10 Geology, Peat, Hydrology and Hydrogeology

Contents

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10 Geology, Peat, Hydrology and Hydrogeology

10.1 Executive Summary

10.1.1 This chapter presents the Applicant's responses to points raised by consultees following the submission of the 2019 EIA Report, and assesses the effects of the 2020 Layout on geological, hydrogeological, hydrological and peat receptors. It is assumed that this SEI chapter is read in conjunction with 2019 EIA Report and Appendices.

10.1.2 The Outline Peat Management and Restoration Plan has been revised for the new 2020 layout and is presented in Appendix 10.1 to the 2020 SEI.

10.1.3 Following the change in design of the Proposed Development from the 2019 Layout to the 2020 Layout a re-assessment of the potential effects of the Proposed Development upon the receptors identified in the 2019 EIA Report has been undertaken. This assessment follows the methodology outlined in Chapter 10 of the 2019 EIA Report and summarises the changes below.

10.1.4 The 2019 Layout for 29 turbines, 9 borrow pit search areas, four construction compounds (including a substation construction compound) and 21 km track has been reduced to 23 turbines, 7 borrow pit search areas, three construction compounds (including a substation construction compound) and 15.3 km track to address some of the objections and concerns to the wind farm development.

10.1.5 The changes in the infrastructure in relation to the hydrology, hydrogeology and geology are summarised below:

- The overall footprint of the Proposed Development reduced from approximately 483,209 m^2 to 383,518 m^2.
- No infrastructure is located within the Burn of Midge Glen, South Burn of Vigon and North Burn of Vigon in the north-west of the site. Therefore, there will be no impacts to these catchments or potential GWDTEs within these catchments.
- The number of turbines with the Gossa Water catchment (Scottish Water public drinking water supply source) has reduced from 3 to 2 with the removal of Turbine 7. The area of infrastructure within the Gossa Water and its catchment (3.98 km^2) has reduced from approximately 20,550 m^2 to 13,581 m^2, equivalent to 0.52 % of the catchment to 0.34%.

10.1.6 The 2020 Layout removes any potential impacts to the catchments (Burn of Midge Glen, South Burn of Vigon and North Burn of Vigon) in the north-west of the site.

10.1.7 The 2020 Layout reduces the scale of some of the potential adverse effects, however the significance of the potential adverse effects for hydrology, hydrogeology, geology and peat remain the same as outlined with the 2019 EIA report, with the exception of the diversion of watercourses that is reduced from moderate to minor significance as the requirement for a main watercourse (shown on 1:50,000 scale mapping) diversion has been removed.

10.2 Introduction

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

10.2.2 The chapter should be read in conjunction with Chapter 10 of the 2019 EIA Report and its supporting appendices. This chapter presents the Applicant's responses to points raised by consultees following the submission of the 2019 EIA Report, and assesses the effects of the 2020 Layout on geological, hydrogeological and hydrological receptors.

10.2.3 A revised Outline Peat Management and Restoration Plan has been provided as Appendix 10.1 of the 2020 SEI as the reduction in infrastructure significantly reduces the development infrastructure area and volumes of peat extracted and re-used.

10.3 Response to Consultation Responses

Scottish Water

Consultee Response

10.3.1 Scottish Water confirmed that they had no objection to the Proposed Development and requested that they are re-consulted during the detailed design phase to ensure that there are no impacts to their assets and that the appropriate mitigation is implemented.

Applicant Response

10.3.2 The Applicant can confirm that they will continue to consult with Scottish Water and implement the mitigation which is outlined within chapter 10 of the 2019 EIA Report and the Scottish Water Mitigation and Contingency Plan Appendix 10.6 of the 2019 EIA Report.

SEPA

Consultee Response

10.3.3 SEPA stated that they consider that there are opportunities to significantly reduce the peat extraction volumes which should be investigated fully. For example, if peat extraction volumes can be reduced for crane hardstandings by modifying the construction methods. These are listed below and outlined in Table 10.1 with a design iteration response.

10.3.4 They also stated that, based on the peat survey (probe depths and interpolated) it appears that it may be possible to make reductions by making further adjustments to the layout design and these adjustments should be investigated:

- Turbines & hardstandings: T7, T12, T14, T18, T23, T29 – could the laydown areas be moved to shallower peat areas? Can peat extraction volumes be reduced for crane hardstandings by modifying the construction methods?
- C2 – could it move north to T28 where peat is shallower?
- Borrow pits: D - move west; E – reduce area to avoid deeper peat in south; F – completely relocate or replace, e.g. by using areas in shallower peat near T8 or near track between T13 and T17/T18; G – move to south between T28 and T29, south of Burn of Hildigill; H – move north to avoid water course and deeper peat.

10.3.5 Regarding peat storage areas, SEPA comments that borrow pit H appears to be excavated in areas containing watercourses so micro siting or a change of size will be required to protect these watercourses. In addition, the northern edge of borrow pit E is less than 50 m from a watercourse, therefore a reduction of size will be required.

10.3.6 In regard to peat reuse, in general SEPA find this acceptable and the storage methods appear to be in accordance with good practice. In re-use, in the bare peat areas active promotion of revegetation is proposed where not occurring naturally. SEPA requested that where peat is deposited as described under infrastructure re-use in the peat management plan, that the revegetation should be monitored, and a similar approach to that taken in bare peat is applied to encourage and promote revegetation if natural revegetation by peatland vegetation is not occurring.

10.3.7 SEPA stated that information to demonstrate the above has been investigated and all viable measures have been taken on site to reduce peat extraction should be provided in the Peat Management Plan (PMP).

10.3.8 They also stated that potential relocation sites would also have to be probed for peat depth to ensure reduction in peat excavation and that 100 m micro-siting allowance is only granted when additional peat survey data is provided to cover the full micro-siting allowance

10.3.9 SEPA had no objection to the wind farm development, subject to the following planning conditions:

- that the peat management plan is updated prior to any works on site and that all works are then carried out in accordance with the agreed plan;
- that all new infrastructure occurs outwith a 50 m buffer area of water features unless justification is provided and agreed in writing with the Planning Authority, in consultation with SEPA;
- that the applicant is enabled to micro-site the built elements of the scheme, notwithstanding the required 50 m watercourse buffer aforementioned;
- that the finalised Construction Environmental Management Plan (CEMP) is submitted to, and approved in writing by, the Planning Authority in consultation with SEPA and that all works on site are undertaken in accordance with the approved CEMP;
- that unless agreed with the Planning Authority in consultation with SEPA, all watercourse crossings should be oversized bottomless culverts or single span bridges designed to accommodate the 1 in 200 year peak flow;
- that it is demonstrated that there should not be an elevation of ground levels within the functional floodplain as a result of any proposed new crossing;
- that it is demonstrated that any diverted watercourses have the same physical characteristics and dimensions as the pre-diverted watercourse channels;
- that the detailed drainage design is provided to the Flood Risk Management Team of the Planning Authority;
- that finalised extraction areas and restoration proposals for borrow pits are to be agreed with the Planning Authority in consultation with SEPA prior to works on site; and,
- that a Decommissioning and Restoration Plan is submitted at least two years prior to the end of the design life of the development.

10.3.10 These SEPA conditions are the same conditions as those agreed in response to the 2019 EIA Report.

10.3.11 SEPA also requested the following:

- that 100 m micro-siting allowance is only granted when additional peat survey data is provided to cover the full micro-siting allowance;
- that further adjustment is made to the layout design to reduce the level of expected peat extraction;
- that the finalised CEMP includes details of the full range of measures to be put in place to protect surrounding wetland habitats, including micro-siting and mitigation measures;
- that once the ground investigation is complete, detailed drawings and method statements for the location, operation and restoration of the borrow pits should be submitted for approval;
- that borrow pits E, H and I are either micro-sited or reduced in size in order to protect nearby watercourses; and,
- it should be noted that if effluent will be disposed of on site after appropriate treatment, authorisation is required under Controlled Activities Regulations for any discharges to land or the water environment from private foul drainage systems.

10.3.12 SEPA Gateway Check Response was received 2nd April 2020 and agreed that the "2020 Layout has reduced impacts on peat due to the removal of turbines and infrastructure" from the impacts on peat of the 2019 layout.

10.3.13 SEPA are satisfied that the environmental issues, as detailed in their response of 24th June 2019, will be addressed through the relevant conditions, as summarised in the Gatecheck Report (Appendix 2.2) and in Section 10.3.9 above.

Applicant Response

10.3.14 The original scheme was scoped at 50 wind turbines. The Applicant undertook numerous design changes, including reducing the number of turbines, when considering the 2019 Layout as detailed in Chapter 2 of the 2019 EIA Report. These design changes took into consideration peat and hydrology, as well as impacts to receptors, including Gossa Water, noise, shadow flicker, ecology, ornithology, visual and cultural heritage.

10.3.15 The following Table 10.1 addresses SEPA's specific comments made 24th June 2019 (paragraph 10.3.4) in respect of possible reductions to peat extraction volumes through further adjustment of the layout design. Table 10.1 summarises SEPA's response and provides a design justification for maintaining the specific locations that are in addition to peat depth considerations.

Table 10.1 – SEPA Consultation Design Comments and Design Iteration and Justification Responses

Infrastructure	SEPA Comment	Design Iteration Response
Turbine 7	Could the laydown be moved to shallower peat nearby?	Accepted: Turbine 7 is removed from the 2020 Layout.
Turbine 12	Could the laydown be moved to shallower peat nearby?	Rejected for the following reasons: Burn of Rimminamartha lies to the west, a small watercourse and Gossa Water lies to the south. Distance to these maintained for water quality following consultation with Scottish Water. Orientating east-west is not feasible due to gradient. Summit pool complexes are south and east of the turbine. North-east would increase the height of the turbine and increase the visual impacts. Crane pad located north of the turbine to increase distance between infrastructure and Gossa Water. Turbine cannot move north west or south east due to separation distances with T10 and T14.
Turbine 14	Could the laydown be moved to shallower peat nearby?	Rejected for the following reasons: South-west closer to the Gossa Water is not advisable due to link to Scottish Water supply (Turbine currently sits outwith the Gossa Water catchment) and Peat Slide Risk increases.

Infrastructure	SEPA Comment	Design Iteration Response
Turbine 14		Crane pad orientated to be outwith the Gossa Water catchment. Further north is within watercourse buffers. Summit pool complexes to the east. North-west would increase gradient and visual impacts. Separation distance to T12 to the north-west and T15 to the east.
Turbine 18	Could the laydown be moved to shallower peat nearby?	Rejected for the following reasons: Restricted with separation distance to T17 to the north-west. River Burn to the south-west restricting water crossing and access track. Gradient restrictions. Deep peat to the south-east – crane pad orientated to avoid as much as possible.
Turbine 23	Could the laydown be moved to shallower peat nearby?	Rejected for the following reasons: Summit pool complexes key restriction here – to the south, west and south-east. Watercourse Burn of Kedillsmires runs north-west-south around the turbine area, access track needs to cross this and maintain the 50m buffer. Small watercourses on north side of proposed access track. Separation distance with T24 to the east. There is no obvious area where there is less peat.
Construction Compound 2	Could it move north to T28 where peat is shallower?	Rejected for the following reasons: Access track now proposed to cut off at T28 as T29 has been removed. Directly north of T28 where there is shallow peat data would be directly under the turbine and could have potential safety issues.
Borrow Pit D	Move west?	Rejected for the following reasons: Summit pool complexes to the west.

Infrastructure	SEPA Comment	Design Iteration Response
		Beyond the summit pool complexes where it was previously moved from is deeper peat and closer to the watercourse.
Borrow Pit E	Reduce area to avoid deeper peat in south	Rejected for the following reasons: This would be feasible but would reduce the volume of rock available. This was previously increased in size following the removal of another potential borrow pit search area from an area of deep peat. The position represents the worst case area of borrow pit required. This will be finalised following ground investigations at detailed design, and it is considered likely the footprint will reduce.
Borrow Pit F	Completely relocate or replace, e.g. by using areas in shallower peat near T8 or near track between T13 and T17/T18	Rejected for the following reasons: Little space near T8 due to Gossa Water catchment, large area of summit pool complexes and area of deep peat. Plus, small watercourses to the north-east of T8 Track between T13 to T17/18 has deep peat to the north and watercourse running north to south which the track crosses.
Borrow Pit G	Move to south between T28 and T29, south of Burn of Hildigill	Accepted: Borrow Pit G is removed
Borrow Pit H	Move north to avoid watercourse and deeper peat	Rejected for the following reasons: Potentially, and this will be considered during detailed design. Summit pool complexes to the north. This was originally bound by the access track to the north which has now been removed. The position represents the worst case of borrow pit area required. This will be finalised following ground investigations at detailed design, and if possible the borrow pit will be microsited to avoid deeper peat and the minor watercourse (which does not appear on the 1:25,000 OS mapping) which will otherwise be diverted.

10.3.16 It should be noted that all the infrastructure locations and detailed design are subject to further ground investigations and for that reason have a micro siting allowance of up to 100 m which may facilitate some further refinements into even better locations, taking into account all the constraints from all disciplines, with the current locations reflecting the worst case position for EIA purposes.

10.3.17 As requested in paragraph 10.3.6 above the Applicant agrees to undertake monitoring of peat reuse and revegetation. The details of this are further described within Appendix 10.1 of the 2020 SEI within the Reuse of Peat in Infrastructure and Borrow Pit Restoration, Bare peat and Peat Reuse sections.

10.3.18 The Applicant agrees to all the conditions listed and summarised by SEPA as listed in Section 10.3.9. These are incorporated into the detailed ground investigation, detailed design, best practice guidance and construction management plans outlined with the 2019 EIA Report and 2020 SEI.

Marine Scotland Consultee Response

10.3.19 Marine Scotland Science (MSS) issued a response on 18th June 2019 to the EIA and a Gateway Check Response on 31st March 2020 in relation to freshwater and diadromous fish and fisheries in the Environmental Impact Assessment Report for the proposed Energy Isles wind farm on the north-west of Yell.

10.3.20 MSS welcomes the proposal to develop a fish species protection plan and site water quality management plan. They state that the Applicant should consult their generic monitoring programme guidelines to establish a strategically designed, robust integrated water quality, macroinvertebrate and fish population monitoring programme to be carried out at least 12 months before, during and for at least 12 months after construction at sites potentially impacted by the Proposed Development and at control sites, where an impact is unlikely.

10.3.21 MSS recommends that key hydrochemical parameters (including turbidity and flow/stage data) are measured in a UKAS accredited laboratory as opposed to less accurate field measurements and for fully quantitative electrofishing surveys to be carried out to enable spatial and temporal comparisons of fish densities.

10.3.22 MSS advises that the developer establishes a robust water quality and aquatic biota monitoring programme, which in addition to the proposed mitigation measures, should aim to ensure full protection of fish populations.

10.3.23 The Gateway Check Response on 31st March 2020 (refer to Appendix 2.3) requested full details regarding the above proposed survey/monitoring programmes should be outlined in the 2020 SEI.

Applicant Response

10.3.24 A Draft Water Quality Monitoring Plan has been provided as part of the 2019 EIA, Appendix 10.6 Proposed Protection of the Gossa Water Catchment (March 2019).

10.3.25 It is acknowledged that a detailed survey and monitoring programme will be required at least 12 months in advance of works commencing and that details of the proposed survey/monitoring programmes will be provided as a condition to the planning application, if permission is granted.

10.3.26 Further response to Marine Scotland's comments on aquatic biota monitoring is covered within Chapter 7 (Ecology) of the 2019 EIA Report and Chapter 7 of the 2020 SEI.

SNH

Consultee Response

10.3.27 SNH stated that they object to the Proposed Development as the greater part of the site is on Class 1 carbon rich soils, deep peat and priority peatland habitat and thus is of national importance. They stated that their site survey confirmed:

- The site supports extensive areas of Class 1 carbon rich soils, deep peat and priority peatland habitat;

- That much of that habitat satisfied the minimum quality standards required of a Site of Special Scientific Interest;
- That despite efforts to reduce impacts on areas of deep peat and summit pool systems, significant damage to areas of deep peat and priority peatland habitat could not be avoided;
- That the peatland is of sufficient quality over an extensive area that on-site habitat restoration would not compensate for the loss and damage resulting from wind farm construction and operation.

10.3.28 SNH continued saying "*The Applicant therefore needs to demonstrate through the EIA that a wind farm can be built on this site without significant loss and damage to these nationally important interests. It is not clear how the off-site compensatory measures can be secured in the long term, nor, even if they could, how these would result in benefits equal to or greater than the losses which will occur on the site*".

Applicant Response

10.3.29 A response to SNH's comments on peatland habitats can be found in Chapter 7 (Ecology) Section 7.3 of the 2020 SEI.

RSPB

Consultee Response

10.3.30 RSPB stated that they object to the Proposed Development on 31st July 2019 as they have concerns regarding the impacts of this Proposed Development on carbon rich habitats and do not consider that it will be possible to fully mitigate the peatland impacts of the Proposed Development.

10.3.31 Much of the application area is covered by blanket bog, a priority habitat on Annex 1 of the EU Habitats Directive and therefore of international importance and also a priority habitat in the UK Biodiversity Action Plan (BAP). The RSPB state that they understand that much of the habitat has been found to satisfy the minimum quality standards required of a Site of Special Scientific Interest (SSSI) by SNH.

10.3.32 RSPB Scotland recognises that while the Applicant has put forward measures to reduce the amount of peat impacted by the Proposed Development, aspects of the Proposed Development could damage blanket bog. RSPB Scotland is concerned about the permanent loss of any blanket bog and considers it misleading to suggest that areas to be restored (temporary materials lay down areas, construction compounds and temporary borrow pits) to have a "barely perceptible adverse impact" as they consider that it will not be possible to restore these in the short term, if at all. There is a requirement to protect peatlands as the first priority to keep existing carbon in the ground.

10.3.33 RSPB Scotland would like to highlight that there is a history of large-scale developments in Shetland (e.g. Total Gas Plant and the Cullivoe Wind farm) underestimating the volume of peat excavated as part of the development. It is noted (and supported) that the Outline Peat Management and Restoration Plan (Appendix 10.3 of the 2019 EIA Report) states that peat will not be transported off site. However, RSPB also state it is unclear what is proposed should the volume of peat be greater than estimated.

Applicant Response

10.3.34 A series of detailed peat depth surveys, geomorphological and ecological habitat surveys have been undertaken to characterise the peatland types, condition, depth and distribution. Where possible, the deeper peat deposits and best quality peatland habitats, such as oligiotrophic bog pools, have been avoided by design whilst considering other constraints.

10.3.35 The Proposed Development is not located on a designated site (refer to Chapter 7 of the 2020 SEI for further information on this point).

10.3.36 It is recognised that areas of the peatland will be disturbed by the Proposed Development and detailed quantitative volumes of peat excavation, split into acrotelm and catotelm, have been provided. It is clearly demonstrated in the 2019 EIA Appendix 10.3 Outline Peat Management and Restoration Plan and the revised Outline Peat Management and Restoration Plan in Appendix 10.1 of the 2020 SEI that all of the peat excavated can be appropriately re-used and restored on-site without the requirement for peat to be transported off site.

10.3.37 The Outline Peat Management and Restoration Plan provided as part of the 2019 EIA Report has been accepted by SEPA. SEPA "*are satisfied that the environmental issues, as detailed in our response of 24 June 2019, will be addressed through the relevant conditions, as summarised in the Gatecheck Report*" (Energy Isles Wind Far EIA Report Supplementary Environmental Information - Gatecheck 23rd March 2020). SEPA had no objection to the Proposed Development, subject to the following relevant planning conditions regarding peat:

- that the peat management plan is updated prior to any works on site and that all works are then carried out in accordance with the agreed plan;
- that the finalised Construction Environmental Management Plan (CEMP) is submitted to, and approved in writing by, the Planning Authority in consultation with SEPA and that all works on site are undertaken in accordance with the approved CEMP;
- that finalised extraction areas and restoration proposals for borrow pits are to be agreed with the Planning Authority in consultation with SEPA prior to works on site; and,
- that a Decommissioning and Restoration Plan is submitted at least two years prior to the end of the design life of the development.

10.3.38 A response to the RSPB's comments on peatland habitats and the habitat management plan can be found in the 2020 SEI Chapter 7 (Ecology).

Ironside Farrar

Consultee Response

10.3.39 Ironside Farrar came back with the following comments on 15th July 2019: "No objection, with the following comments:

- that the Peat Landslide Hazard and Risk Assessment (2019 EIA Report, Appendix 10.4) does not state if blasting is required in the borrow pits;
- a review of historical mapping data, local knowledge and newspaper articles has not been specifically referenced; and
- the number of facets used in the analysis is unclear."

Applicant Response

10.3.40 There is currently no blasting in borrow pits proposed. However, the 2019 EIA report states that following detailed ground investigations, should blasting be required to remove the rock then a blasting assessment including a vibration assessment will be undertaken and submitted to Shetland Island Council prior to construction commencing, which would be a condition of planning.

10.3.41 The peat slide risk mitigation is outlined in Appendix 10.4 Peat Slide Risk Assessment of the 2019 EIA Report and the mitigation for excavations includes "*the monitoring of the ground upslope of excavation works for creep, heave, displacement, tension cracks, subsidence or changes in surface water content*", this is particularly important during blasting activities (if required at nearby borrow pits). Excavation works will also avoid being undertaken during blasting activities (if required at borrow pits).

10.3.42 Section 3 of Appendix 10.4 Peat Slide Risk Assessment of the 2019 EIA Report provides a literature review of peat instability, specifically noting landslides on Shetland (e.g. at the proposed Viking site in paragraph 3.1.6, at Channerwick in paragraph 3.1.3 and impacting on shellfish, paragraph 3.1.3).

The Shetland Times is a reference provided in the reference list. Interviews with local landowners were not undertaken.

10.3.43 Section 4.3.1 of Appendix 10.4 Peat Slide Risk Assessment of the 2019 EIA Report states that the landslide susceptibility approach is based on the layering of contributory factors to produce unique 'slope facets' that define areas of similar susceptibility to failure. The number and size of slope facets will vary from one part of the site to another according to the complexity of ground conditions. In total, c. 9,093 facets were considered in the analysis, with an average area of c. 1,800 m^3 (or an average footprint of c. 42 m x 42 m, consistent with smaller to medium scale peaty soil or peat slides reported in the published literature). The number of facets stated in Section 14.3.19 is a typo and should have also said 9,093 facets.

10.4 Assessment of Residual Effects

Changes to Impacts

10.4.1 Following the change in design of the Proposed Development from the 2019 Layout to the 2020 Layout a re-assessment of the potential effects of the Proposed Development upon the receptors identified in the 2019 EIA Report has been undertaken. This assessment follows the methodology outlined in Chapter 10 of the 2019 EIA Report and summarises the changes below.

10.4.2 The 2019 Layout for 29 turbines, 9 borrow pit search areas, 4 construction compounds, a substation and 21 km track has been reduced to 23 turbines, 7 borrow pit search areas, 3 construction compounds, a substation and 15.3 km track to address some of the objections and concerns to the wind farm development.

10.4.3 The changes in the infrastructure in relation to the hydrology, hydrogeology and geology are summarised below:

- The overall footprint of the Proposed Development reduced from approximately 483,209 m^2 to 383,518 m^2.
- No infrastructure is located within the Burn of Midge Glen, South Burn of Vigon and North Burn of Vigon in the north-west of the site. Therefore, there will be no impacts to these catchments or potential GWDTEs within these catchments.
- The number of turbines with the Gossa Water catchment (Scottish Water public drinking water supply source) has reduced from 3 to 2 with the removal of Turbine 7. The area of infrastructure within the Gossa Water and its catchment (3.98 km^2) has reduced from approximately 20,550 m^2 to 13,581 m^2, equivalent to 0.52 % of the catchment to 0.34 %.

10.4.4 For peat slide risk (Appendix 10.4 of the 2019 EIA Report), infrastructure within the main areas of peat instability risk have been removed: 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). Therefore, the infrastructure locations overlapping with "Moderate" landslide likelihoods has reduced from 22 to 17, and overlapping with "Medium" risks has reduced from 10 to 9. Source zone location 1 to 3 and 6 to 7 are no longer applicable to the wind farm development. The PSRA mitigation is outlined in Appendix 10.4 of the 2019 EIA Report and the mitigation for excavations includes "*the monitoring of the ground upslope of excavation works for creep, heave, displacement, tension cracks, subsidence or changes in surface water content*", this is particularly important during blasting activities (if required at nearby borrow pits). Excavation works will also avoid being undertaken during blasting activities (if required at borrow pits). Requirements for main watercourse crossings (shown on 1:50,000 scale Ordnance Survey Mapping) has reduced from 14 to 10 (labelled as watercourse crossing numbers 4 to 13 and described in the 2019 EIA Report, Appendix 10.5 Watercourse Crossing Inventory and shown as green circles on 2019 EIA Report, Figure 10.6a) and other watercourse crossings (shown or 1:25,000 scale OS mapping or identified during the site walkover) has reduced from 27 to 20 (labelled as 7 to 26 and described in the 2019 EIA report, Appendix 10.5 Watercourse Crossing Inventory and shown as red dots on 2019 EIA Report, Figure 10.6a). The approximate 200 known new crossings of minor man-made drains, natural ephemeral

drains and diffuse drainage areas or ephemeral flows crossing the site has been reduced to approximately 180 new minor crossings. These crossings will comprise of culverts or where the drainage area is wide a series of culverts. The design of the watercourse crossings 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.

10.4.5 Potential requirements for watercourse diversions for the borrow pit search areas has reduced from 5 to 4. The main watercourse diversion (labelled number 2 in the EIA Report) in the north of the site is no longer required as borrow pit I has been removed. All four of the remining diversions are of minor watercourses (not shown on 1:50,000-scale mapping but 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 four remaining diversions are still subject to further detailed ground investigation and may be able to be avoided or made into watercourse crossings as part of the detailed design stage of the borrow pit excavation areas and Turbine 6 crane pad area.

10.4.6 Peat has been determined to be present up to a maximum depth of 6.15 m and an average depth of 1.45 m across the site m based on 13,061 depth of penetration probes across the site and 174 cores undertaken near to proposed infrastructure. The data indicates that peat (>1.0 m depth) is present across 71.46 % of the proposed infrastructure and no peat (0 – 0.5 m depth) is present across 5.25 % of the proposed infrastructure. Acrotelm thickness ranges from 0.00 m to 0.30 m with an average depth of 0.15 m. The average peat depth across the original Study Area is calculated to be approximately 1.45 m. The average peat depth within the infrastructure footprint is recalculated to be 1.32 m.

10.4.7 The area of the turbines and crane pad infrastructure is up to 3,427 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 1,854 m^2 each. Therefore, the required total land take for the turbines and crane pads has reduced from up to 183,404 m^2 (133,135 m^2 excavated and 50,269 m^2 floating/temporary) to a total land take of up to 122,060 m^2 (83,728 m^2 excavated and 38,332 m^2 floating/temporary).

10.4.8 Access track has been reduced from 21 km of 5 m wide site tracks resulting in 104,820 m^2 of permanent land take and 5,698 m^2 of temporary land take to 15.3 km of approximately 5 m wide site tracks with cable route alongside or under the track resulting in 84,567 m^2 of permanent land take and 4,002 m^2 of temporary land take. Floating track length has reduced from 19.325 km to 12.50 km and excavated track has decreased from 1.75 km to 1.00 km.

10.4.9 The construction compounds have been reduced from 4 to 3 (including the substation compound) resulting in an approximate 2,500 m^2 footprint reduction.

10.4.10 Borrow pit I and G have been removed resulting in a 36,252 m^2 and 4,160 m^2 footprint or land take decrease respectively.

10.4.11 The Outline Peat Management and Restoration Plan has been revised and appended to this chapter (2020 SEI, Appendix 10.1) to reflect the reduction of infrastructure and therefore excavation volumes and to identify suitable peat re-use options within the site in close proximity to the proposed infrastructure. 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 reduced from approximately 394,200 m^3 (in the previous Draft Peat Management Plan, 2019 EIA Report, Appendix 10.3) to 326,959 m^3 (in the current Draft Peat Management Plan, Appendix 10.1 of the 2020 SEI);
- Total volume of acrotelm which will be excavated has reduced from approximately 52,500 m^3 (in the previous Draft Peat Management Plan, 2019 EIA Report, Appendix 10.3) to 41,428 m^3 (in the current Draft Peat Management Plan, Appendix 10.1 of the 2020 SEI); and,

- Total volume of catotelm which will be excavated has reduced from 341,700 m^3 (in the previous Draft Peat Management Plan, 2019 EIA Report, Appendix 10.3) to 285,531 m^3 (in the current Draft Peat Management Plan, Appendix 10.1 of the 2020 SEI).

10.4.12 The revised Draft Peat Management Plan (Appendix 10.1 of the 2020 SEI) demonstrates that all excavated peat can appropriately be reused on site and therefore no off-site disposal of peat is required.

Residual Effects

10.4.13 Following the change in design of the Proposed Development from the 2019 Layout to the 2020 Layout a re-assessment of the residual effects of the Proposed Development upon the receptors identified in the 2019 EIA Report has been undertaken. This assessment follows the methodology outlined in Chapter 10 of the 2019 EIA Report and assumes that all mitigation detailed within the EIA Report is undertaken.

Construction

10.4.14 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 10.4 Peat Slide Risk Assessment, Appendix 10.5 Scottish Water Contingency Plans, Chapter 7: Ecology and Appendix 7.7 Outline Habitat Management Plan from the 2019 EIA Report and the revised Outline Peat Management and Restoration Plan (Appendix 10.1 of the 2020 SEI) are adhered to the residual significant effect can be reassessed as:

Water Quality

10.4.15 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**.

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

Drainage Alteration

10.4.17 The requirement to divert existing watercourses around infrastructure will result in an overall residual effect of **Minor.** There are no longer any requirements to divert main watercourses (shown on 1:50,000 OS Mapping) therefore the residual effects from the 2019 EIA has been reduced from Minor to Moderate to Minor. The new sections of minor watercourse channels will be carefully designed to tie in with the existing habitat and allow new similar channels to develop in so far as is possible.

10.4.18 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.

10.4.19 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 Appendix 7.1 of the 2020 SEI. Taking this mitigation into account, the overall residual effect is assessed to be **Minor** to **Moderate**, Minor/Moderate for the Gossa Water DWPA due to its sensitivity and **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

10.4.20 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,** and **Major** where the excavation of deep peat cannot be avoided.

Operation

10.4.21 Assuming the mitigation measures outlined in the 2019 EIA Report Section 10.8, 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 10.6 Scottish Water Contingency Plans and Chapter 7: Ecology are adhered to the residual significant effect of operation can be reduced to:

Water Quality

10.4.22 The impact on 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 of low magnitude, therefore the residual effect significance is **Minor**, with the exception of the Gossa Water Drinking Water protected catchment where the residual significance is **Minor/Moderate** due to the sensitivity of the catchment. Rigorous mitigation will be put in place in accordance with the agreed water quality monitoring and contingency plan agreed with Scottish Water (2019 EIA Report Appendix 10.6 Scottish Water Contingency Plans).

Drainage Alteration

10.4.23 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 magnitude and therefore the residual effect significance is **Minor**.

Geological Alteration

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

Decommissioning

10.4.25 Assuming the additional mitigation measures outlined in 2019 EIA Report Section 10.8 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 7: Ecology are adhered to the residual significant effect of decommissioning can be reduced to:

Water Quality

10.4.26 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.

10.4.27 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 2019 EIA Report Appendix 3.1 and the Scottish Water Contingency Plan 2019 EIA Report Appendix 10.6 due to its very high sensitivity. For the residual assessment, the significance is assessed as **Minor /Moderate.**

Drainage Alteration

10.4.28 The risk of drainage alteration during decommissioning is considered to be of **Minor** significance with the exception of the Gossa Water catchment which is **Minor/Moderate** due to its sensitivity.

Geological Alteration

10.4.29 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**.

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

10.5 Additional Mitigation

10.5.1 No additional mitigation to that previously proposed in the 2019 EIA Report is required.

10.6 Assessment of Cumulative Effects

10.6.1 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 1.5 km 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.

10.6.2 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.

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

10.7 Comparison of Effects

10.7.1 Table 10.2 below provides a comparison of effects between the assessment undertaken on the 2019 Layout and reported within the 2019 EIA Report, and the assessment undertaken on the 2020 Layout reported above.

Table 10.2 – Summary of Effects

Description of Effect	2019 Effects		2020 Effects	
	Significance	**Beneficial/ Adverse**	**Significance**	**Beneficial/ Adverse**
Construction				
Erosion and Sedimentation				
Water Quality	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity	Adverse	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
Drainage Alteration	Minor to Minor/Moderate Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse	Minor to Minor/Moderate Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
Peat Disturbance	Minor	Adverse	Minor	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
Pollution				
Water Quality	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity	Adverse	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
Natural Drainage Alteration				

Description of Effect	2019 Effects		2020 Effects	
	Significance	**Beneficial/ Adverse**	**Significance**	**Beneficial/ Adverse**
Watercourse Crossings	Minor	Adverse	Minor	Adverse
Watercourse Diversions	Moderate	Adverse	Minor	Adverse
Bog Pools and waterbodies	Minor to Moderate. 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.	Adverse	Minor to Moderate. 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.	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
Geological Alteration				
Disturbance of peat	Minor to Major. Major, where excavation of Annex I deep peat cannot be avoided	Adverse	Minor to Major. Major, where excavation of Annex I deep peat cannot be avoided	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
Operation				
Erosion and Sedimentation				
Water Quality	Minor to Minor/ Moderate,	Adverse	Minor to Minor/ Moderate,	Adverse

Description of Effect	2019 Effects		2020 Effects	
	Significance	**Beneficial/ Adverse**	**Significance**	**Beneficial/ Adverse**
	Minor/Moderate for the Gossa Water DWPA due to its sensitivity		Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	
Pollution	Minor	Adverse	Minor	Adverse
Natural Drainage Alternation				
Alteration of natural drainage patterns	Minor	Adverse	Minor	Adverse
Flood Risk	Minor	Adverse	Minor	Adverse
Geological Alteration				
Disturbance of peat	Minor	Adverse	Minor	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
Decommissioning				
Erosion and Sedimentation				
Water Quality	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
Drainage Alteration	Minor to Minor/Moderate	Adverse	Minor to Minor/Moderate	Adverse

Description of Effect	2019 Effects		2020 Effects	
	Significance	**Beneficial/ Adverse**	**Significance**	**Beneficial/ Adverse**
	Minor/Moderate for the Gossa Water DWPA due to its sensitivity.		Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	
Peat Disturbance	Minor	Adverse	Minor	Adverse
Peat Slide	Minor	Adverse	Minor	Adverse
Pollution				
Water Quality	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse	Minor to Minor/ Moderate, Minor/Moderate for the Gossa Water DWPA due to its sensitivity.	Adverse
Geological Alteration				
Disturbance of peat	Minor	Beneficial	Minor	Beneficial

Table 10.3 – Summary of Cumulative Effects

Receptor	Effect	Cumulative Developments	2019 Cumulative Effect		2020 Cumulative Effect	
			Significance	**Beneficial/ Adverse**	**Significance**	**Beneficial/ Adverse**
Hydrology	No direct connectivity with the Proposed Development, being located within a different	Five-turbine Garth Wind Farm, located on north Yell (the closest	No effects	N/A	No effects	N/A

Receptor	Effect	Cumulative Developments	2019 Cumulative Effect		2020 Cumulative Effect	
			Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
	catchment and therefore outwith the hydrological zone of influence. 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	Garth turbine is just over 1.5 km to the east of the Proposed Development site boundary).				

10.8 References

As per the 2019 EIA Report, with the addition of the following guidance update:

Scottish Renewables, SNH, SEPA & Forestry Commission Scotland (2019); Good practice during windfarm construction, 4th Edition.