilisation of peat and peat slide/bog burst |
| | | | Site drainage:<br>Continued dewatering of peat<br>Peat slide |

*(Summarised from Environment Agency (2002) Scoping Guidelines on the Environmental Impact Assessment (EIA) of Projects. Environment Agency (EA), Bristol)*

10.6.5 During the development and lifetime of the Proposed Development there would be some activities which, if not properly managed, could have the potential to lead to significant effects on the water and peatland environment.

10.6.6 The main construction activities are described in Chapter 3: Project Description and the site layout is shown in Figures 1.2 and 10.1.

### *Good Practice and Standard Mitigation Methods*

10.6.7 Following good practice guidance, the assessment process assumes the application of standard mitigation measures as presented in Appendix 10.1. A range of measures have already been applied as part of the iterative design development process (see Chapter 2: Design Iteration), to avoid the higher value areas of blanket bog, waterbodies and watercourses.

10.6.8 Standard mitigation also includes adherence to current environmental protection policies and guidance, including but not limited to:

- Good Practice During Wind Farm Construction (SNH, 2015a)
- Constructed tracks in the Scottish uplands (SNH, 2015b);
- WAT-SG-75 (SEPA, 2018);
- A Practical Guide to the CAR Regulations (SEPA, 2019); and

- LUPS-GU31 (SEPA, 2017).

10.6.9 Development of a Site Construction Environmental Management Plan (CEMP), in consultation with stakeholders (i.e. SEPA, SNH and Shetland Islands Council) to include:

- Appointment of a suitably qualified and experienced Ecological Clerk of Works (ECoW) and Hydrological Clerk of Works (HCoW) to oversee application of the CEMP;
- Site Water Management Plan (SWMP);
- Outline Peat Management and Restoration Plan (PMP); see Appendix 10.3;
- Materials Management Plan (MMP; to include a Waste Policy/Management Plan); and
- Habitat Management Plan (HMP); see Appendix 7.7).
- Preconstruction ecological survey programme of habitats and watercourse crossing points, to identify any changes to otter or fish use of the channels, to feed into the final micro-siting process;
- Use of Method Statements during construction, to include current good practice and prescribed use of low noise and vibration plant to limit fish avoidance behaviours when working near watercourses; and,
- Development of an Operational Site Management Plan, (OSMP) to include an HMP and maintenance task Method Statements.

10.6.10 The good practice techniques that will be employed by the Applicant during the construction and operation of the wind farm are detailed in Appendix 10.1. These techniques have been assumed to be adopted as part of the Proposed Development when undertaking the assessment of potential effects and are considered the standard that will be applied rather than specific mitigation. This list is not exhaustive and guidance and good practice literature will be used. Mitigation measures are over and above these standards and will be specific to the source-pathway-receptor identified at risk.

## *Assessment of Potential Impacts*

10.6.11 The following tables describe those elements of the Proposed Development with the main potential for impacts on hydrology, hydrogeology and geology, including hydrological/hydrogeological impacts on peat. A magnitude of potential impact has been assigned to these based on their location and activity and the duration of impacts, whether the impacts are long term or short term. This magnitude of potential impact takes into account the good practice and standard mitigation methods described in Appendix 10.1.

10.6.12 The assessment of magnitude of potential impacts of the individual items of infrastructure feeds in to the assessment of likely significant effects of the infrastructure in each catchment and the assessment of the whole Proposed Development.

**Turbines and Crane Hardstandings**

10.6.13 The relevant elements are 29 wind turbines foundations (up to 636m$^2$ each) and associated excavated crane hardstandings (irregular shape 3,512m$^2$ to 4,689m$^2$ each) and floated temporary laydown areas (1,364m$^2$ to 1,948m$^2$) (Table 10.11) – these areas include the excavated areas and drains outside of the infrastructure footprint as presented in the Outline Peat Management and Restoration Plan (Appendix 10.3).

10.6.14 The area of this infrastructure is up to 5,272 m$^2$ for each turbine base and associated crane pad area excavated. The temporary land take for laydown areas that are floating is up to 1,948m$^2$. Therefore, requires a total land take of up to 183,404 m$^2$ (133,135m$^2$ excavated and 50,269m$^2$ floating/temporary).

**Table 10.11 - Inventory of turbine and crane hardstanding locations and their associated magnitude of potential impact of causing sedimentation, pollution, alteration of natural water flows, excavation of peat, peat slide risk and changes to peat hydrology.**

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| T1 | 448784<br>1203666 | Gradient: Steep.<br>Catchment: South Burn of Vigon<br>Watercourse proximity: approx.160m up gradient of main tributary to the South Burn of Vigon. Turbine approx. 70m northeast of sinkhole. Laydown area approx. 35m upgradient of sinkhole.<br>Waterbody: None.<br>Average peat depth: 1.17m at turbine base, 0.86m at crane hardstanding and 0.88m at laydown area.<br>Estimated volume of peat excavated: 580m$^3$ at turbine base and 2,966 m$^3$ at crane hardstanding.<br>Peat slide risk likelihood: Moderate. Bog Burst likelihood: Low to moderate. Overall peat slide risk to receptors: Low.<br>Other sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality, no watercourse close.<br>Low for drainage alteration.<br>High for turbine base and medium for crane pad, mostly on shallow peat.<br>Low for groundwater disturbance as located on impermeable geology<br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T2 | 448331<br>1203036 | Gradient: Steep to very steep.<br>Catchment: South Burn of Vigon<br>Watercourse proximity: over 50m from turbine, approx. 235m to northeast and southwest.<br>Waterbody: None.<br>Average peat depth: 0.68m at turbine base, 0.76m at crane hardstanding and 0.68m at laydown area.<br>Estimated volume of peat excavated: 304m$^3$ at turbine base and 2,541 m$^3$ at crane hardstanding.<br>Peat slide risk likelihood: Very low. Bog Burst likelihood: Very low. Overall peat slide risk to receptors: very low.<br>Other sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality, no watercourse close.<br>Low for drainage alteration.<br>Medium for peat disturbance, mostly on shallow peat.<br>Low for groundwater disturbance as located on impermeable geology<br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T3 | 449144<br>1203369 | Gradient: Moderate to steep.<br>Catchment: North Burn of Vigon | Low for water quality, no watercourse close. |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Watercourse proximity: over 50m from turbine, approx. 100m to southeast. Over 25m from temporary floating laydown (no excavation required), approx. 27m from watercourse. Sinkhole approx. 25m northwest and 115m northeast of turbine.<br><br>Waterbody: Located on 7 small bog pools.<br><br>Average peat depth: 0.72m at turbine base, 0.96m at crane hardstanding and 1.14m at laydown area.<br><br>Estimated volume of peat excavated: 323m$^3$ at turbine base and 3,291 m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low to moderate. Bog Burst likelihood: Low to moderate. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for drainage alteration due to bog pools.<br><br>Medium for peat disturbance, mostly on shallow peat<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T4 | 449765<br>1203441 | Gradient: Low.<br><br>Catchment: North Burn of Vigon.<br><br>Watercourse proximity: over 50m from turbine, approx.225m to northwest.<br><br>Waterbody: Located on one larger bog pool, approx. 25m diameter.<br><br>Average peat depth: 0.40m at turbine base, 0.28m at crane hardstanding and 0.47m at laydown area.<br><br>Estimated volume of peat excavated: 119m$^3$ at turbine base and 448 m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low. Bog Burst likelihood: Low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality, no watercourse close.<br><br>Medium to High for drainage alteration due to bog pools.<br><br>Low for peat disturbance, mostly on no peat<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T5 | 449676<br>1202945 | Gradient: Moderate to low.<br><br>Catchment: Burn of Rulesgill<br><br>Watercourse proximity: approx. 10m to watercourse to north and northeast on saddle of catchment. Main watercourse over 50m from turbine, approx.65m to north west and east.<br><br>Waterbody: Located on a few minor sinuous bog pools. | Medium for water quality, close to minor watercourse, no main watercourse close.<br><br>Medium for drainage alteration due to bog pools. |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Average peat depth: 0.91m at turbine base, 1.21m at crane hardstanding and 1.25m at laydown area.<br><br>Estimated volume of peat excavated: 439m$^3$ at turbine base and 4,088m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low. Bog Burst likelihood: Low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium to High for peat disturbance<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T6 | 449640<br>1202314 | Gradient: Moderate to steep.<br><br>Catchment: Burn of Gossawater via Burn of Amframires and River Burn<br><br>Watercourse proximity: Minor watercourse through crane pad area requires diverting. Main watercourse over 50m from turbine, approx.150m to southeast.<br><br>Waterbody: Laydown area located on 2 very small bog pools.<br><br>Average peat depth: 1.91m at turbine base, 1.55m at crane hardstanding and 1.61m at laydown area.<br><br>Estimated volume of peat excavated: 980m$^3$ at turbine base and 5,553m$^3$ at crane hardstanding.<br><br>Peat Condition: Wet, deep erosional gully<br><br>Peat slide risk likelihood: Low. Bog Burst likelihood: Low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality.<br><br>Medium for drainage alteration.<br><br>High for peat disturbance, located on mainly deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T7 | 448360<br>1201874 | Gradient: Moderate to steep.<br><br>Catchment: Gossa Water Surface Water Drinking Water Protected Area via Grud Waters and Burn of Rimminanmartha.<br><br>Watercourse proximity: Main watercourse over 50m from turbine. Located on several small drains.<br><br>Waterbody: none.<br><br>Average peat depth: 1.05m at turbine base, 1.64m at crane hardstanding and 1.71m at laydown area. | Low for water quality<br><br>Low for drainage alteration.<br><br>High for peat disturbance, mostly on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Estimated volume of peat excavated: 521m$^3$ at turbine base and 5,988m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low to very low. Bog Burst likelihood: Low to very low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | |
| T8 | 449002<br>1201654 | Gradient: Moderate to low.<br><br>Catchment: Burn of Gossawater via Burn of Amframires and River Burn.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx.230m to northeast. Located on several minor drains.<br><br>Waterbody: Located 200m to northwest of Fugla water.<br><br>Average peat depth: 0.74m at turbine base, 0.93m at crane hardstanding and 1.14m at laydown area.<br><br>Estimated volume of peat excavated: 335m$^3$ at turbine base and 3,263m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low to very low. Bog Burst likelihood: Low to very low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality no main watercourse close.<br><br>Low for drainage alteration.<br><br>Medium for peat disturbance, mostly shallow peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T9 | 449577<br>1201755 | Gradient: Moderate to low.<br><br>Catchment: Burn of Gossawater via Burn of Amframires and River Burn.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 67m to south.<br><br>Waterbody: Located on 3 small bog pools.<br><br>Average peat depth: 1.49m at turbine base, 1.52m at crane hardstanding and 1.35 at laydown area.<br><br>Estimated volume of peat excavated: 736m$^3$ at turbine base and 5,065m$^3$ at crane hardstanding.<br><br>Peat Condition: Wet peat | Low for water quality no main watercourse close.<br><br>Low to Medium for drainage alteration.<br><br>High for peat disturbance, mostly on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Peat slide risk likelihood: Low. Bog Burst likelihood: Low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | |
| T10 | 448922 1201085 | Gradient: Steep to very steep.<br><br>Catchment: Gossa Water Surface Water Drinking Water Protected Area. Burn of Rimminanmartha.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, 125m downgradient. Located on several small drains.<br><br>Waterbody: none.<br><br>Average peat depth: 0.79m at turbine base, 0.97m at crane hardstanding and 1.10m at laydown area.<br><br>Estimated volume of peat excavated: 371m$^3$ at turbine base and 3,303m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Very low to moderate. Bog Burst likelihood: Low to very low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality, located on drains within Gossa Water catchment.<br><br>Medium for drainage alteration.<br><br>Medium for peat disturbance, mostly shallow peat<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T11 | 449777 1201270 | Gradient: Moderate.<br><br>Burn of Gossawater via River Burn.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 210m to northeast and east. Located on several small drains.<br><br>Waterbody: None.<br><br>Average peat depth: 1.96m at turbine base, 1.96m at crane hardstanding and 2.15m at laydown area.<br><br>Estimated volume of peat excavated: 1,037m$^3$ at turbine base and 7,233m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Very low to low. Bog Burst likelihood: Very low to low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel | Low for water quality no main watercourse close.<br><br>Low to medium for drainage alteration.<br><br>High for peat disturbance, mostly on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | |
| T12 | 449088 1200632 | Gradient: Steep to very steep.<br><br>Catchment: Gossa Water Surface Water Drinking Water Protected Area. Burn of Rimminanmartha.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, 125m downgradient. Located on several small drains. Laydown area located on sinkhole.<br><br>Waterbody: none.<br><br>Average peat depth: 1.11m at turbine base, 1.37m at crane hardstanding and 1.56m at laydown area.<br><br>Estimated volume of peat excavated: 544m$^3$ at turbine base and 4,818m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low to moderate. Bog Burst likelihood: Low to moderate. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality, located on drains within Gossa Water catchment.<br><br>Medium for drainage alteration.<br><br>High for peat disturbance, mostly on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T13 | 449752 1200772 | Gradient: Low to moderate.<br><br>Burn of Gossawater.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 130m to southeast. Located on one small drain.<br><br>Waterbody: None.<br><br>Average peat depth: 0.83m at turbine base, 1.22m at crane hardstanding and 1.86m at laydown area.<br><br>Estimated volume of peat excavated: 403m$^3$ at turbine base and 4,340m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low. Bog Burst likelihood: Low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality no main watercourse close.<br><br>Low for drainage alteration.<br><br>Medium to high for peat disturbance, on shallow and deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk Appendix 10.4 PSHRA) |
| T14 | 449368 1200263 | Gradient: Low to moderate.<br><br>Burn of Gossawater. | Low for water quality no main watercourse close. |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Watercourse proximity: Main watercourse over 50m from turbine, approx. 150m to southeast and northeast. Not within Gossa Water Lochan drinking water catchment.<br><br>Waterbody: Approx. 150m to Gossa Water Lochan to south.<br><br>Average peat depth: 1.48m at turbine base, 1.55m at crane hardstanding and 1.55m at laydown area.<br><br>Estimated volume of peat excavated: 746m$^3$ at turbine base and 5,527m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low to moderate. Bog Burst likelihood: Low to moderate. Overall peat slide risk to receptors: low to medium (Blade fingers and turning head for Turbine 14 (Unnamed tributary to Burn of Gossawater / buried Scottish Water infrastructure)<br><br>Other Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for drainage alteration.<br><br>High for peat disturbance, mostly on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low to medium for peat slide risk (Appendix 10.4 PSHRA) |
| T15 | 449961 1200325 | Gradient: Steep to very steep.<br><br>Burn of Gossawater. Scottish Water Raw water supply pipeline approx. 95m downgradient at nearest location.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 140m to south. Located on one minor man-made drain<br><br>Waterbody: None.<br><br>Average peat depth: 0.72m at turbine base, 1.03m at crane hardstanding and 1.15m at laydown area.<br><br>Estimated volume of peat excavated: 347m$^3$ at turbine base and 3,512m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low to moderate. Bog Burst likelihood: Low to moderate. Overall peat slide risk to receptors: Medium (Burn of Gossawater / buried Scottish Water infrastructure).<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality no main watercourse close.<br><br>Low for Scottish water infrastructure disturbance.<br><br>Low for drainage alteration.<br><br>Medium to High for peat disturbance, on shallow to deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Medium for peat slide risk (Appendix 10.4 PSHRA) |
| T16 | 450428 1200150 | Gradient: Moderate.<br><br>Burn of Gossawater. Scottish Water Raw water supply pipeline approx. 75m downgradient at nearest location. | Low for water quality no main watercourse close. |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Watercourse proximity: Main watercourse over 50m from turbine, approx. 80m to east. Located on one minor man-made drain<br><br>Waterbody: None.<br><br>Average peat depth: 1.37m at turbine base, 1.57m at crane hardstanding and 1.56m at laydown area.<br><br>Estimated volume of peat excavated: 678m$^3$ at turbine base and 5,732m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low. Bog Burst likelihood: Low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for Scottish water infrastructure disturbance.<br><br>Low for drainage alteration.<br><br>High for peat disturbance, on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T17 | 450396<br>1201116 | Gradient: Moderate.<br><br>Burn of Gossawater via River Burn.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 250m to west. Located on a few minor drains.<br><br>Waterbody: None.<br><br>Average peat depth: 1.08m at turbine base, 0.87m at crane hardstanding and 0.97m at laydown area.<br><br>Estimated volume of peat excavated: 523m$^3$ at turbine base and 2,707m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Very low to low. Bog Burst likelihood: Very low to low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality no main watercourse close.<br><br>Low to medium for drainage alteration.<br><br>Medium to High for peat disturbance, on shallow to deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T18 | 450606<br>1200678 | Gradient: Moderate to low.<br><br>Burn of Gossawater via River Burn.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 125m to south. Located on a few minor drains.<br><br>Waterbody: None.<br><br>Average peat depth: 1.89m at turbine base, 2.09m at crane hardstanding and 2.07m at laydown area. | Low for water quality no main watercourse close.<br><br>Low to medium for drainage alteration.<br><br>Very high for peat disturbance, on deep to very deep peat. |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Estimated volume of peat excavated: 985m$^3$ at turbine base and 8,057m$^3$ at crane hardstanding.<br>Peat slide risk likelihood: Low. Bog Burst likelihood: Low. Overall peat slide risk to receptors: Medium (River Burn)<br>Other sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for groundwater disturbance as located on impermeable geology<br>Medium for peat slide risk (Appendix 10.4 PSHRA) |
| T19 | 451071 1200336 | Gradient: Moderate.<br>Burn of Gossawater via River Burn.<br>Watercourse proximity: Main watercourse over 50m from turbine. Located on a few minor drains.<br>Waterbody: None.<br>Average peat depth: 1.80m at turbine base, 1.52m at crane hardstanding and 1.53m at laydown area.<br>Estimated volume of peat excavated: 922m$^3$ at turbine base and 5,569m$^3$ at crane hardstanding.<br>Peat slide risk likelihood: Very low to low. Bog Burst likelihood: Very low to low. Overall peat slide risk to receptors: low.<br>Other sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality no main watercourse close.<br>Low for drainage alteration.<br>High for peat disturbance, on deep peat.<br>Low for groundwater disturbance as located on impermeable geology<br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T20 | 451554 1200185 | Gradient: Moderate to steep.<br>Burn of Firth via Burn of Kedillsmires and Burn of Tongafield.<br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 160m to east. Located on a few minor drains and adjacent to two watercourses not shown on OS mapping.<br>Waterbody: None.<br>Average peat depth: 1.75m at turbine base, 1.77m at crane hardstanding and 1.57m at laydown area.<br>Estimated volume of peat excavated: 895m$^3$ at turbine base and 6,511m$^3$ at crane hardstanding.<br>Peat slide risk likelihood: Very low to low. Bog Burst likelihood: Very low to low. Overall peat slide risk to receptors: low. | Low for water quality no main watercourse close.<br>Low to medium for drainage alteration.<br>High for peat disturbance, on deep peat.<br>Low for groundwater disturbance as located on impermeable geology<br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Other sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | |
| T21 | 450563<br>1201645 | Gradient: Moderate to steep.<br>Burn of Firth via Burn of Osmand's Dale.<br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 105m to northwest.<br>Waterbody: Located on a few very small bog pools in northwest.<br>Average peat depth: 0.98m at turbine base, 0.95m at crane hardstanding and 0.82m at laydown area.<br>Estimated volume of peat excavated: 478m$^3$ at turbine base and 3,292m$^3$ at crane hardstanding.<br>Peat slide risk likelihood: Very low to moderate. Bog Burst likelihood: Very low to moderate. Overall peat slide risk to receptors: low.<br>Other sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality no main watercourse close.<br>Low to Medium for drainage alteration.<br>Medium for peat disturbance, on shallow peat.<br>Low for groundwater disturbance as located on impermeable geology<br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T22 | 451005<br>1201521 | Gradient: Steep to very steep.<br>Burn of Firth via Burn of Kedillsmires and Burn of Tongafield.<br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 225m to east. Located on several minor drains.<br>Waterbody: Located on three small bog pools.<br>Average peat depth: 0.77m at turbine base, 1.24m at crane hardstanding and 1.27m at laydown area.<br>Estimated volume of peat excavated: 370m$^3$ at turbine base and 4,339m$^3$ at crane hardstanding.<br>Peat slide risk likelihood: Very low to low. Bog Burst likelihood: Very low to low. Overall peat slide risk to receptors: low.<br>Other sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality due to drains and steepness.<br>Medium for drainage alteration.<br>Medium to High for peat disturbance, shallow to deep peat.<br>Low for groundwater disturbance as located on impermeable geology<br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| T23 | 451298 1200900 | Gradient: Moderate to steep.<br><br>Burn of Firth via Burn of Kedillsmires and Burn of Tongafield.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx.185m to south and 270m to northeast. Located on a few minor drains.<br><br>Waterbody: Located on a few small bog pools.<br><br>Average peat depth: 1.46m at turbine base, 1.21m at crane hardstanding and 1.47m at laydown area.<br><br>Estimated volume of peat excavated: 742m$^3$ at turbine base and 4,290m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Very low to low. Bog Burst likelihood: Very low to low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality no main watercourse close.<br><br>Medium for drainage alteration.<br><br>High for peat disturbance, on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T24 | 451800 1200817 | Gradient: Moderate to very steep.<br><br>Burn of Firth via Burn of Kedillsmires and Burn of Tongafield.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx.190m to southeast. Located on a minor man-made drain.<br><br>Waterbody: None<br><br>Average peat depth: 1.70m at turbine base, 1.56m at crane hardstanding and 1.34m at laydown area.<br><br>Estimated volume of peat excavated: 870m$^3$ at turbine base and 5,841m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Very low to moderate. Bog Burst likelihood: Very low to moderate. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality no main watercourse close.<br><br>Low for drainage alteration.<br><br>High for peat disturbance, on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T25 | 451593 1201475 | Gradient: Moderate to steep.<br><br>Burn of Firth via Burn of Kedillsmires and Burn of Tongafield. | Low for water quality no main watercourse close. |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Watercourse proximity: Main watercourse over 50m from turbine, approx.100m to south southeast. Located on two minor drains.<br><br>Waterbody: Located on four small bog pools.<br><br>Average peat depth: 1.51m at turbine base, 1.48m at crane hardstanding and 1.55m at laydown area.<br><br>Estimated volume of peat excavated: 765m$^3$ at turbine base and 5,250m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Very low to moderate. Bog Burst likelihood: Very low to moderate. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for drainage alteration.<br><br>High for peat disturbance, on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T26 | 451724 1202184 | Gradient: Moderate to steep.<br><br>Burn of Firth via Burn of Gilpapund and Burn of Tongafield.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 100m to northeast. Located on two small drains. Satellite hardstanding directly adjacent to watercourse not shown on OS mapping (Figure 10.6a).<br><br>Waterbody: Located on four small bog pools.<br><br>Average peat depth: 1.70m at turbine base, 1.83m at crane hardstanding and 1.76m at laydown area.<br><br>Estimated volume of peat excavated: 871m$^3$ at turbine base and 6,900m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low. Bog Burst likelihood: Low. Overall peat slide risk: to receptors Low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality, adjacent watercourse not shown on OS mapping.<br><br>Medium for drainage alteration.<br><br>High for peat disturbance, on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T27 | 451323 1202379 | Gradient: Moderate to low.<br><br>Burn of Firth via Burn of Tongafield and Burn of Thisledale.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 82m to east and 180m to west.<br><br>Waterbody: Located on eight small bog pools. Bog pool complex upgradient. | Low for water quality no main watercourse close.<br><br>Medium for drainage alteration.<br><br>High to very high for peat disturbance, on deep to very deep peat. |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Average peat depth: 1.98m at turbine base, 2.00m at crane hardstanding and 1.82m at laydown area.<br><br>Estimated volume of peat excavated: 1,051m$^3$ at turbine base and 7,129m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Low. Bog Burst likelihood: Low. Overall peat slide risk to receptors: Low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T28 | 451037<br>1202718 | Gradient: Moderate to steep.<br><br>Catchment: Burn of Hildigill.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 165m to northeast. Located on three small drains. Washed out erosional area.<br><br>Waterbody: Located on eight small bog pools. Bog pool complex upgradient.<br><br>Average peat depth: 0.49m at turbine base, 0.87m at crane hardstanding and 0.89m at laydown area.<br><br>Estimated volume of peat excavated: 162m$^3$ at turbine base and 3,090m$^3$ at crane hardstanding.<br><br>Peat slide risk likelihood: Very low to low. Bog Burst likelihood: Very low to low. Overall peat slide risk to receptors: low.<br><br>Other sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality no main watercourse close.<br><br>Medium for drainage alteration.<br><br>Low to Medium for peat disturbance, on no peat to shallow peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |
| T29 | 450906<br>1203324 | Gradient: Moderate to steep.<br><br>Catchment: Burn of Hildigill.<br><br>Watercourse proximity: Main watercourse over 50m from turbine, approx. 145m to southeast.<br><br>Waterbody: Laydown area on two bog pools.<br><br>Average peat depth: 1.40m at turbine base, 1.72m at crane hardstanding and 1.46m at laydown area.<br><br>Estimated volume of peat excavated: 705m$^3$ at turbine base and 6,895m$^3$ at crane hardstanding. | Low for water quality no main watercourse close.<br><br>Medium for drainage alteration.<br><br>High for peat disturbance, mostly on deep peat.<br><br>Low for groundwater disturbance as located on impermeable geology<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Turbine | Location | Description | Magnitude of Impact |
|---|---|---|---|
| | | Peat slide risk likelihood: Very low to low. Bog Burst likelihood: Very low to low. Overall peat slide risk to receptors: low.<br>Other sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | |

**Access and Site Tracks**

10.6.15 The relevant elements are (Table 10.12):

- 21km of 5m wide site tracks with one access point from the existing A968 road, resulting in 104,820m$^2$ of permanent land take and 5,698m$^2$ of temporary land take;
- 19.325km of new floating track 5m wide, resulting in 92,057m$^2$ of land take;
- 1.75km new excavated floating track 5m wide, resulting 12,763m$^2$ of land take and 13,791m$^3$ of excavated peat;
- 0.525km of Old Cullivoe Road to be widened by 4m to the north side with floating track, resulting in 2,103m$^2$ land take; and,
- Cable routing laid in trenches along the edges of tracks 0.5m deep and 1m wide or under the access track (no additional permeant land take).

**Table 10.12- Inventory of track sections and their associated Magnitude of Potential Impact of causing sedimentation, pollution, alteration of natural water flows, excavation of peat, peat slide risk and changes to peat hydrology**

| Track | Description | Magnitude of Impact |
|---|---|---|
| Old Cullivoe Road to new access track<br>Existing, new excavated bellmouth junction, WTW to site entrance widened to the northside - floating. | Gradient: Low to steep slope.<br>Catchment: Burn of Gossa Water and Basta Voe coastal inlet.<br>Watercourse proximity: Within 50m (approx. 15m) of main watercourse. Existing 2 main watercourse crossings which will potentially require to be expanded.<br>Scottish Water raw pipeline crossing and mains pipeline along the southern edge of existing track (opposite side to where widening)<br>Peat Occurrence: no peat <0.5m by road to very deep peat 2.0m to 3.0m.<br>Peat slide likelihood: Low.<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel | Medium for water quality<br>Low for drainage alteration<br>Low to Medium for Scottish Water infrastructure disruption.<br>Negligible to Low for peat disturbance as on no peat or shallow peat floating<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |

| Track | Description | Magnitude of Impact |
|---|---|---|
| | (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | |
| New track from Old Cullivoe Road to cross roads<br><br>Track: New floated | Gradient: Low to steep slope.<br><br>Catchment: Burn of Gossa Water and River Burn.<br><br>Watercourse proximity: >50m of main watercourse except at junction. 2 crossings of small man-made drain.<br><br>Peat Occurrence: Peat Occurrence: no peat 1.0m to 3.0m.<br><br>Peat slide likelihood: Very low to moderate<br><br>Sensitivities:<br><br>Scottish Water mains pipeline along the edge track requires crossing.<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low for peat slide risk<br><br>Low for shallow groundwater disturbance as located on impermeable geology<br><br>Low for Scottish Water infrastructure |
| T20 Spur<br><br>Excavated and floated | Gradient: Low to steep slope.<br><br>Catchment: Burn of Gossa Water and River Burn.<br><br>Watercourse proximity: >50m of watercourses, except one minor watercourse crossing (no.20)<br><br>Peat Occurrence: no peat 1.0m to 2.0m.<br><br>Peat excavated: 1.0 to 3.0m depth<br><br>Peat slide likelihood: Low<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low to Medium for peat disturbance<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T19 to BPSA B<br><br>Track floated | Gradient: Low to moderate slope.<br><br>Catchment: Burn of Firth via Burn of Kedillsmires and Burn of Tongafield<br><br>Watercourse proximity: >50m of watercourses, except one minor watercourse crossing (no.19)<br><br>Peat Occurrence: no peat 1.0m to 3.0m.<br><br>Peat slide likelihood: Low<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |

| Track | Description | Magnitude of Impact |
|---|---|---|
| | (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | |
| Cross roads to T16<br><br>Track floated and excavated | Gradient: Low to moderate slope.<br><br>Catchment: Burn of Gossawater via River Burn<br><br>Watercourse proximity: >50m from watercourses with the exception of: a section of track running parallel to and within 10m of a minor watercourse, one main watercourse crossing (no.8, River Burn) and one minor watercourse crossing (no.18)<br><br>Peat Occurrence: 0.5m to >4.0m<br><br>Peat excavated: <0.5m to 1.0m depth<br><br>Peat slide likelihood: Very low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low to medium for peat disturbance<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| Substation spur<br><br>Track floating | Gradient: Low to moderate slope.<br><br>Catchment: Burn of Gossawater via River Burn<br><br>Watercourse proximity: >50m, except one minor watercourse crossing (no.17)<br><br>Peat Occurrence: 1.0m to >2.0m<br><br>Peat slide likelihood: Very low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T16 to T15<br><br>Track floating | Gradient: Low to moderate slope.<br><br>Catchment: Burn of Gossawater<br><br>Watercourse proximity: >50m, except two minor watercourse crossings (no.15 and no.16)<br><br>Peat Occurrence: 0.5m to 2.0m<br><br>Peat slide likelihood: Very low to low<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |

| Track | Description | Magnitude of Impact |
|---|---|---|
| T15 to T-junction<br><br>Track floating | Gradient: Low slope.<br><br>Catchment: Burn of Gossawater and River Burn<br><br>Watercourse proximity: >50m, except one minor watercourse crossings (no.14)<br><br>Peat Occurrence: 0.5m to 3.0m<br><br>Peat slide likelihood: Very low to low<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T-Junction to T12<br><br>Track floating | Gradient: Low to steep slope.<br><br>Catchment: Burn of Gossawater and River Burn<br><br>Watercourse proximity: >50m from watercourses, except one main watercourse crossings of un-named tributary of Burn of Gossawater (no.7)<br><br>Peat Occurrence: 0.5m to 3.0m<br><br>Peat slide likelihood: Very low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low to Medium at T13 junction for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T12 to T10<br><br>Track floating | Gradient: Moderate to steep slope.<br><br>Catchment: Gossa Water Drinking Water Protection Area via Burn of Rimminanmartha.<br><br>Watercourse proximity: >50m from watercourses, crosses several small drains.<br><br>Peat Occurrence: 0.5m to 3.0m<br><br>Peat slide likelihood: Low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| Junction to T13, BPF and T11<br><br>Track floating | Gradient: Low to moderate slope.<br><br>Catchment: Burn of Gossawater and River Burn<br><br>Watercourse proximity: >50m from watercourses. Several small drains. | Low for water quality<br><br>Low for drainage alteration |

| Track | Description | Magnitude of Impact |
|---|---|---|
| | Peat Occurrence: 0.5m to 3.0m<br>Peat slide likelihood: Very low to low<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for peat disturbance as track is floating<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |
| T11 to T9<br>Track floating | Gradient: Low to steep slope.<br>Catchment: Burn of Gossawater via Burn of Amframires and River Burn<br>Watercourse proximity: >50m from watercourses. Several small drains.<br>Peat Occurrence: 0.5m to 3.0m<br>Peat slide likelihood: Very low to moderate<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |
| T8 spur<br>Track floating | Gradient: Low to steep slope.<br>Catchment: Burn of Gossawater via Burn of Amframires and River Burn<br>Watercourse proximity: >50m from watercourses, except one main watercourse crossing (no.6) and two minor watercourse crossings (no.11 and no.12)<br>Peat Occurrence: 0.5m to 3.0m<br>Peat slide likelihood: Very low to moderate near T8 junction<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low for peat slide risk Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |
| T9 to T6<br>Track floating and excavated | Gradient: Low to steep slope.<br>Catchment: Burn of Gossawater via Burn of Amframires and River Burn<br>Watercourse proximity: >50m from watercourses with the exception of one main watercourse crossings (No.4) and one minor watercourse crossing (no.10). A few small drains. | Low for water quality<br>Low for drainage alteration<br>Low to very high for peat disturbance<br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Track | Description | Magnitude of Impact |
|---|---|---|
| | Peat Occurrence: 0.5m to 3.0m<br>Peat excavated: <0.5 to 2.0m depth<br>Peat slide likelihood: Very low to moderate<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for shallow groundwater disturbance as located on impermeable geology |
| T6 to BPH and T5<br>Track floating | Gradient: Moderate to steep slope.<br>Catchment: Burn of Firth via Burn of Rulesgill<br>Watercourse proximity: >50m from watercourses with the exception of three minor watercourses crossings (no.9, 8 and 7). Several small drains.<br>Peat Occurrence: 0.5m to 3.0m<br>Peat slide likelihood: Very low to moderate<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low for peat slide risk at T5 spur junction (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |
| T5 to T4<br>Track floating | Gradient: Low to steep slope.<br>Catchment: Burn of Firth via Burn of Rulesgill and North Burn of Vigon via Burn of Riggadale<br>Watercourse proximity: >50m from watercourses with the exception of two minor watercourse crossings (no.5 and 4).<br>Peat Occurrence: <0.5m to 3.0m<br>Peat slide likelihood: Very low to moderate<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |
| T5 spur to T3<br>Track floating and excavated | Gradient: Low to steep slope.<br>Catchment: North Burn of Vigon via Burn of Riggadale<br>Watercourse proximity: >50m from watercourses with the exception of one main watercourse crossing (No.3) and one minor watercourse (no.3).<br>Peat Occurrence: 0.5m to 4.0m | Low for water quality<br>Low for drainage alteration<br>Low to medium for peat disturbance |

| Track | Description | Magnitude of Impact |
|---|---|---|
| | Peat slide likelihood: Low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T3 to T2<br><br>Track floating and excavated | Gradient: Moderate to very steep slope.<br><br>Catchment: North Burn of Vigon via Burn of Riggadale and South Burn of Vigon<br><br>Watercourse proximity: >50m from watercourses with the exception of one main watercourse crossing (No.2, South Burn of Vigon).<br><br>Peat Occurrence: <0.5m to 4.0m<br><br>Peat disturbance:<br><br>Peat slide likelihood: Very low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low to High for peat disturbance as track is floating and excavated where deep peat is present<br><br>Low to moderate peat slide risk near T1 junction (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T1 spur<br><br>Excavated | Gradient: Moderate to very steep slope.<br><br>Catchment: North Burn of Vigon via Burn of Riggadale and South Burn of Vigon<br><br>Watercourse proximity: >50m from watercourses. Sub-terrain drains downgradient.<br><br>Peat Occurrence: 0.5m to 3.0m<br><br>Peat excavated: section ranging 0.5m to 2.0m<br><br>Peat slide likelihood: Very low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>High for peat disturbance all excavated and deep peat is present<br><br>Low to moderate for peat slide risk. Mostly moderate risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T2 to T7<br><br>Track floating and excavated | Gradient: Low to very steep slope.<br><br>Catchment: Gossa Water Drinking water protection area via Grud waters and Burn of Rimminanmartha and Burn of Midge Glen, Burn of Blackies and Burn of Wirwick Glen.<br><br>Watercourse proximity: >50m from watercourses with the exception of one main watercourse crossing (no.2, | Low for water quality<br><br>Low for drainage alteration<br><br>Low to Medium for peat<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Track | Description | Magnitude of Impact |
|---|---|---|
| | Burn of Midge Glen) and two minor watercourse crossings (no. 1 and 2).<br>Peat Occurrence: <0.5m to 3.0m<br>Peat excavated: section ranging <0.5 to 1.5m<br>Peat slide likelihood: Very low to low<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for shallow groundwater disturbance as located on impermeable geology |
| T-Junction to T18 spur<br>Track floating | Gradient: Low to very steep slope.<br>Catchment: River Burn<br>Watercourse proximity: >50m from watercourses with the exception of one main watercourse crossing (no.8, River Burn).<br>Peat Occurrence: 0.5m to 3.0m<br>Peat slide likelihood: Very low to low<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |
| Spur T17 to T21<br>Track floating | Gradient: Moderate to steep slope.<br>Catchment: River Burn<br>Watercourse proximity: >50m from watercourses<br>Peat Occurrence: 0.5m to 3.0m<br>Peat slide likelihood: Very low to low<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |
| T17 junction to T22<br>Track floating | Gradient: Moderate to steep slope.<br>Catchment: River Burn and Burn of Firth via Burn of Kedillsmires and Burn of Tongaland<br>Watercourse proximity: >50m from watercourses<br>Peat Occurrence: 0.5m to 3.0m<br>Peat slide likelihood: Very low to moderate | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Track | Description | Magnitude of Impact |
|---|---|---|
| | Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel. | Low for shallow groundwater disturbance as located on impermeable geology |
| Junction to T23<br>Track floating | Gradient: Moderate to steep slope.<br>Catchment: Burn of Firth via Burn of Kedillsmires and Burn of Tongaland<br>Watercourse proximity: >50m from watercourses with the exception of one main watercourse (no.10, Burn of Kedillsmires<br>Peat Occurrence: 0.5m to 3.0m<br>Peat slide likelihood: Very low to moderate<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |
| T23 to 3 way junction<br>Track floating | Gradient: Moderate to steep slope.<br>Catchment: Burn of Firth via Burn of Kedillsmires and Burn of Tongaland<br>Watercourse proximity: >50m from watercourses with the exception of one minor watercourse crossing (no.22)<br>Peat Occurrence: 0.5m to 3.0m<br>Peat slide likelihood: Very low to moderate<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low to moderate for peat slide risk. Moderate near 3 way junction (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance as located on impermeable geology |
| 3 way junction to T24 and existing track<br>Track floating | Gradient: Moderate to very steep slope.<br>Catchment: Burn of Firth via Burn of Kedillsmires and Burn of Tongaland<br>Watercourse proximity: >50m from watercourses with the exception of one minor watercourse crossing (no.24)<br>Peat Occurrence: 0.5m to 5.0m<br>Peat slide likelihood: Very low to moderate<br>Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel | Low for water quality<br>Low for drainage alteration<br>Low for peat disturbance as track is floating<br>Low to moderate for peat slide risk. Moderate at 3 way junction and to east of BPC (Appendix 10.4 PSHRA)<br>Low for shallow groundwater disturbance |

| Track | Description | Magnitude of Impact |
|---|---|---|
| | (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | as located on impermeable geology |
| 3 way junction to T25<br><br>Track floating | Gradient: Moderate to steep slope.<br><br>Catchment: Burn of Firth via Burn of Kedillsmires and Burn of Tongaland<br><br>Watercourse proximity: >50m from watercourses with the exception of one minor watercourse crossing (no.25)<br><br>Peat Occurrence: 0.5m to 3.0m<br><br>Peat slide likelihood: Low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low to moderate for peat slide risk. Moderate at 3 way junction (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T25 to BPE and T26<br><br>Track floating and excavated | Gradient: Moderate to steep slope.<br><br>Catchment: Burn of Firth via Burn of Gilpapund and Burn of Tongaland<br><br>Watercourse proximity: >50m from watercourses with the exception of one main watercourse (no.11, Burn of Gilpapund and one minor watercourse crossing (no.26)<br><br>Peat Occurrence: 0.5m to 3.0m<br><br>Peat excavated: 1.0m to 2.0m depth<br><br>Peat slide likelihood: Low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low to high for peat disturbance as mostly floating. Some excavation of deep peat<br><br>Low to Medium for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T26 to T27<br><br>Track floating | Gradient: Low to moderate slope.<br><br>Catchment: Burn of Firth via Burn of Gilpapund and Burn of Tongaland<br><br>Watercourse proximity: >50m from watercourses with the exception of two main watercourses (no.12 and 13) and one minor watercourse crossing (no.25)<br><br>Peat Occurrence: 0.5m to 3.0m<br><br>Peat slide likelihood: Low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low-moderate for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |

| Track | Description | Magnitude of Impact |
|---|---|---|
| | (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | |
| T27 to T28<br><br>Track floating | Gradient: Low to moderate slope.<br><br>Catchment: Burn of Firth via Burn of Thistledale<br><br>Watercourse proximity: >50m from watercourses<br><br>Peat Occurrence: 0.5m to 3.0m<br><br>Peat slide likelihood: very low to low<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |
| T28 to T29<br><br>Track floating | Gradient: Low to very steep slope.<br><br>Catchment: Burn of Hildigill<br><br>Watercourse proximity: >50m from watercourses with the exception of one main watercourse crossing (no.14, Burn of Hildigill) and one minor watercourse crossing (no.27)<br><br>Peat Occurrence: 0.5m to 3.0m<br><br>Peat slide likelihood: very low to moderate<br><br>Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality<br><br>Low for drainage alteration<br><br>Low for peat disturbance as track is floating<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for shallow groundwater disturbance as located on impermeable geology |

**Watercourse and Drain Crossings**

10.6.16 A total of 41 new watercourse crossings will be constructed on site. Of the 41 new watercourse crossings, 14 of the crossings required are over main watercourses (shown on 1:50,000 scale OS Mapping) and 27 are required over watercourses shown on 1:25,000 scale OS mapping or watercourse that were observed on site and not shown on OS mapping.

10.6.17 Two main watercourse crossings (shown on 1:50,000 OS mapping) are existing and may require replacement crossings as part of the widening of Old Cullivoe Road. This will be determined through the detailed design process post-consent. These are located at NGR HU 51053 99255 and HU 51052 99375.

10.6.18 The watercourse crossing locations are shown on Figures 10.6a to 10.6e Water Features with 1:50,000 scale crossings shown as orange circles and 1:25,000 scale and other watercourse crossing shown as green circles. The watercourse crossings of watercourses shown on 1:50,000scale OS mapping are summarised in Table 10.13.

**Table 10.13 - Main Watercourse Crossings shown on 1:50,000 Scale OS Mapping Summary**

| ID | Watercourse | Location | NGR | Type of Crossing | Description | Magnitude of Impact |
|---|---|---|---|---|---|---|
| 1 | South Burn of Vigon Tributary | New track between T1 and T2 | 448541 1203215 | Single Span or open arch culvert | Small to moderate watercourse in a moderately deep incised valley.<br>Substrate bedrock, gravel and peat. | Low |
| 2 | Burn of Midge Glen | New track T2 to T7 | 448235 1202780 | Single Span or open arch culvert | Moderate watercourse in a moderate to large incised valley.<br>Substrate bedrock, gravel and peat. | Low |
| 3 | Burn of Riggadale | New track T3 to T5 | 449443 1203103 | Open arch culvert | Small watercourse in peat and vegetation substrate, incised into peat<br>Substrate: peat and vegetation | Low |
| 4 | Un-named tributary of Burn of Amframires | New track T6 to T9 | 449628 1202129 | Open arch culvert | Small wide watercourse in peat and vegetation substrate, formed peat hag to south west.<br>Substrate: Peat and vegetation. | Low |
| 5 | Burn of Amframires | New track T9 to T8 junction | 449572 1201656 | Single Span or open arch culvert | Moderate watercourse in wide valley with a wide flood plain. Channel shallow, peat, gravel and cobble substrate. | Low |
| 6 | Un-named tributary of Burn of Amframires from the Fugla Water | New track T9 junction to T8 | 449294 1201567 | Open arch culvert dug out or single span | Small watercourse in peat and vegetation substrate, some evidence of sub-terrain flow – two sinkholes downstream. | Low |
| 7 | Un-named tributary of Burn of Gossa Water | New track T13 to T12/T14 junction | 449545 1200794 | Open arch culvert or culvert | Small watercourse in peat substrate | Low |
| 8 | River Burn | New track T16 to T19 | 450532 1200131 | Single span or open arch culvert | Large watercourse, moderate valley, wide watercourse with cobble and gravel substrate | Low |

| ID | Watercourse | Location | NGR | Type of Crossing | Description | Magnitude of Impact |
|---|---|---|---|---|---|---|
| 9 | River Burn | New track T13 to T17/T18 junction | 450245 1200792 | Single span or open arch culvert | Large watercourse, moderate valley, wide watercourse with cobble and gravel substrate | Low |
| 10 | Burn of Kedillsmires | New track T22 junction to T23 | 450998 1200982 | Single Span or open arch culvert | Moderate watercourse. Steep valley, cobble and gravel substrate | Low |
| 11 | Burn of Gilpapund | New track T25 to T26 | 451812 1201756 | Single Span or open arch culvert | Wide deep channel in peat substrate. Very flashy. | Low |
| 12 | Un-named tributary of Burn of Gilpapund | New track T26 to T27 | 451592 1202105 | Single Span or open arch culvert | Wide shallow upland watercourse, vegetation substrate. Flashy. | Low |
| 13 | Un-named tributary of Burn of Gilpapund | New track T26 to T27 | 451561 1202110 | Single Span or open arch culvert | Wide shallow upland watercourse, vegetation substrate. Flashy. | Low |
| 14 | Burn of Hilidgill | New track T28 to T29 | 450886 1202982 | Single span | Deep valley, rock and gravel substrate | Low |

10.6.19 The watercourse crossings of watercourses shown on 1:25,000 OS mapping or observed onsite to be a watercourse similar to those shown on the 1:25,00scale OS mapping are summarised in Table 10.14.

**Table 10.14 - Minor Watercourse Crossings shown on 1:25,000 Scale OS Mapping or Recorded during the Site Visit Summary**

| Scale | ID | Watercourse | Location | NGR | Type of Crossing | Description | Magnitude of Effect |
|---|---|---|---|---|---|---|---|
| Not on OS map | 1 | Un-named Tributary of Burn of Blackmires | New track between T1 and T2 | 448101 1202451 | Open arch culvert or culvert | Small watercourse in small valley. Bedrock and vegetation substrate. | Low |
| Not on OS map | 2 | Un-named Tributary of Burn of Blackmires | New track between T1 and T2 | 448135 1202547 | Open arch culvert or culvert | Small watercourse in small valley. Bedrock and vegetation substrate. | Low |

| Scale | ID | Watercourse | Location | NGR | Type of Crossing | Description | Magnitude of Effect |
|---|---|---|---|---|---|---|---|
| Not on OS map | 3 | Un-named tributary of North Burn of Vigon | T3 to junction | 449249 1203282 | Open arch culvert or culvert | Moderate valley, vegetation, bedrock and peat substrate. | Low |
| Not on OS map | 4 | Headwaters of Burn of Riggadale | T5 to T4 | 449690 1203008 | Large culvert | Sinuous bog pools to drains, peat and vegetation substrate | Low |
| Not on OS map | 5 | Headwaters of Burn of Riggadale | T5 to T4 | 449687 1202988 | Large culvert | Sinuous bog pools to drains, peat and vegetation substrate | Low |
| Not on OS map | 6 | Tributary of Burn of Rulesgill (same watercourse as minor crossing No.7) | T3 to T6 | 449659 1202784 | Large culvert | Erosional gully in peat substrate. | Low |
| Not on OS map | 7 | Tributary of Burn of Rulesgill (same watercourse as minor crossing No.6) | T5 to T6 | 449715 1202749 | Large culvert | Erosional gully in peat substrate. | Low |
| Not on OS map | 8 | Tributary of Burn of Rulesgill (Diverted, see diversion 1) | T5 to T6 | 449685 1202532 | Large culvert | Erosional gully in peat substrate. | Low |
| Not on OS map | 9 | Tributary of Burn of Rulesgill | T5 to T6 | 449674 1202460 | Large culvert | Erosional gully in peat substrate. | Low |
| Partially shown on 1:25K OS map | 10 | Tributary of Burn of Amfrafires | T6 to T9 | 449627 1202051 | Large culvert | Erosional gully in peat substrate. | Low |

| Scale | ID | Watercourse | Location | NGR | Type of Crossing | Description | Magnitude of Effect |
|---|---|---|---|---|---|---|---|
| Not on OS map | 11 | Tributary of Burn of Amfrafires | T9 to T8 | 449395 1201551 | Large culvert | Small watercourse in peat and vegetation substrate, some evidence of sub-terrain flow nearby | Low |
| Not on OS map | 12 | Tributary of Burn of Amfrafires | T9 to T8 | 449371 1201551 | Large Culvert | Small watercourse in peat and vegetation substrate, some evidence of sub-terrain flow nearby | Low |
| Not on OS map | 13 | Tributary of River Burn | T13 to T15 | 450022 1200623 | Large culvert | Sinuous pools to small watercourse | Low |
| Not on OS map | 14 | Tributary of the Burn of Gossa Water (same as minor watercourse 15) | T13 to T15 | 450134 1200327 | Culvert | Small watercourse, peat and vegetation substrate. | Low |
| Not on OS map | 15 | Tributary of the Burn of Gossa Water (same as minor watercourse 15) | T15 spur | 450132 1200302 | Culvert | Small watercourse, peat and vegetation substrate. | Low |
| Shown on 1:25K map | 16 | Tributary of the Burn of Gossa Water | T15 to T16 | 450234 1200230 | Large culvert | Small watercourse, peat and vegetation substrate | Low |
| Not on OS map | 17 | Tributary of River Burn | Spur to substation / construction compound | 450751 1200116 | Culvert | Small watercourse, peat and vegetation substrate. | Low |

| Scale | ID | Watercourse | Location | NGR | Type of Crossing | Description | Magnitude of Effect |
|---|---|---|---|---|---|---|---|
| Not on OS map | 18 | Tributary of River Burn | T16 to T19 | 451006 1200184 | Culvert | Small watercourse, peat and vegetation substrate. | Low |
| Not on OS map | 19 | Tributary of River Burn | T19 to Borrow pit B | 451132 1200480 | Culvert | Small watercourse, peat and vegetation substrate. | Low |
| Not on OS map | 20 | Tributary of Burn of Kedillsmires | Spur to T20 | 451438 1200204 | Culvert | Small watercourse, peat and vegetation substrate. | Low |
| Not on OS map | 21 | Tributary of Burn of Kedillsmires | T13 to T18 | 451202 1201041 | Culvert | Small watercourse, peat, gravel and vegetation substrate. | Low |
| Not on OS map | 22 | Tributary of Burn of Kedillsmires | T23 to Borrow pit C | 451388 1201094 | Large culvert | Small watercourse, peat and vegetation substrate. Surrounded by deep peat. | Low |
| Not on OS map, 1:50K waterco urse downstr eam | 23 | Tributary of Burn of Kedillsmires | T24 to T25 | 451687 1201275 | Large culvert | Small watercourse, peat and vegetation substrate. Surrounded by deep peat. | Low |
| Not on OS map, 1:50K waterco urse downstr eam | 24 | Tributary of Burn of Kedillsmires | T24 to existing track | 452074 1200728 | Culvert | Small watercourse, peat and vegetation substrate. Surrounded by deep peat. | Low |
| Shown on 1:25K map | 25 | Tributary of Burn of Gilpapund (same as minor | T26 to T27 | 451680 1202079 | Large culvert | Small watercourse, peat, gravel and vegetation substrate. | Low |

| Scale | ID | Watercourse | Location | NGR | Type of Crossing | Description | Magnitude of Effect |
|---|---|---|---|---|---|---|---|
| | | watercourse 26) | | | | Surrounded by deep peat. | |
| Shown on 1:25K map | 26 | Tributary of Burn of Gilpapund (same as minor watercourse 26) | T26 spur | 451751 1202095 | Large culvert | Small watercourse, peat, gravel and vegetation substrate. Surrounded by deep peat. | Low |
| Not on OS map | 27 | Tributary of the Burn of Hildigill | T28 to T29 | 450897 1203154 | Culvert | Small watercourse, peat and vegetation substrate. | Low |

10.6.20 The site is characterised by numerous minor drains, rills and erosional gullies within the peat substrate. The locations of these minor drains are shown on Figure 10.6a to 10.6e Water Features. There are approximately 200 known new crossings of minor man-made drains, natural ephemeral drains and diffuse drainage areas or ephemeral flows crossing the site. These crossings will comprise of culverts or where the drainage area is wide a series of culverts.

10.6.21 A total of 5 watercourse diversions are required around borrow pit areas, construction compound areas and turbine and crane pad areas. One diversion is of a main watercourse (as shown on 1:50,000-scale OS mapping) and four of the diversions are of minor watercourses (not shown on 1:50,000-scale mapping and confirmed onsite as being watercourses). These watercourses are not considered to be of importance for migratory fish where diverted as they are in the upper reaches of the catchment. The locations are presented on Figure 10.6 a to 10.6e Water Features and summarised in the Table 10.15.

**Table 10.15 - Watercourse Diversion Summary**

| Scale | ID | Watercourse | Location | NGR | Description | Magnitude of Effect |
|---|---|---|---|---|---|---|
| 1:50K OS map | 1 | Tributary to the Burn of Rulesgill (same as Minor crossing 8) | Borrow pit H | 449524 1202536 | Headwaters of main watercourse in valley of peat and vegetation. Flows to a flat wetland area downgradient.<br>Divert around borrow pit. | Medium for water quality<br>High for drainage alteration |
| Not on OS map | 2 | Tributary to South Burn of Vigon | Borrow Pit I | 449050 1203589 | Headwaters of small watercourse with vegetation, peat and rock substrate, in valley.<br>Supply feeds wetland downstream. | Medium for water quality<br>Very high for drainage alteration |

| Scale | ID | Watercourse | Location | NGR | Description | Magnitude of Effect |
|---|---|---|---|---|---|---|
| | | | | | Divert around borrow pit or microsite excavation area to avoid. | |
| Not on OS map | 3 | Tributary to the Burn of Rulesgill | Turbine 6 | 449617 1202352 | Small watercourse in peat and vegetation.<br>Divert around crane pad and laydown area or culvert section. | Medium for water quality<br>High for drainage alteration |
| Not on OS map | 4 | Tributary of Burn of Kedillsmires | Borrow Pit B | 451354 1200517 | Small watercourse with vegetation, and peat substrate.<br>Divert around borrow pit or microsite excavation area to avoid. | Medium for water quality<br>Very high for drainage alteration |
| Not on OS map | 5 | Tributary of Burn of Kedillsmires | Borrow Pit B | 451346 1200508 | Small watercourse with vegetation, and peat substrate.<br>Divert around borrow pit or microsite excavation area to avoid. | Medium for water quality<br>Very high for drainage alteration |

10.6.22 All watercourse crossings will consider the migratory requirements of fish and eel, the passage of otter and the adherence to pollution prevention guidelines and current good practice techniques.

10.6.23 The design of the water course crossing will follow good practice guidelines and will be adequately sized to enable them to convey the 1 in 200 year design flow at each point without causing constriction of flow or exacerbation to flood risk elsewhere.

**Other Infrastructure**

10.6.24 The other relevant elements are:

- four construction compounds (1, 2, 3 and substation). These will all be floated and restored after construction;
- one substation which will be partly excavated and partly floated; and
- nine temporary borrow pit search areas (there will be up to 9 borrow pits) which have been assumed to be excavated in their entirety as worst case, and will be restored after construction.

**Table 10.16 - Inventory of other infrastructure and their associated Magnitude of Potential Impact of causing sedimentation, pollution, alteration of natural water flows, excavation of peat, peat slide risk and changes to peat hydrology**

| Infrastructure | Location | Comments | Magnitude of Impact |
|---|---|---|---|
| Construction Compound 1 (C1) | 451380 1198860 | Moderate slope.<br>Catchment: Basta Voe coastal inlet | Low for water quality |

| Infrastructure | Location | Comments | Magnitude of Impact |
|---|---|---|---|
| 100mx100m<br><br>Floating | | Watercourse proximity: None within 50m, located 185m up gradient of Basta Voe coastal water inlet.<br><br>Scottish Water mains water pipeline along A968 road within 10m on opposite side of existing track<br><br>Average peat depth: 0.75m<br><br>Estimated volume of peat excavated or disturbed: 0m3<br><br>Peat Slide Likelihood: Low<br><br>Other Sensitivities: | Low for peat disturbance as mostly no peat to shallow peat and floating<br><br>Low to Medium for drainage alteration<br><br>Low for Scottish Water infrastructure disturbance<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for groundwater disturbance as located on impermeable geology |
| Construction compound 2 (C2)<br><br>50mx50m<br><br>Floating | 451100<br>1201570 | Moderate to low slope.<br><br>Catchment: Burn of Firth.<br><br>Watercourse proximity: >50m from 1:50K scale watercourse. North eastern corner located on large bog pool 25m in length.<br><br>Average peat depth:1.87m<br><br>Estimated volume of peat excavated or disturbed: 0m$^3$ as floating construction<br><br>Peat Condition: Two tension cracks to south east.<br><br>Peat slide Likelihood: Low<br><br>Other Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality.<br><br>High for drainage alteration<br><br>Low for peat disturbance as construction compound will be a floating construction on deep peat.<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for groundwater disturbance as located on impermeable geology |
| Construction compound 3 (C3)<br><br>50mx50m<br><br>Floating | 449590<br>1202900 | Moderate to steep slope.<br><br>Catchment: North Burn of Vigon via Burn of Riggadale and Burn of Rulesgill<br><br>Watercourse proximity: >50m from 1:50K scale watercourse. Located on four small bog pools and two small drains.<br><br>Average peat depth: 1.22m<br><br>Estimated volume of peat excavated or disturbed: 0m3 as floating construction<br><br>Peat slide Likelihood: Low<br><br>Other Sensitivities: | Medium for water quality.<br><br>Medium for drainage alteration, loss of small bog pools.<br><br>Low for peat disturbance as construction compound will be a floating construction on deep peat.<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Infrastructure | Location | Comments | Magnitude of Impact |
|---|---|---|---|
| | | Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for groundwater disturbance as located on impermeable geology |
| Substation Construction compound 4 (C4)<br>50mx60m<br>Floating | 450820 1200070 | Moderate slope.<br>Catchment: Burn of Gossawater<br>Watercourse proximity: >50m from 1:50K scale watercourse. North eastern corner located on drain which becomes a watercourse downgradient.<br>Average peat depth: 1.29m<br>Estimated volume of peat excavated or disturbed: 0m$^3$ as floating construction<br>Peat slide Likelihood: Low<br>Other Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality.<br>Medium for drainage alteration<br>Low for peat disturbance as construction compound will be a floating construction on deep peat.<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for groundwater disturbance as located on impermeable geology |
| Substation<br>60m x 100m<br>Floated and excavated | 450750 1200060 | Moderate to low slope.<br>Catchment: Burn of Gossawater.<br>Watercourse proximity: >50m from 1:50K scale watercourse.<br>Average peat depth:1.16m where excavated, 0.97m where floated.<br>Estimated volume of peat excavated: 4,370m3<br>Peat slide Likelihood: Low<br>Other Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for water quality.<br>Low for drainage alteration<br>High for peat disturbance as on deep peat in excavated area<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for groundwater disturbance as located on impermeable geology |
| Borrow pit A (BPA)<br>Approximately rectangular 100m x 240m<br>24,926m$^2$ | 451270 1199010 | Moderate to steep slope.<br>Catchment: Burn of Gossawater and Basta Voe coastal inlet<br>Watercourse proximity: None within 50m, located 185m up gradient of Basta Voe coastal water inlet and the Burn of Gossa | Low for water quality<br>Low to medium for drainage alteration |

| Infrastructure | Location | Comments | Magnitude of Impact |
|---|---|---|---|
| | | water mouth. Located on a few small drains.<br><br>Scottish Water mains water pipeline along A968 road within 10m on opposite side of existing track<br><br>Average peat depth: 0.60m<br><br>Estimated volume of peat excavated or disturbed: 11,208m3<br><br>Peat Slide Likelihood: Low<br><br>Other Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for peat disturbance as mostly no peat to shallow peat<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for groundwater disturbance as located on impermeable geology |
| Borrow pit B (BPB)<br><br>Irregular<br><br>14,618m$^2$ | 451270<br>1200530 | Low slope.<br><br>Catchment: Burn of Firth via Burn of Kedillsmires and Burn of Tongafield.<br><br>Watercourse proximity: >50m from 1:50K scale watercourse. Located on two minor watercourses that enter the Burn of Kedillmires – require diverting.<br><br>Average peat depth: 1.05m<br><br>Estimated volume of peat excavated or disturbed: 15,268m3<br><br>Peat slide Likelihood: Low<br><br>Other Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality.<br><br>High for drainage alteration, unless microsite to avoid watercourses<br><br>Medium for peat disturbance<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for groundwater disturbance as located on impermeable geology |
| Borrow pit C (BPC)<br><br>Irregular<br><br>13,184m$^2$ | 451550<br>1201100 | Very steep slope.<br><br>Catchment: Burn of Firth via Burn of Kedillsmires and Burn of Tongafield.<br><br>Watercourse proximity: >50m from 1:50K scale watercourse, approx. 180m to north. Watercourse not shown on OS mapping approx. 70m downgradient. Located on one minor drain.<br><br>Average peat depth: 1.10m | Medium for water quality.<br><br>Low for drainage alteration<br><br>Very high for peat disturbance as borrow pit on shallow to very deep<br><br>Low to Medium for peat slide risk (Burn of Kedillsmires) (Appendix 10.4 PSHRA) |

| Infrastructure | Location | Comments | Magnitude of Impact |
|---|---|---|---|
| | | Estimated volume of peat excavated or disturbed: 16,011m3<br><br>Peat slide Likelihood: Low to Moderate. North eastern corner is located in moderate peat slide risk area<br><br>Other Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for groundwater disturbance as located on impermeable geology |
| Borrow pit D (BPD)<br><br>Irregular<br><br>6,734m$^2$ | 451230<br>1200930 | Moderate to low slope.<br><br>Catchment: Burn of Firth via Burn of Kedillsmires and Burn of Tongafield.<br><br>Watercourse proximity: >50m from 1:50K scale watercourse. Located in valley, 25m upgradient of minor watercourse to the north that flows into Burn of Kedillsmires. Located on three small drains and numerous bogs pool in the south, part of a summit bog pool complex.<br><br>Average peat depth: 1.14m<br><br>Estimated volume of peat excavated or disturbed: 7,617m3<br><br>Peat slide Likelihood: Low<br><br>Other Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality.<br><br>Medium to High for drainage alteration<br><br>High for peat disturbance as borrow pit mostly on shallow peat with valley of deep peat.<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for groundwater disturbance as located on impermeable geology |
| Borrow pit E (BPE)<br><br>Irregular<br><br>38,648m$^2$ | 451400<br>1201660 | Very steep slope.<br><br>Catchment: Burn of Firth via Burn of Kedillsmires and Burn of Tongafield.<br><br>Watercourse proximity: >50m from 1:50K scale watercourse, 52m to Burn of Gilpapund to the north and 65m to Burn of Tongafield to the west. Located on five small drains and a man-made drain.<br><br>Average peat depth:1.07m<br><br>Estimated volume of peat excavated or disturbed: 40,027m3<br><br>Peat slide Likelihood: Low | Medium for water quality.<br><br>Medium for drainage alteration<br><br>High for peat disturbance as borrow pit on no peat to deep peat.<br><br>Low for peat slide risk (Appendix 10.4 PSHRA) |

| Infrastructure | Location | Comments | Magnitude of Impact |
|---|---|---|---|
| | | Other Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Low for groundwater disturbance as located on impermeable geology |
| Borrow pit F (BPF)<br>Irregular<br>28,831m$^2$ | 449700<br>1201090 | Moderate slope.<br>Catchment: Burn of Gossa Water via River Burn.<br>Watercourse proximity: >50m from 1:50K scale watercourse. Located on four small drains and several small bog pools in the west, on edge of bog summit complex. Large bog pools in south west.<br>Average peat depth:1.64m<br>Estimated volume of peat excavated or disturbed: 47,207m$^3$<br>Peat slide Likelihood: Low<br>Other Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality.<br>High for drainage alteration<br>High for peat disturbance as borrow pit mostly on deep peat.<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for groundwater disturbance as located on impermeable geology |
| Borrow pit G (BPG)<br>Irregular<br>4,160m$^2$ | 450960<br>1203190 | Low slope.<br>Catchment: Burn of Hildigill.<br>Watercourse proximity: >50m from 1:50K scale watercourse, approx. 60m to east and 105m to south. Located on six small bog pools and two small drains.<br>Average peat depth:1.03m<br>Estimated volume of peat excavated or disturbed: 4,180m$^3$<br>Peat slide Likelihood: Low<br>Other Sensitivities:<br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality.<br>Medium for drainage alteration<br>High for peat disturbance as borrow pit on no peat to deep peat.<br>Low for peat slide risk (Appendix 10.4 PSHRA)<br>Low for groundwater disturbance as located on impermeable geology |
| Borrow pit H (BPH) | 449600<br>1202580 | Low slope. | Medium for water quality. |

| Infrastructure | Location | Comments | Magnitude of Impact |
|---|---|---|---|
| Approximately rectangular 130m x 185m<br><br>24,629m$^2$ | | Catchment: Burn of Gossa Water via River Burn and Burn of Firth via Burn of Rulesgill.<br><br>Watercourse proximity: >50m from 1:50K scale watercourse, approx. 130m to east. Located on one watercourse and small drain not shown on OS mapping that will require diverting. Located on six small bog pools and three larger ones up to 25m in length.<br><br>Average peat depth:1.42m<br><br>Estimated volume of peat excavated or disturbed: 34,827m$^3$<br><br>Peat Condition: Located on tension cracks/scarp. Sinkhole downgradient.<br><br>Peat slide Likelihood: Low<br><br>Other Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | High for drainage alteration.<br><br>Very high for peat disturbance as borrow pit on shallow to very deep peat.<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for groundwater disturbance as located on impermeable geology |
| Borrow pit I (BPI)<br><br>Irregular<br><br>36,252m$^2$ | 448920<br>1203620 | Very steep slope.<br><br>Catchment: South Burn of Vigon.<br><br>Watercourse proximity: Located on 1:50K scale watercourse that flows north into a wetland. Located on one small man-made drain.<br><br>Average peat depth:0.80m<br><br>Estimated volume of peat excavated or disturbed: 26,848m$^3$<br><br>Peat Condition: sink holes and underground drainage to east and west. Scarp/tension cracks to southeast.<br><br>Peat slide Likelihood: Low<br><br>Other Sensitivities:<br><br>Lower reaches of watercourses in catchment potentially support salmonids, brown trout and European eel (section 7.5, 7.6 & 7.7, Chapter 7 Ecology and Nature Conservation). | Medium for water quality<br><br>Very high for drainage alteration<br><br>Very high for peat disturbance as borrow pit on no peat to very deep peat in watercourse valley.<br><br>Low for peat slide risk (Appendix 10.4 PSHRA)<br><br>Low for groundwater disturbance as located on impermeable geology |

### *Assessment of Construction Effects*

10.6.25 Following the methodology in Table 10.3 to 10.5, the significance of effect has been determined by considering the magnitude of predicted impact (determined in Tables 10.11 to 10.16) and the sensitivity of the receptor (Table 10.10).

**Erosion / Sedimentation**

10.6.26 One general potential impact of construction of site facilities, turbines and tracks, watercourse crossings, dewatering of turbine foundations and passive road drainage, is disturbance to soils and a consequent rise in the sediment loads observed in rivers and streams. Potential impacts may occur from the following:

- construction of up to 21km of new track of which 1.75km will be excavated with 19.325km floating. The excavated track will involve stripping and stockpiling of material to expose underlying soils or bedrock, potentially increasing runoff and the potential for transportation of sediment;
- new or upgraded watercourse crossings and watercourse and rainfall runoff diversion increasing the potential for increased runoff of silt and debris;
- removal and stockpiling of material for each turbine foundation base and crane hardstanding, which could result in increased silt run-off;
- dewatering of shallow groundwater and direct rainfall into excavations (potentially containing silt and other debris), which may result in transportation of fine sediments into watercourses. This would be compounded by increased movement over and around these disturbed environments;
- extreme rainfall events which could result in the overflowing of existing on-site drainage and resulting erosion and sediment transport, as well as the potential failure of pollution prevention measures to operate under high runoff flow conditions;
- vehicle movements around the site transporting silt off site;
- peat slide and bog burst; and,
- peat storage and reuse.

<u>Effect Assessment</u>

10.6.27 The potential effects that occur from erosion and sedimentation during the construction period have the potential to cause or have an impact on the water quality, natural drainage pattern, peat disturbance and peat slide.

*Water Quality*

10.6.28 Infrastructure within the site has been located, in so far as possible, over 50m from main watercourses, with the exception of where tracks approach watercourse crossings and some minor sections of track or infrastructure.

10.6.29 The sensitivity of the Gossa Water lochan catchment is very high as it is a drinking water protection area and Scottish Water have an abstraction from the Gossa Water lochan for the Yell public water supply. There are 3 turbines and a section of associated track within this catchment and activities will at worst case occur throughout the duration of the construction phase with any effects likely to be of relatively short duration. Therefore, the significance of effect is Minor/Moderate to **Moderate**.

10.6.30 The sensitivity of the Burn of Gossawater, the Burn of Firth and North Burn of Vigon catchments is high due to the presence of Brown Trout, salmonids and European eel and that the Burn of Gossawater drains to the Fetlar to Haroldswick MPA. The magnitude of potential impacts on water quality due to sedimentation and erosion during construction are low for the majority of the site

and medium in specific areas where watercourses require diverting, there are a larger number of drains on steep slopes, borrow pits where there is ephemeral drainage and areas where minor drainage can potentially connect directly to watercourses. Therefore, the significance of effect will be at most Minor to **Moderate**.

*Drainage Alteration*

10.6.31 Design parameters for watercourse crossings will be developed in consultation with SEPA following detailed engineering assessment, and will be provided in either the Construction Method Statement (CMS), or any required application for CAR licencing.

10.6.32 On the basis that any watercourse crossings will be of small to medium size, the magnitude of potential impact, and potential impacts of stream crossing design in causing erosion and sedimentation, using good practice techniques, is assessed as Low. All watercourse crossings are at medium to high sensitivity locations, so the effect significance is at most Minor.

10.6.33 Trenches (~1m in depth) will be dug for the laying of electrical cables linking the turbines to the site substation. Where trenches are constructed on slopes the flow of water could lead to the erosion of soils. The removal of material and stockpiling could also lead to sedimentation of the local watercourses which have a Low to High sensitivity. However, standard cabling practice includes the rapid excavation and re-instatement of cables, thus there will be minimal exposed trench to allow for water flow causing erosion or sedimentation. Based on use of good practice cable installation, the magnitude of any potential impact of sediments due to erosion is assessed as a maximum of Low so the effect significance is at most Minor or Minor/Moderate within the Gossa water lochan catchment.

10.6.34 Water management will be by the use of diversion ditches around the structures to prevent water entry into open foundation bases. However, some dewatering is still likely to be required. Dewatering fluids will be directed into surface silt traps and discharged via settlement ponds and other sediment control structures onto surrounding vegetation to reduce the effect of dewatering and to avoid the sedimentation of low to very high sensitivity watercourses. The magnitude of any potential impact of disposal of dewatering fluids is assessed as Low, thus the significance of these effects is at most Minor or Minor/Moderate within the Gossa Water catchment.

10.6.35 As vehicles on site may be travelling over newly constructed roads or areas of exposed sediment, they may transport mud and silt away from site and onto public roads, where it may be washed into low to high sensitivity watercourses. However, experience has shown that the majority of such mud is shaken off the wheels before the vehicle reaches the public road, although if necessary, wheel washes should be used. The magnitude of any potential impact of vehicles transporting sediment is Negligible to Low, thus the significance of these effects will be at most Minor or Minor/Moderate with in the Gossa Water catchment.

*Peat Disturbance*

10.6.36 Infrastructure within the site has been located to try to avoid the deepest peat where possible taking into account other constraints.

10.6.37 The potential erosion of peat can increase the potential for further peat disturbance by washing away peat deposits or exposing peat deposits to drying out or oxidising. The magnitude of sediment disturbance by erosion is at most Minor to **Moderate**.

*Peat Slide*

10.6.38 Infrastructure has been located as far as possible to avoid areas of peat slide or bog burst likelihood and peat slide risk taking into account other constraints. The risk of peat slide can be increased by erosion removing the top vegetative layer or acrotelm that has higher tensile strength, increasing the amount of water passing over or through the catotelmic layer of peat, increasing the wetting and drying of peat and production of cracks. The magnitude of sediment disturbance by erosion is at most Minor to **Moderate**.

10.6.39 In summary, and based on the effect significance criteria developed in regard to hydrology for the potential effects on geology, surface water and groundwater, the likely effect significance from

erosion and sedimentation, using good practice techniques, is mostly assessed as **Low to Moderate.** Moderate impacts are generally in areas where the distance to the watercourses are less than 50m, watercourses require diverting or where there are numerous small drains and erosional gullies on steep slopes joining to watercourses downgradient.

**Pollution**

10.6.40 Pollution of watercourses could potentially occur through the following pathways:

- Oil and chemical spills from:
  - Oil leakages during vehicle movements or when on standby;
  - Refuelling areas such as the compound; and/or
  - Chemical/fuel storage areas.
- Leakage of cement powder or liquid concrete during pouring. Concrete is highly alkali (high pH) and changes in the pH balance could affect the water quality and the species that depend on baseline conditions.
- Improper management of on-site waste.
- Poor sanitary plumbing.
- Poor water storage.
- Sedimentation and erosion (as previously discussed)

10.6.41 There will be no oil filled cables running across the site.

Effect Assessment

10.6.42 The potential effects that occur from erosion and sedimentation have the potential to cause or have an impact on water quality.

*Water Quality*

10.6.43 Even taking into account the application of good practice (Appendix 10.1), appropriate cement pouring and waste storage there is still a small risk of potential fuel, cement or waste spillage on site due to the number of vehicles, turbine foundations and potential leaks or accidents. The magnitude of impact of a fuel/oil, cement or chemical spillage and of contamination due to sanitary plumbing is Low.

10.6.44 However, the sensitivity of on-site receptors is assessed as being Low to High for watercourses with the exception of the Gossa Water catchment which is classified as Very High sensitivity. Therefore, the likely effect on surface water from pollution is mostly assessed as **Minor** significance and no additional mitigation above good practice methods are likely to be required. However, the significance of effect on areas within Gossa Water lochan catchment are **Moderate** and additional mitigation is required (Section 10.7).

**Alteration to Natural Drainage Patterns/ Runoff Volumes and Rates**

10.6.45 The development of tracks and cable trenches has the potential to alter natural drainage on the site by the development of preferential flow pathways. If constructed against the topographic gradient, roads could act as barriers to run-off resulting in the ponding of water. If constructed in line with the gradient, the development of preferential flow down the roadway could occur.

10.6.46 Excavated infrastructures, such as turbine foundations, crane pad areas and borrow pits have the potential to alter natural drainage patterns on site and runoff volume and rates by intercepting watercourses, drains or by the removal or drainage of bog pools. Five watercourse diversions are required for the Proposed Development: one main watercourse diversion at BPI and four minor watercourse diversions.

10.6.47 Where watercourses or drains are diverted they could alter water dependent habitat conditions and the removal or draining of bog pools could remove or significantly alter valuable habitat and reduce the capacity of surface water attenuation within the catchment.

10.6.48 Groundwater levels in peat could potentially be reduced in the immediate vicinity of site infrastructure. With regard to turbine bases and cable trenches this water level reduction will be temporary during excavation and concrete pouring/ cable installation. With respect to excavated tracks the effects will be permanent as a seepage face will develop at the peat – track interface.

Effect Assessment

10.6.49 The potential effects that occur from the alteration to natural drainage patterns, runoff volumes and rates have the potential to cause or have an impact on the water quality, natural drainage and peat slide.

*Water Quality*

10.6.50 The water quality aspects related to the alteration of natural drainage are those related to sediment release and erosion and are discussed above so are not duplicated here.

*Natural Drainage*

10.6.51 The most significant effects that are likely to occur on natural drainage are mainly from the larger areas of land disturbance associated with the Proposed Development infrastructure such as borrow pits, construction compounds and some crane hardstandings.

10.6.52 Where floating track crosses watercourses or drains these locations will be watercourse crossings to allow the continuation of the watercourse's natural runoff (section 10.6, Table 10.13 and Table 10.14 and therefore the effect is of **Minor** significance. Main watercourse crossings with the Gossa Water catchment have been avoided by design.

10.6.53 Five diversions of watercourses are required for the Proposed Development: one main 1:50,000-scale Ordnance survey watercourse (high sensitivity) at BPI; Two 1:25,000-scale Ordnance Survey watercourses (medium sensitivity) at BPB; One minor 1:25,000-scale Ordnance Survey watercourse headwater (medium sensitivity) at BPH and one minor 1:25,000-scale Ordnance Survey watercourse at T6. The diversion at BPI has a very high potential magnitude of impact being a main watercourse feeding a wetland downgradient and therefore the significance of effect is **Major**. The diversions at BPB also have a high magnitude of impact and therefore the significance of effect is also **Major**. The remaining diversions are of smaller watercourses into less sensitive water features and therefore the impact is of Medium magnitude and significance of effect **Moderate.** Three of the five diversion are therefore of **Major** significance and the other two are **Moderate.**

10.6.54 Several sections of the site infrastructure are located where there is a higher frequency of minor drains and steeper slopes. In locations where several minor drains are required to be crossed or diverted, the magnitude of impact is considered to be Medium and therefore the significance of effect is **Moderate**. Where there are few minor drains and slower natural runoff, the impact magnitude of altering or crossing these is low and therefore the effect significance is **Minor**.

10.6.55 The runoff rates on site are relatively fast based on the presence of low permeability bedrock and superficial deposits, and steep slopes. The inclusion of semi-permeable hardstanding (<5% of each catchment) and impermeable turbine foundations (<1.2% of each catchment) is unlikely to significant increase runoff rates and therefore the effects of runoff increase is considered to be of **Minor** significance.

10.6.56 The majority of the Proposed Development infrastructure avoids waterbodies and bog pool complexes where possible and therefore for the majority of the infrastructure the significance of drainage alteration by intercepting waterbodies or bog pool complexes is **Minor**. Where small isolated bog pools are altered or excavated for the infrastructure, the significance of effect is considered to be **Moderate**. Five locations of infrastructure (T4, C2, BPD, BPF and BPH) are located on or partially located on large bog pools or sections of a bog pool complex based on the review of aerial imagery and observations on site. Where infrastructure requiring excavation work is located

on large bog pools or areas of bog pool complexes the magnitude of impact is considered to be high on highly sensitive features and therefore the significance of effect is **Major.**

*Peat Slide*

10.6.57 Infrastructure has been located as far as possible to avoid areas of peat slide or bog burst likelihood and peat slide risk taking into account other constraints. The risk of peat slide can be increased by the alteration of natural drainage as this can remove the top vegetative layer or acrotelm that has higher tensile strength, increasing the amount of water passing over or through the catotelmic layer of peat, increasing the wetting and drying of peat and production of cracks. New drains can also introduce additional water to slopes or dewater them which can lead to changes in the geotechnical properties of the peat and therefore the potential for peat slides. The magnitude of peat disturbance by drainage alteration is at most **Minor** to **Moderate**.

10.6.58 In summary, and based on the effect significance criteria developed in regard to hydrology for the potential effects on geology, surface water and groundwater, the likely effect from alteration of natural drainage patterns, runoff volumes and rates, prior to mitigation and management, is assessed as Minor to Major. The majority of sections are **Minor** with the exception of the alteration of Oligiotrophic and Dystrophic bog pools which are **Moderate to Major,** the diversion of a main watercourse at BPI and a watercourse at BPB which are **Major**, the diversion of watercourses which are **Moderate** and the alteration or diversion of sections of several minor drains on steep slopes which is **Moderate** significance.

**Watercourse Crossings**

10.6.59 Good practice with regard to avoiding or minimising stream crossings has been adopted, this is reflected in the reduction in the number of locations where access tracks cross watercourses and re-uses locations already used as crossing points as discussed in Chapter 3: Project Description. As well as construction, these watercourse crossings may require ongoing maintenance to ensure they do not become blocked and prevent the passage of fish, eel or otters as well as posing a flood risk.

10.6.60 In Scotland, works in, over or under a watercourse or works altering or repairing any structure in, over or under a watercourse must be authorised by SEPA through the Controlled Activities Regulations. SEPA will be notified of all of these works and the appropriate GBR, authorisations or licences will be applied for. It is likely for the site that a complex licence will need to be applied for.

Effect Assessment

10.6.61 A total of 14 watercourse crossings will be of main watercourses shown on 1:50,000 scale Ordnance Survey mapping or directly linked to a watercourse shown on 1:50,000 scale Ordnance Survey mapping. The remaining 27 new watercourse crossings will be minor or small crossings shown on 1:25,000 scale OS mapping or deemed to be similar to those shown on 1:25,000 scale OS mapping based on site observations.

10.6.62 Approximately 200 culvert crossings of small man-made or natural drainage gullies, diffuse drainage and ephemeral runoff within peat or vegetation substrate have been identified. These are of low sensitivity not supporting fish or eel and have been further assessed within Appendix 3.1 Drainage Management Strategy.

10.6.63 All the watercourse crossings will be designed to allow fish and eel passage maintaining the natural substrate and will be installed with suitable mammal passage.

10.6.64 On the basis that the majority of crossing work will be on watercourses (of Low to High sensitivity), and will require authorisation by SEPA, the magnitude of potential impacts of stream crossing design in impeding water flows are assessed as Low due to the requirement for suitable design. The effect significance before mitigation is therefore assessed as **Minor** for the minor crossings. The 14 main watercourse crossings will require more detailed assessment to determine an appropriate design to avoid disturbing the peat substrate, disturbing active erosional zones, reducing the flow channel, flood plain volume and to minimize works within the watercourse. These will also require authorisation by SEPA. With appropriate good practice design the magnitude of impeding flows or sediment entering the watercourse is Low.

**Increase in the Magnitude of Frequency of Flood Events**

10.6.65 The site has minimal flood risk areas based on SEPA flood mapping. There are some localised areas of surface water flooding mostly near waterbodies and some localised risk of fluvial flood directly adjacent to the watercourses on site. The proportion of land take for each catchment is minimal and therefore will not increase runoff rates significantly.

Effect assessment

10.6.66 The potential effects that occur from an increase in the magnitude of frequency of flood events have the potential to cause or have an impact on the water quality, natural drainage pattern, peat disturbance; and peat slide.

10.6.67 The track network and turbine layout has been designed to avoid, as far as is practicable, areas that have been identified as at risk of flooding as shown on SEPA flood mapping and based on site observations. The flood risk onsite and downstream of the site is considered to be of low risk and no sensitive receptors were identified downstream, although there would be the potential for impact on the high sensitivity watercourses or peat, therefore, the significance of effect for flooding is **Minor**.

10.6.68 Flood risk assessment for at least the 14 main watercourse crossings will be required for appropriate design and will be undertaken post-consent.

**Alteration of the Geological Environment**

10.6.69 The construction of the Proposed Development will involve the excavation of soils, peat, drift deposits and bedrock in varying amounts. Of these, peat is designated when it forms blanket bog habitat (see Chapter 7: Ecology) and is also protected due to its ability to store carbon (See Chapter 3: Project description and Chapter 16). The sensitivity of peatland to disturbance is low to very high depending on the condition, activity and land use practices of the peatland. On the site it is mostly in an undisturbed, natural condition and it is therefore assigned a sensitivity of **Very High**.

Effect assessment

10.6.70 The potential effects that occur from alteration of the geological environment have the potential to cause or have an impact on the water quality, natural drainage pattern, peat disturbance and peat slide.

10.6.71 Over the whole of the site conservative estimates for the volume of peat that will be excavated (including footprints and a wider distance for slope batters) are:

- Total volume of peat which will be excavated = ~394,200m$^3$.
- Total volume of acrotelm which will be excavated = ~52,500m$^3$.
- Total volume of catotelm which will be excavated = 341,700m$^3$.

10.6.72 Generally, across the site where peat is present, tracks and construction compounds will be floated, where possible, and these areas would have a low magnitude of impact. Where there is a requirement for excavation of infrastructure (tracks, crane hardstandings, borrow pits, substation and met mast) and peat is present the magnitude of impact would be medium for peat depth 0.5m to 1.0m, high for deep peat (1.0m to 2.0m) and very high for very deep peat (>2.0m) as a larger volume of peat would be disturbed and in accordance with guidance.

10.6.73 The deepest average area of peat to be extracted for the infrastructure is 1.98m at T27, 2.09m at the crane hardstanding of T18, 1.64m for BPG and 1.16m for excavated track. Further information on the peat survey and peat volume assessment is presented in Appendix 10.2 Peat Survey Report and 10.3 Outline Peat Management and Restoration Plan.

10.6.74 Therefore, the significance of effect prior to mitigation and management, is assessed as **Minor to Major**. Minor for infrastructure not located on peat, moderate for floating infrastructure and major for excavated infrastructure on deep peat.

10.6.75 The magnitude of potential impacts due to peat slide risk are low to moderate as these could affect nearby watercourses through a surge in sedimentation. Therefore, the effect of potential peat slide on watercourses will be **Minor to Moderate** significance depending on the section of infrastructure (the Gossa Water DWPA catchment being the most sensitive to peat potentially entering the watercourse and the raw water pipeline being sensitive to disturbance).

**Summary of Significance of Effect during Construction Phase**

10.6.76 Based on the effect significance criteria developed in regard to hydrology, hydrogeology and geology for the potential effects on surface water, groundwater and the geological environment, the likely effect from the various potential impacts, using good practice techniques, is assessed as **Negligible to Major.** The majority of the infrastructure is assessed as **low**. The infrastructure that will result in an overall significance of **Moderate or Major** for erosion/sedimentation of watercourses, for alteration of natural drainage patterns, runoff volumes and rates, and alteration of the geological environment will require additional mitigation.

10.6.77 The following infrastructure elements will require additional mitigation as they have been evaluated to have a potential Major or Moderate significance of effect. These are considered in combination with the other elements that also have a significant impact either on a catchment basis, the whole of the site, or the particular sensitive receptor as appropriate. It is considered that elements with significance of effect of minor or less do not combine to produce a higher level of effect:

10.6.78 Where significance is **Major:**

- Drainage Alteration
  - Turbines and associated crane hardstandings: T4 due to the loss of bog pools; and
  - Other Infrastructure: C2, BPD and BPF for loss of bog pools, BPB and BPI for watercourse diversion and BPH for both loss of bog pools and watercourse diversion.
  - All bog pools are considered individually for impact rather than a number across the whole of the site which would be in the thousands. The watercourse diversions are in the south Burn of Vignon (BPI), two subcatchments of the Burn of Firth; the Burn of Rulesgill (BPH) and the Brun of Kedillsmires (BPB) and therefore the effects are not considered to increase in combination. These are permanent effects, however it is considered that the watercourse diversion habitat will reach a new equilibrium over time and if correctly designed will allow a similar habitat to develop.
- Peat Disturbance
  - Turbines and associated crane hardstandings: T1 (turbine base only), T5 (crane hardstanding only), T6, T7, T9, T11, T12, T13 (crane hardstanding only), T14, T15 (crane hardstanding only), T16, T17 (turbine base only), T18, T19, T20, T22 (crane hardstanding only), T23, T24, T25, T26, T27 and T29 as located on deep or very deep peat;
  - Track sections: T1 to spur, T2 to T7, T9 to T6, and T25 to BP3 and T26 as excavated section on deep peat;
  - Other infrastructure: BPB, BPC, BPD, BPE, BPF, BPG, BPH and substation as located on deep or very deep peat.
  - Overall the area of the Proposed Development that is considered to be of Major impact (excavated infrastructure located on peat >1m depth) is 187,286m$^2$ (38.8%) of the total infrastructure footprint of 483,209m$^2$. This is a permanent effect, however once the peat is reused for restoration or reinstatement the effects will decrease as the overall resource will not be lost.

10.6.79 Where significance is **Moderate**.

- Water Quality
  - Turbines: T5, T22 and T26 in the Burn of Firth catchment, T6 in the Burn of Gossawater catchment and T7, T10 and T12 in the Gossa Water drinking water catchment as they are located on or near watercourses and minor drains on steep slopes;
  - Track sections: T12 to T10 in the Gossa Water drinking water catchment as located on or near minor drains on steep slopes;
  - Other infrastructure: C3, BPC, BPD, BPE and BPH in the Burn of Firth catchment and C4 and BPF in the Burn of Gossawater catchment.
  - Although there are catchments such as the Burn of Firth catchment (three turbines, four borrow pits and a construction compound) where the concentration of infrastructure, that may potentially result in a moderate effect, is higher the overall effect on each of these catchments is still considered to be Moderate. These effects are likely to be limited to the duration of the construction period and potentially the initial part of the operation period as aspects such as the drains become vegetated and established.
- Drainage Alteration
  - Turbines: T3, T4, T5, T21, T27 and T29 due to bog pools, T6 due to watercourse diversion, T22, T23, T26 and T28 for both loss of bog pools and watercourse/drain diversion and T10 and T12 for drain diversions within the Gossa Water DWPA;
  - Other Infrastructure: C4 and BPE for drain diversion/loss and C3 and BPG for loss of bog pools.
  - All bog pools are considered individually for impact rather than a number across the whole of the site which would be in the thousands. The watercourse diversions are a minor unnamed tributary of the Burn of Amrfamires (T6), minor drains within the Gossa Water drinking water catchment (T10 and (T12), minor drains within the Burn of Firth catchment (T22, T23, T26 and BPE), minor drains within the Burn of Hildigil (T28) and a minor drain within the Burn of Gossawater catchment, therefore the effects are not considered to increase in combination. These are permanent effects, however it is considered that the watercourse diversion habitat will reach a new equilibrium over time and if correctly designed will allow a similar habitat to develop.
- Peat Slide
  - Turbines: T14, T15 and T18, within the Burn of Gossawater catchment, as located in moderate peat slide risk areas (T14 and T15 upgradient of raw water supply piping);
  - Track sections: T1 junction (South Burn of Vignon), T13 junction and T15 spur (Burn of Gossawater) and 3-way junction to T23, T24 and T25 (Burn of Firth) as located in moderate peat slide risk areas;
  - Other Infrastructure: BPC (Burn of Firth) north eastern corner is located in moderate peat slide risk area.
  - The Moderate risk locations are primarily associated with potential impacts on wind farm infrastructure, the raw drinking water supply pipeline and minor watercourses.
  - These effects are not considered to increase above moderate in any of these catchments due to the small, localised nature and spatial distribution of these Moderate areas being located within different sub-catchments.

- Peat Disturbance
  - Turbines: T1 (crane hardstanding only), T2, T3, T5 (turbine base only), T8, T10, T13 (turbine base only), T15 (turbine base only), T17(crane hardstanding only), T21, T22 (turbine base only) and T28 (crane hardstanding only) as located on peat and excavated.
  - Other infrastructure: BPI and excavated part of substation as located on peat.
  - Overall the area of the Proposed Development that is considered to be of Moderate impact (excavated infrastructure located on peat 0.5m to 1m depth) is 100,443m$^2$ (20.8%) of the total infrastructure footprint of 483,209m$^2$. This is a permanent effect, however once the peat is reused for restoration or reinstatement the effects will decrease as the overall resource will not be lost.

### *Operation*

**Erosion / Sedimentation**

10.6.80 During the operation and maintenance of the Proposed Development the water environment will be subject to fewer potential adverse effects than during the construction phase. Access tracks will be complete and no regular substantial works on the site will be expected during the life of the facility other than periodic monitoring and maintenance. The potential for any additional sedimentation is low, therefore the likely effect from erosion and sediment transport, prior to mitigation and management, is considered to be Low on all receptors, thus the overall significance is **Minor.**

**Pollution**

10.6.81 A number of possible operational effects on the water environment have been identified including the potential for spillage of oil and fuels from vehicles used for accessing and traversing across the site. However, vehicle use will be minimal and the likely effects from pollution, on all receptors, prior to mitigation and management, are assessed to be Low, therefore the overall significance is **Minor.**

**Alteration to Natural Drainage Patterns/ Runoff Volumes and Rates**

10.6.82 Although the 29 turbine bases and associated crane hardstanding and the substation are permanent, they represent only a small change to the hydrological characteristics of the site. The total area of all combined will be small in relation to the overall catchment areas. Therefore, the potential effects predicted for interference to natural drainage patterns by tracks and other infrastructure is considered to be Low on all receptors. The overall significance is also **Minor.**

10.6.83 There is potential for the water crossings of smaller streams to become blocked if not maintained. Due to the terrain and size of the crossings, this could result in minor flooding. All of these streams are classified as low to high sensitivity due to their receiving waters. The likely magnitude of potential effects on natural water flows due to unmaintained stream crossings in the operational phase, prior to mitigation and management, is assessed as Low at the site of the stream crossings and Negligible downstream, thus the overall significance is **Minor.**

**Alteration of the Geological Environment**

10.6.84 No further earthworks or additional land take should be required, therefore no excavation of the peat would be necessary during the operation period. There is a potential for natural peat slide or bog burst albeit low within the Proposed Development area and infrastructure may have the potential to trigger a peat slide during the operation period due to a longer term effect from changes to the peat characteristics (drainage, loading, etc). The infrastructure and the wider area will be regularly monitored for features of movement, cracking, subsidence, bulging or slides. Therefore, the overall significance is **Minor**.

### *Decommissioning*

10.6.85 The potential effects that decommissioning could have on water resources will be similar, although of lesser magnitude, to those detailed above for the construction phase. Further peat disturbance will be minimised and no further drainage alteration or loss of bog pools is expected. The main potential effect during the decommissioning phase will therefore be on the water quality from sediment laden runoff or pollution. This will be managed by good practice methodology and mitigation as outlined in Appendix 10.1 and for the most sensitive catchment, the Gossa Water Drinking Water Protected area, the Scottish Water Mitigation and Contingency plan as outlined in Appendix 10.5 will be put in place during the decommission phase. The overall significance is **Minor** with the exception of the Gossa Water drinking water catchment where the overall significance is **Moderate**.

10.6.86 If new guidelines are published prior to decommissioning of the Proposed Development then these will be taken into account in the decommissioning procedures.

## 10.7 Mitigation

10.7.1 From the assessment of potential effects, those elements of the site which have demonstrated a potential effect significance of Moderate and Major during the construction phase have additional mitigation and management requirements above and beyond the standard good practice.

10.7.2 Specific mitigation for each type of effect is presented below.

**Water Quality**

10.7.3 The section of track between T10 and T12 and both turbines and associated crane hardstanding areas within the Gossa Water Scottish Water drinking supply catchment would need to be carefully managed in accordance with the Drainage Strategy presented in Appendix 3.1 and the Scottish Water Mitigation Plan Appendix 10.6. This will include the installation of continuous loggers and other regular monitoring as well as careful timing of works to limit any potential impact and assistance of an HCOW during the construction period.

10.7.4 The other areas of site that have a moderate significance of effect will also be subject to additional monitoring and HCOW advice during construction. The HCOW will provide advice on drainage control and sediment management as well as on dewatering and other aspects potentially effecting the water environment.

**Drainage Alteration**

Watercourses

10.7.5 Where watercourses will be diverted new sections of watercourse will be designed to tie in to the existing watercourse, maintain habitat and limit any effect of increased sedimentation, flow velocities or potential for channel alteration. Although there will be a loss of a section of watercourse the new diverted section will be designed to limit any impact on the remaining watercourse and create new habitat.

Bog Pools

10.7.6 The removal of a few shallow bog pools which retain very little surface water overall per catchment will not significantly affect other hydrological conditions such as groundwater levels within the peat, flood risk, or the water quality of the watercourse systems as these bog pools are not directly linked to main watercourses and are small scale drainage alterations considered on a catchment scale.

10.7.7 There are a number of areas where bog pools impacts are more significant, including a large bog pool at T4, a bog pool complex in the south of BPD, bog pools in the southwest of BPF and bog pools in the north of BPH.

10.7.8 Where there are oligiotrophic and dystrophic standing waters present, classified within Chapter 7: Ecology as being of Council Level importance, the loss of these bog pools is therefore deemed to be of **Moderate** significance. The disturbance of bog pools within the infrastructure footprint are

mainly in the large borrow pit areas and therefore there are opportunities to offset some of these adverse effects by creating bog pool habitats as part of the borrow pit restorations. This is further assessed within Chapter 7 and Appendix 7.7.

**Geological Alteration**

Peat Slide

10.7.9 The Peat Slide Hazard Risk Assessment (PSHRA) Report undertaken by East Point Geo Ltd and presented in Appendix 10.4 details appropriate mitigation required for areas with a peat slide risk of moderate (T14, T15, T18, T1 junction, T13 junction, T15 spur and 3-way junction between T23, 24 and T25 and BPC). The additional mitigation includes:

- Post-consent analysis of the effects of drains on areas identified with Moderate likelihoods:
  - at present, where drains are aligned oblique to slope, they are assigned worst case scores in the likelihood assessment and these may be overly conservative. Investigate and manage drains in areas susceptible to peat slide or bog burst and consider excavation rather than floating structure in specific location to remove source materials.
- Precautionary construction measures:
  - use of close monitoring for excavations and construction, good practice and a geotechnical risk register in all locations and potential catch fences
- Undertaking site specific stability analysis using better quality topographic data, final design loads for infrastructure and detailed ground models in areas of specific concern.

10.7.10 With the inclusion of these additional peat slide risk design inputs and mitigation measures, the peat slide risk significance can be reduced from Low to Moderate to Negligible to low. Therefore, with the detailed design and mitigation measures detailed in the (PSHRA Appendix 10.4) the significance of peat slide risk can be reduced from Moderate to Low.

Peat Management

10.7.11 The PMP (Appendix 10.3) demonstrates that with the appropriate excavation, storage and management of peat all the volumes of peat disturbed can be appropriately re-used onsite for dressing verges and slopes, reinstatement of peat on temporary areas such as construction compounds and the reprofiling and reinstatement of borrow pits as soon as possible in a staged approach. These plans will enable the excavated peat to retain some of its integrity, retain carbon and allow areas of excavated peatland to regenerate and start to produce peat again.

10.7.12 The calculations of peat excavation have generally assumed worst case for the infrastructure footprint and it is considered that the actual volumes are likely to be smaller due to:

- the crane hardstanding area is likely to reduce as more of the area will likely be floated as it will be used as laydown and the hardstanding part may also reduce once the final turbine design is specified; and
- there is the potential for the sequential use of borrow pits for construction compounds and temporary peat storage areas to reduce the overall land take.

10.7.13 In addition to the on-site mitigation measures detailed above the Applicant proposes to undertake off-site restoration works as part of the habitat management plan (HMP) to offset some of the adverse effects on peatland. Further details are provided in the Outline Habitat Management Plan (OHMP) in Appendix 7.7.

Peatland Habitat

10.7.14 The majority of the site is Annex I blanket bog habitat with some infrastructure areas located on oligiotrophic and dystrophic bog pools of high importance. The Ecology Chapter 7 assesses the effects of the Proposed Development on the peatland and bog pool habitats.

# 10.8 Residual Effects

## *Construction*

10.8.1 Assuming the additional mitigation measures outlined in Section 10.7, detailed in Appendix 3.1 Drainage Strategy, Appendix 10.1 Good practice and Standard Mitigation, Appendix 10.3 Outline Peat Management and Restoration Plan, 10.4 Peat Slide Risk Assessment, Appendix 10.5 Scottish Water Contingency Plans, Chapter 7: Ecology and Appendix 7.7 Outline Habitat Management Plan are adhered to the residual significant effect can be reassessed as:

**Water Quality**

10.8.2 The Gossa Water Scottish Water drinking supply catchment, which would need to be carefully managed in accordance with the Drainage Strategy presented in Appendix 3.1 and the Scottish Water Mitigation and Contingency Plan Appendix 10.6 due to its very high sensitivity. For the residual assessment, the significance is assessed as **Minor /Moderate**.

10.8.3 Other watercourse catchments are considered to have a residual significance of effect of **Minor** once all mitigation is considered.

**Drainage Alteration**

10.8.4 The requirement to divert existing watercourses around infrastructure will result in an overall residual effect of minor to **Moderate**, **Moderate** where sections of OS mapped watercourses will be permanently removed. These new sections of channel will be carefully designed to tie in with the existing habitat and allow new similar channels to develop in so far as is possible.

10.8.5 On a catchment scale a small amount of bog pools will be lost and drainage diverted which will not significantly affect flood risk or habitats in the watercourses downstream on a catchment scale and therefore is considered to be an effect of **Minor** significance.

10.8.6 Despite considerate design and additional measures with regards to avoiding watercourses, drains and bog pool where possible, the disturbance and removal of bog habitats can only be partly mitigated by the development of new replacement habitats elsewhere. The re-creation of blanket bog within the borrow pit restoration areas and the restoration of additional areas of blanket bog outwith the site boundary is detailed within the Outline Habitat Management Plan, presented within Chapter 7: Ecology. Taking this mitigation into account, the overall residual effect is assessed to be **Minor** to **Moderate**, **Moderate** where the excavation of bog pools cannot be avoided and are classified as Oligiotrophic and Dystrophic standing water habitats of Council level importance in the Ecology Chapter 7.

**Geological Alteration**

10.8.7 Despite considerate design and additional measures with regards to appropriate peat re-use to offset for excavated peat and avoiding deep peat and peat slide risk areas where possible, the disturbance and excavation of peat and peatland habitats cannot be fully mitigated; therefore, the overall residual effect is assessed to be **Minor to Major, Major** where the excavation of deep peat cannot be avoided.

## *Operation*

10.8.8 Assuming the additional mitigation measures outlined in section 10.8 detailed in Appendix 3.1 Drainage Strategy, Appendix 10.1 Good practice and Standard Mitigation, Appendix 10.3 Outline Peat Management and Restoration Plan, 10.4 Peat Slide Risk Assessment, Appendix 10.5 Scottish

Water Contingency Plans and Chapter 3: Ecology are adhered to the residual significant effect of operation can be reduced to:

***Water Quality***

10.8.9 Water quality as a result of diverting some minor water flows, the use of the access tracks, activities onsite and potential incidents on a catchment scale is considered to be low and therefore the residual effect significance is Minor, with the exception of the Gossa Water Drinking Water protected catchment where the residual significance is **Minor** due to the sensitivity of the catchment.

**Drainage Alteration**

10.8.10 Hydrological changes, as a result of diverting some minor water flows, drainage and oxidation of some peat and the removal of some bog pools attenuating water on a catchment scale is considered to be low and therefore the residual effect significance is **Minor**.

**Geological Alteration**

10.8.11 No further earthworks or additional land take should be required. With the mitigation outlined the risks from peat slide should remain low. Therefore, there will be no further disturbance of peat other than some marginal and the residual effect significant is **Minor.**

### *Decommissioning*

10.8.12 Assuming the additional mitigation measures outlined in section 10.8 detailed in Appendix 3.1 Drainage Strategy, Appendix 10.1 Good practice and Standard Mitigation, Appendix 10.3 Outline Peat Management and Restoration Plan, 10.4 Peat Slide Risk Assessment, Appendix 10.5 Scottish Water Contingency Plans and Chapter 3: Ecology are adhered to the residual significant effect of decommissioning can be reduced to:

**Water Quality**

10.8.13 Method statements, pollution controls and management plans and mitigation applied to protect the watercourses will ensure protection of the site water resource. For the residual assessment, the significance is assessed to be **Minor** for the majority of the site.

10.8.14 The exception is the Gossa Water Scottish water drinking supply catchment would need to be carefully managed in accordance with the Drainage Strategy presented in Appendix 3.1 and the Scottish Water Contingency Plan Appendix 10.6 due to its very high sensitivity. For the residual assessment, the significance is assessed as **Minor /Moderate.**

**Drainage Alteration**

10.8.15 On a catchment scale small amount of bog pools will be lost and drainage diverted which will not significantly affect flood risk or habitats in the watercourses downstream on a catchment scale and therefore is considered to be of **Minor** significance.

**Geological Alteration**

10.8.16 No additional land take should be required other than temporary reopening the construction compound areas which will be restored. Therefore, there will be no significant further disturbance of peat other than some marginal areas and the residual significance is **Minor**.

10.8.17 Where possible further peat will be restored where access tracks are removed and around and over turbine bases and associated crane hardstanding areas.

## 10.9 Cumulative Assessment

10.9.1 At time of writing, the only wind farm project in close proximity to the Proposed Development that could have a hydrological connection is the five-turbine Garth Wind Farm, located on north Yell (the closest Garth turbine is just over 1.5km to the east of the Proposed Development site boundary).

This project has no direct connectivity with the Proposed Development, being located within a different catchment and therefore outwith the hydrological zone of influence.

10.9.2 In terms of the hydrological zone of influence, cumulative adverse impacts are only likely in relation to fish and otter which are covered by Chapter 7: Ecology.

10.9.3 There are therefore considered to be no significant cumulative effects on hydrology and hydrogeology. Peat is not considered in terms of cumulative effects.

## 10.10 Summary

10.10.1 A summary of the hydrology, hydrogeology and geology chapter including baseline, mitigation and residual effects is provided below.

### *Baseline*

10.10.2 The site is characterised as being open moorland in the north eastern area of Yell, between the coastal inlets of Basta Voe and Gloup Voe. The site comprises of rolling hills up to around 112mAOD to sea level at the coastal inlets. The majority of the site is covered by blanket bog habitat and the area is currently used for some low intensity livestock grazing and by Scottish Water for the Yell drinking water abstraction, treatment and distribution.

10.10.3 The surface water catchments of the site can be divided into five main catchments: Burn of Gossa water draining to the southeast, Burn of Firth draining to the North, Burn of North Vigon draining to the northeast, South Burn of Vigon draining to the northeast and the Burn of Hildigill. These catchments are steep in places and have flashy runoff. The lower reaches of the catchments are important for brown trout, salmonids, European eel and otters use the catchment areas.

10.10.4 There are numerous minor drains, peat rills and erosional gullies on the slopes of the hillsides. The upper areas of the catchments are dominated by bog pool summit complexes which have been avoided where possible during the design process. Those classified as oligiotrophic or dystrophic standing waters or bog pool within the ecological survey area.

10.10.5 The site geology comprises of Moine Group Gneissose low productivity aquifer, overlain by relatively impermeable glacial till capped with relatively impermeable deep peat deposits.

10.10.6 Four phases of peat surveys were undertaken to assess the peat depth and distribution across the entire site and in detail around the infrastructure to inform the peat slide risk assessment, the design process and so that a quantitative Outline Peat Management and Restoration Plan could be developed. Peat depth onsite ranged from <0.5m not present to a maximum of 6.15m. Average peat depth across the site was calculated to be 1.45m and the average peat depth of the infrastructure footprint is 1.25m. The total volume of peat excavated (including footprints and a wider distance for slope batters) is about 394,200m$^3$ (52,500m$^3$ acrotelm and 341,700m$^3$ catotelm). The PMP demonstrates that the volumes of peat extracted can be appropriately re-used on site for verge batters, reinstatement of temporary areas and borrow pit restoration.

10.10.7 A peat slide hazard risk assessment was undertaken by East Point Geo Ltd to identify areas of peat slide or bog burst could occur for input into the design procedure. The majority of infrastructure is located on low peat slide risk areas with the exception of 8 specific areas identified where peat slide risk was assessed be of moderate risk.

10.10.8 The sensitive features or receptors of the site include:

- Gossa Water Drinking Water Protected Area catchment, Scottish Water's potable water supply abstraction and infrastructure including water treatment works, raw and mains water piping.
- Presence of widespread undisturbed blanket bog and deep peat across much of the site.
- Presence of Oligiotrophic and dystrophic bog pool summit complexes.
- Lower reaches of Burn of Gossa Water, Burn of Firth and North Burn of Vigon for Brown trout, salmonids, European Eel and otter across the site; and,

- The Basta Voe coastal inlet as part of the Fetlar to Haroldswick MPA to the south of the site.

### *Mitigation*

10.10.9 The site layout was designed to avoid all sensitive features where feasible taking into account other constraints. Further information on the site design is presented in Chapter 2.

10.10.10 The good practice methodology and standard mitigation for the management of the water and soils environment for a wind farm development will be followed and are outlined in Appendix 10.1.

10.10.11 Additional to the good practice methods and standard mitigation the following will be undertaken:

- Further detailed post consent analysis to inform: detailed design; Construction environmental management plan (CEMP) including a detailed drainage management plan (DMP) and surface water monitoring programme (SWMP); Geotechnical risk register; Consultation and agreements with SEPA and Scottish Water.
- Precautionary construction measures to include: use of monitoring; good practice; An Ecological Clerk of Works (ECoW) and Hydrological Clerk of Works (HCoW); a geotechnical risk register in all locations, timing of most sensitive works to avoid specific seasons or high rainfall periods.
- Undertaking site specific analysis: using better quality topographic data; Investigate and manage drains in source zones; final design loads for infrastructure; detailed ground models in areas of specific concern.

10.10.12 Site specific outline mitigation plans have been developed at this stage include:

- Appendix 3.1 Drainage Strategy
- Appendix 10.3 Outline Peat Management and Restoration Plan developed in consultation with SEPA.
- Appendix 10.6 Scottish Water Mitigation Plan developed in consultation and agreement with Scottish Water.
- Appendix 7.7 Outline Habitat Management Plan

**Residual Effects**

10.10.13 After implementing the good practice and standard mitigations measures and site-specific mitigation measure outline within this EIAR the residual impacts of the wind farm development are:

- Water Quality - Minor to Moderate for the construction period and decommissioning period
    - Minor for water quality with the exception of the Gossa Water catchment which is **Minor/Moderate** due to the sensitivity of the catchment being very high as it is the drinking water supply catchment for Yell.
- Drainage alteration - Minor to Moderate for the construction period
    - **Moderate** where sections of OS mapped watercourses will be permanently removed. These new sections of channel will be carefully designed to tie in with the existing habitat and allow new similar channels to develop in so far as is possible.
    - Minor where only drains or minor watercourses require alteration, minor for watercourse crossings and **Moderate** where the excavation of bog pools cannot be avoided and are classified as Oligiotrophic and Dystrophic standing water habitats in the Ecology Chapter 7 and **Moderate** where OS mapped watercourses require diversion.
- Geological alteration and peat disturbance – Minor to Major – for the construction period

- Minor for peat slide, minor for floating infrastructure and **Major** where the excavation of deep peat cannot be avoided.

10.10.14 The residual impacts should be considered with the overall need and beneficial effects of the Proposed Development detailed in Chapter 3: Project Description and Chapter 16: Carbon Calculator.

**Table 10.17 – Summary of Effects**

| Description of Effect | Significance of Potential Effect | | Mitigation Measure | Significance of Residual Effect | |
|---|---|---|---|---|---|
| | Significance | Beneficial/ Adverse | | Significance | Beneficial/ Adverse |
| Construction | | | | | |
| *Erosion / Sedimentation* | | | | | |
| Water Quality | Minor to **Moderate** | Adverse | Monitoring, HCoW and ECoW advice and management<br>Drainage Statement, Appendix 3.1<br>Scottish Water agreed mitigation and contingency plan, Appendix 10.6. | Minor to Minor/ Moderate,<br>Minor/Moderate for the Gossa Water DWPA due to its sensitivity. | Adverse |
| Drainage Alteration | Minor to Minor/Moderate | Adverse | No specific additional mitigation required | Minor to Minor/Moderate<br>Minor/Moderate for the Gossa Water DWPA due to its sensitivity. | Adverse |
| Peat Disturbance | Minor to **Moderate** | Adverse | Monitoring, HCoW and ECoW advice and management<br>Drainage Statement, Appendix 3.1 | Minor | Adverse |
| Peat Slide | Minor to **Moderate** | Adverse | Investigate and manage drains in areas susceptible to peat slide, monitoring and geotechnical risk register, site specific stability analysis using more accurate data after final design and install catch nets in moderate risk areas<br>Drainage Statement, Appendix 3.1 | Minor | Adverse |

| Description of Effect | Significance of Potential Effect | | Mitigation Measure | Significance of Residual Effect | |
|---|---|---|---|---|---|
| | Significance | Beneficial/ Adverse | | Significance | Beneficial/ Adverse |
| *Pollution* | | | | | |
| Water Quality | Minor to **Moderate**<br>**Moderate** for the Gossa Water DWPA due to its sensitivity. | Adverse | Monitoring, HCoW and ECoW advice and management<br>Drainage Statement, Appendix 3.1<br>Scottish Water agreed mitigation and contingency plan, Appendix 10.6. | **Minor to Minor/ Moderate,**<br>**Minor/Moderate** for the Gossa Water DWPA due to its sensitivity. | Adverse |
| *Natural Drainage Alteration* | | | | | |
| Watercourse Crossings | **Minor** | Adverse | Bottomless culverts, arches or single span crossing with otter passage to allow Brown trout, salmonid, European Eel and otter passage. Appropriately designed for 1:200year flood event, flood risk assessment for main crossings and CAR licence application from SEPA. | Minor | Adverse |
| Watercourse Diversions | **Moderate to Major** | Adverse | Further detailed investigation and detailed design.<br>Drainage Statement, Appendix 3.1<br>Appropriately designed diversion channel to replicate habitat | **Moderate** | Adverse |
| Bog Pools and waterbodies | Minor to **Major** | Adverse | Further detailed investigation and detailed design.<br>Peatland restoration plan and HMP. | Minor to **Moderate,**<br>**Moderate** where the excavation of bog pools cannot be avoided and are classified as Oligiotrophic and | Adverse |

| Description of Effect | Significance of Potential Effect | | Mitigation Measure | Significance of Residual Effect | |
|---|---|---|---|---|---|
| | Significance | Beneficial/ Adverse | | Significance | Beneficial/ Adverse |
| | | | | Dystrophic standing water habitats in the Ecology Chapter 10. | |
| Peat Slide | Minor to **Moderate** | Adverse | Further detailed investigation, modelling and detailed design, monitoring, geotechnical register, good practice and installation of catch nets in Moderate risk areas. | Minor | |
| *Geological Alteration* | | | | | |
| Disturbance of peat | Minor to **Major** | Adverse | Implementation of PMP demonstrates peat excavated can be appropriately reused on site for dressing and restoration of borrow pits.<br>Further detailed investigation and detailed design.<br>Peat restoration plan and HMP. | Minor to **Major**<br>**Major**, where excavation of Annex I deep peat cannot be avoided | Adverse |
| Peat Slide | Minor to **Moderate** | Adverse | Further detailed investigation, modelling and detailed design, monitoring, geotechnical register, good practice and installation of catch nets in Moderate risk areas. | Minor | Adverse |
| Operation | | | | | |
| Erosion /Sedimentation | | | | | |
| Water quality | Minor | Adverse | Good practice and standard mitigation.<br>Drainage Statement, Appendix 3.1 | Minor | Adverse |

| Description of Effect | Significance of Potential Effect | | Mitigation Measure | Significance of Residual Effect | |
|---|---|---|---|---|---|
| | Significance | Beneficial/ Adverse | | Significance | Beneficial/ Adverse |
| | | | Scottish Water agreed mitigation and contingency plan, Appendix 10.6. | | |
| Pollution | Minor | | Good practice and standard mitigation.<br>Drainage Statement, Appendix 3.1<br>Scottish Water agreed mitigation and contingency plan, Appendix 10.6. | Minor | Adverse |
| *Natural Drainage Alteration* | | | | | |
| Alteration of natural drainage patterns | Minor | Adverse | Good practice and standard mitigation. | Minor | Adverse |
| Flood Risk | Minor | Adverse | Good practice and standard mitigation. | Minor | Adverse |
| *Geological Alteration* | | | | | |
| Disturbance of peat | Minor | Adverse | Good practice and standard mitigation.<br>Peat restoration plan and HMP. | Minor | Adverse |
| Peat Slide | Minor | Adverse | Good practice, standard mitigation and ongoing monitoring. | Minor | Adverse |
| Decommissioning | | | | | |
| *Erosion / Sedimentation* | | | | | |

| Description of Effect | Significance of Potential Effect | | Mitigation Measure | Significance of Residual Effect | |
|---|---|---|---|---|---|
| | Significance | Beneficial/ Adverse | | Significance | Beneficial/ Adverse |
| Water Quality | Minor to **Moderate** | Adverse | Monitoring, HCoW and ECoW advice and management<br>Drainage Statement for decommissioning<br>Scottish Water mitigation and contingency plan for decommissioning | Minor to Minor/ Moderate,<br>Minor/Moderate for the Gossa Water DWPA due to its sensitivity. | Adverse |
| Drainage Alteration | Minor to Minor/Moderate | Adverse | Monitoring, HCoW and ECoW advice and management<br>Drainage Statement for decommissioning<br>Scottish Water mitigation and contingency plan for decommissioning | Minor to Minor/Moderate<br>Minor/Moderate for the Gossa Water DWPA due to its sensitivity. | Adverse |
| Peat Disturbance | Minor | Adverse | Good practice, standard mitigation and ongoing monitoring. | Minor | Adverse |
| Peat Slide | Minor | Adverse | Good practice, standard mitigation and ongoing monitoring. | Minor | Adverse |
| *Pollution* | | | | | |
| Water Quality | Minor to **Moderate**<br>**Moderate** for the Gossa Water DWPA due to its sensitivity. | Adverse | Monitoring, HCoW and ECoW advice and management<br>Drainage Statement for decommissioning<br>Scottish Water mitigation and contingency plan for decommissioning | **Minor to Minor/ Moderate,**<br>**Minor/Moderate** for the Gossa Water DWPA due to its sensitivity. | Adverse |

| Description of Effect | Significance of Potential Effect | | Mitigation Measure | Significance of Residual Effect | |
|---|---|---|---|---|---|
| | Significance | Beneficial/ Adverse | | Significance | Beneficial/ Adverse |
| *Geological Alteration* | | | | | |
| Disturbance of peat | Minor | Beneficial | Further excavation of peat is not anticipated and any removal of infrastructure will focus on peat restoration and improvement | Minor | Beneficial |

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