8. HYDROLOGY AND HYDROGEOLOGY APPRAISAL

8.1 Introduction

8.1.1 Scope of the Assessment

This chapter considers the potential effects of the proposed development on hydrology and hydrogeology. The assessment is based on the proposed development as outlined in Chapter 2: Development Description.

The scope of the assessment has been informed by the following legislation and policy context:

- the Water Framework Directive (WFD), which aims to protect and enhance the quality of surface freshwater (including lakes, rivers and streams), groundwater, Groundwater Dependent Terrestrial Ecosystems (GWDTEs), estuaries and coastal waters;
- the Water Environment and Water Services (Scotland) Act 2003 (WEWS Act), which gives Scottish Ministers powers to introduce regulatory controls over water activities in order to protect, improve and promote sustainable use of Scotland's water environment; and
- the Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended (the 'CAR Regulations'). The CAR Regulations mean that it is an offence to undertake the following activities without an authorisation under the CAR Regulations:
  - Discharges to all wetlands, surface waters and groundwaters (replacing the Control of Pollution Act 1974);
  - Impoundments (dams and weirs) of rivers, lochs, wetlands and transitional waters; and
  - Undertaking of engineering works in inland waters and wetlands.

The scope of the assessment is also informed by the following Scottish Environment Protection Agency (SEPA) guidance:

- The SEPA Position Statement on Culverting of Watercourses[1] (WAT-PS-06-02) and supporting guidance on Sediment Management[2] (WAT-SG-78) and the River Crossings Good Practice Guide[3];
- Land Use Planning System (LUPS) Guidance Note 4: Planning Guidance on Onshore Windfarm Developments[4]; and
- LUPS Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems.

8.1.2 Objectives

- The specific objectives of the chapter are to describe the geological, hydrogeological and hydrological baseline and then to consider the potential effects, including direct, indirect and cumulative effects of the proposed development on hydrology and hydrogeology. Measures are identified, where appropriate, to mitigate effects.

This chapter refers to the following technical appendices where appropriate:

- Technical Appendix 8.1: Groundwater Dependent Terrestrial Ecosystem (GWDTE) Assessment; and

[1] SEPA, 2006, SEPA Position Statement to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2005: Culverting of Watercourses.
[2] SEPA, 2012, Supporting Guidance: Sediment Management Authorisation (replacing WAT-PS-06-03).
[3] SEPA, November 2012, Engineering in the water environment: River Crossings Good Practice Guide (WAT-SG-25).
[4] SEPA, Land Use Planning System SEPA Guidance Note 4, Planning guidance on on-shore windfarm developments, Version 7, May 2014.

- Technical Appendix 8.2: Watercourse Crossing Assessment;

8.2 Methodology

8.2.1 Study Area

The study area for consideration of potential direct effects on the water environment associated with the construction phase of the proposed development equates to all watercourses within a 1 km radius as identified on the Ordnance Survey 1.25,000 scale map. Consideration was also given to downstream effects within the same catchment or to areas in hydraulic continuity with the proposed development.

8.2.2 Desk Study

The following information sources have been sources used in the desk-based review of the study area in order to characterise baseline conditions and assess potential impacts of the proposed development:

- Ordnance Survey (OS) 1:10,000 and 1:25,000 mapping;
- OS 5 m Digital Terrain Model (DTM) data;
- Aerial imagery (ESRI world imagery);
- BGS 1:50,000 superficial and bedrock WMS digital geological map data;
- BGS 1:625,000 hydrogeological mapping;
- National Soils Map for Scotland (National Soils Inventory for Scotland (NSIS1));
- SEPA Flood Risk Management Maps (updated 23 April 2018) web mapping; and
- Scotland: Water Classification Hub web mapping.

8.2.3 Field Survey

A field survey of the watercourses that would be crossed by the proposed development was undertaken to determine the hydrological context of the proposed development and gain a more detailed understanding of the sensitivities associated with the main watercourses. Where possible, the locations where the proposed development would cross watercourses were recorded and photographs and field notes were taken, reporting the dimensions of the watercourse channel and flood channel (where apparent), flow, instream vegetation and the type of substrate. The surveyed watercourse crossings vary from small headwater crossings to larger stream and river crossings.

The site survey of the southern section of the proposed alignment (to the south of Barrhill) was carried out by Ramboll in August 2019, as part of additional Phase 1 habitat surveys. Further surveying was carried out by Bowland Ecology from the south of the Duisk River near Barrhill (NX 23680 81710) to Mark Hill substation (NX 23828 86077). The site was assessed for the presence of Groundwater Dependent Terrestrial Ecosystems (GWDTE), which are protected under the Water Framework Directive[5] due to their hydrological sensitivity and potential to be adversely affected by development.

8.3 Baseline Conditions

8.3.1 Surface Hydrology

As presented in Figure 8.1 the proposed alignment intersects the following watercourses and their tributaries (listed from north to south)

5 https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf

- River Stinchar (tributaries);
- River Duisk (and its tributaries, including Lily Burn, Kildonan Burn, Cross water, Laggish Burn);
- Water of Luce; and
- Cross Water of Luce.

The proposed alignment passes through the catchments of the River Stinchar and the Water of Luce.

8.3.2 Flood Risk

At two locations, the proposed alignment crosses fluvial flood risk areas, as defined by SEPA in their Flood Risk Management Maps[6]. These areas are described below in sequence from north to south.

- At NGR 224024, 581573 the proposed alignment crosses the River Duisk. Land to the north of this crossing, in close proximity to the River Duisk, is considered to be at a high likelihood of fluvial flooding (a flood event is likely to occur in the defined area on average once in every ten years (1:10), or a 10% annual probability). Approximately 145 m of the proposed alignment falls within this area, and three pole locations are proposed within this area.
- The proposed alignment crosses the Cross Water of Luce (Main River) at NGR 218939, 575270. An area adjacent to Cross Water of Luce is assessed by SEPA to be at a high likelihood of fluvial flooding (a flood event is likely to occur in the defined area on average once in every ten years (1:10), or a 10% annual probability).

It is noted that no infrastructure or permanent development is proposed on areas at risk of flooding, with the exception of the three proposed pole locations on land to the north of the River Duisk. It is therefore considered that the site is of low sensitivity with regard to flood risk.

8.3.3 Water Quality

The Cross Water of Luce and the River Duisk have been classified under the Water Framework Directive[7] as follows:

- The Cross Water of Luce has been classified as having an overall status of Moderate.
- The River Duisk has been classified as having an overall status of Good.

No other watercourses within the site have been classified under the SEPA River Basin Management Plan (RBMP). The lochs within 500 m of the proposed alignment are also not classified under the RBMP.

8.3.4 Groundwater Bodies

The proposed alignment passes through South Ayrshire Hills, Clyde groundwater body, which is classified as ‘Good’. According to BGS 1:625,000 hydrogeological mapping, the underlying aquifer is a ‘Low Productivity’ aquifer in which limited groundwater may be present in near surface weathered zone and secondary fractures.

[6] SEPA, Flood Risk Management Maps. Available at: http://map.sepa.org.uk/floodmap/map.htm [last accessed October 2020]
[7] Accessed via the SEPA Water Classification Hub. Available at https://www.sepa.org.uk/data-visualisation/water-classification-hub/ [last accessed October 2020]

8.3.5 Groundwater Dependent Terrestrial Ecosystems

Surveying of vegetation communities within the study area identified habitats that are potentially groundwater dependent according to NVC vegetation classification. These were identified through fieldwork carried out by Ramboll in August 2019 and Bowland Ecology in June and July 2020. Description of potential GWDTE habitats is provided in Chapter 7: Ecology and Ornithology, and assessment provided by Bowland Ecology (Technical Appendix 7.3). Assessment of potential hydrogeological impacts of the proposed development on potential GWDTE areas is provided in a separate appendix to this chapter (Technical Appendix 8.1, GWDTE Assessment).

8.3.6 Water Resource

The Environmental Health Department of South Ayrshire Council maintains a register of existing householder private water supplies (PWS). Consultations with an Enforcement Office at the Environmental Health department[8] have identified one property served by a PWS within 250 m of the proposed alignment.

Private Water Supplies (PWS)

The closest PWS within a 2.5 km radius are presented in Figure 8.2 and described below:

- Altercannoch – two properties (one of which is within 250m of the proposed development) with the possible source identified as Loch Alty at NGR 223589,579839 the 1.4 km south east of the proposed alignment. The proposed development is outwith the 250m buffer of the abstraction source and is hydrologically downstream of the source and the property it serves. There is therefore no potential for the proposed alignment to affect water quality at this location;
- Ferngate – two properties with the possible source on the Cross Water of Luce at NGR221500, 580189, approximately 400 m west of the proposed alignment;
- Chirmorie – one property with four possible sources
    - NGR 2200783, 576893 approximately 630 m east of the proposed alignment
    - NGR 220827,576886 approximately 670 m east of the proposed alignment
    - NGR 220781, 576774 approximately 460 m east of the proposed alignment
    - NGR 220671, 576467 approximately 715 m east of the proposed alignment

As all PWS sources identified are outwith a 250 m buffer of the proposed alignment, and PWS locations are shown not to be in hydrological connection to the proposed alignment and indicative access routes (all are upstream). Therefore, no further appraisal of potential impacts to PWS is presented in this appraisal.

Public Water Supplies

There are no Drinking Water Protected Areas (Surface) as classified by SEPA within 1 km of the proposed alignment, or in downstream hydrological connectivity. The area is classified by SEPA as a Drinking Water Protected Area (Ground), in line with all underlying aquifers in Scotland.

8.4 Potential Impacts

8.4.1 Construction

Potential effects during construction are detailed in Table 8.1 below, which also details the relevant receptor and mitigation or control measures, where appropriate. Proposed measures to mitigate potential impacts on Groundwater Dependent Terrestrial Ecosystems and Watercourse Crossings are set out in Technical Appendices 8.1 and 8.2 respectively.

[8] Email correspondence with Constance Lobban, 18th May 2016, updated in 2019.

Table 8.1: Potential Impacts on Hydrology and Hydrogeology during Construction and Relevant Mitigation/Control Measures		
Potential Impact	**Receptor**	**Mitigation/Control Measures Proposed**
Compaction and soil erosion along the proposed alignment, including temporary construction compounds.	Soils and peatland	All sections of stone tracks used for construction are proposed as temporary in nature and will be removed following completion of the development, with land reinstated to as close to its existing condition, as reasonably possible. 4.5 m wide stone tracks would be proposed where necessary, depending on the ground conditions at site, which will be weather dependent. Best practice measures to control compaction and soil erosion caused by temporary access during construction would be set out in the construction phase Environmental Management Plan (EMP).
Siltation or pollution of watercourses during excavation and installation of wood poles.	Watercourses	Where pole installation is required within 30 m of a watercourse, good practice silt management, which would be outlined in the CEMP, would be put in place, with nearby watercourses checked during periods of high rainfall during construction activities. Ground excavation work would temporarily stop work during periods of high rainfall. Following the reinstatement of ground conditions at the proposed pole locations the contractor shall remove mitigation measures (should they be required), such that the release or 'flushing' of sediments to watercourses is avoided.
Spills or contamination from materials/wastes handled or stored at the temporary construction compounds. Temporary construction compounds causing pollution of watercourses.	Watercourses, peatland	All excavated material would be carefully stored a minimum of 30 m away from any watercourse, with particular care taken to preserve the integrity of soil structure and prevent any risk of runoff or sediment blow-off into watercourses. Areas of exposed soils (excavations or stockpiles) shall be bunded and diversion drains employed to prevent clean water entering the area and dirty water from leaving the area. Bunds and diversion drains shall be constructed of non-erodible material such as turf, straw bales or geotextiles. Temporary construction compounds will be kept to the minimum necessary for safe implementation of the works. On-site storage of oil and fuels will be avoided if possible but where on-site storage is required, the volumes to be stored would be minimised and stored in accordance with all applicable legislation and good practice.
Watercourse crossings leading to siltation or pollution if good practice not followed.	Watercourses	The OHL construction would require the construction of new watercourse crossings. Access would involve use of existing tracks and watercourse crossings as far as possible. Where required, temporary track mats and bog mats would be used to cross areas of soft ground. Bog mats would be used to cross minor watercourses without damage to bank integrity and temporary bridging solutions are also likely in places, under the relevant CAR registrations.

Table 8.1: Potential Impacts on Hydrology and Hydrogeology during Construction and Relevant Mitigation/Control Measures		
Potential Impact	**Receptor**	**Mitigation/Control Measures Proposed**
Modification of groundwater flows by location of wood poles and/or by excavation of cable trench, forming a preferential flow path for sub-surface flows. In addition, any excavations below the groundwater level along the length of the proposed alignment could lead to a localised groundwater drawdown.	Groundwater flow	The wood pole installation would ensure that drainage design measures would not result in pollution to surface water; this would be set out in the CEMP; Water within the excavations for footings would be dispersed to vegetated areas at a suitable distance from watercourses. As the excavations for installation of the wood poles and reinstatement of ground conditions shall be carried out expeditiously, minimal disruption would occur to groundwater flows. Were rock encountered, there is the potential excavations may be carried out over a longer timescale. Between stages of excavation, material would be backfilled and broken out on recommencing of excavation, until the desired depth is achieved.
Flood Risk	Contractors and Equipment	Locations at which the proposed alignment crosses areas assessed by SEPA to be at risk of fluvial flooding are limited to land in close proximity to the River Duisk and land adjacent to the Cross Water of Luce. Where working in close proximity to larger watercourses (particularly on lower lying areas close to the River Duisk) contractors shall sign up for SEPA's Floodline to receive flood warnings and shall not work in such areas should a flood warning be received. As set out in TA 8.2, larger, temporary watercourse crossings shall be designed to accommodate a 1 in 200 (0.5%) annual probability flood.

8.4.3 Operation

Potential effects during operation are detailed in Table 8.2 below, which also details the relevant receptor and mitigation or control measures, where appropriate.

Table 8.2: Potential Impacts on Hydrology and Hydrogeology during Operation and Relevant Mitigation/Control Measures

Potential Impact	Receptor	Mitigation/Control Measures Proposed
Alteration of shallow groundwater flows due to the installation of wood pole footings.	Groundwater	Given the small scale of footings required for the wood poles any potential impacts of the footings of themselves are considered very unlikely to cause significant alteration to shallow groundwater flows. The design of the proposed development has avoided hydrologically sensitive areas where possible and has ensured appropriate buffer distances between construction elements and watercourses. This would minimise the risk of alterations to surface and groundwater flow patterns
Risk of minor leaks of fuel and hydraulic oil from maintenance vehicles.	Surface water, groundwater and soils	The design of the proposed development has avoided hydrologically sensitive areas where possible and has ensured appropriate buffer distances between construction elements and watercourses. This would minimise the risk of water pollution during the operational phases. Based on appropriate maintenance measures to vehicle and maintenance equipment, the potential for the release of pollutants is considered very unlikely.

TECHNICAL APPENDIX 8 - HYDROLOGY

8.1: Ground Water Dependent Terrestrial Ecosystem Assessment

8.2: Watercourse Crossing Assessment

TECHNICAL APPENDIX 8.1: GROUND WATER DEPENDENT TERRESTRIAL ECOSYSTEM ASSESSMENT

8.1 Introduction

Excavation of soil and bedrock during the construction phase of the proposed development could, if unmitigated or poorly designed, cause localised disruption and interruption to groundwater flow. Interruption of groundwater flow could potentially reduce the supply of groundwater water to Groundwater Dependent Terrestrial Ecosystems (GWDTEs) thereby causing an alteration/change in the quality or quantity of and/or the physical or biological characteristics of the GWDTE. Contamination of groundwater could also cause physical or chemical contamination to the GWDTE.

Following identification of potential GWDTEs from National Vegetation Classification (NVC) mapping data, the hydrological and hydrogeological desktop study information has been used to help qualitatively determine the potential sensitivity of each potential GWDTE.

The assessment has been undertaken in accordance with guidance available from the Scottish Environment Protection Agency (SEPA), including:

- Land Use Planning System (LUPS) Guidance Note 4: Planning Guidance on Onshore Windfarm Developments[1]; and
- LUPS Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems[2].

Further details with regard to each GWDTE identified are provided below. The sensitivity of each of the GWDTE receptors has been classed based upon classifications provided within SEPA's guidance LUPS4.

8.2 Identification of Groundwater Dependent Terrestrial Ecosystems (GWDTE)

As described further in Chapter 7: Ecology and Ornithology and Confidential Technical Appendix 7.3 (Bowland Ecology Preliminary Ecological Appraisal), NVC Surveys were completed to identify potential GWDTEs. NVC surveys were carried out by Ramboll ecologists in August 2019 and further surveying was carried out to the north of Barrhill in June/July 2020 by Bowland Ecology ecologists.

A number of potential Highly and Moderately GWDTE were identified following the NVC surveys. Table 8.1 details the vegetation community types identified within the study area during the NVC surveys.

Table 8.1.1: Vegetation Community Types Identified as Potential GWDTE

NVC Vegetation Community Type	Potential GWDTE Status
M6 *Carex echinata-Sphagnum fallax/denticulatum,* mire	High dependency
M6d Carex echinata-*Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community	High dependency
MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community	Moderate dependency

[1] https://www.sepa.org.uk/media/136117/planning-guidance-on-on-shore-windfarms-developments.pdf
[2] https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf

Table 8.1.1: Vegetation Community Types Identified as Potential GWDTE	
NVC Vegetation Community Type	**Potential GWDTE Status**
M15 *Trichophorum cespitosum Erica tetralix,* wet heath	Moderate dependency
M15d Scirpus cespitosus-Erica tetralix wet heath with Vaccinium myrtillus sub-community	Moderate dependency
M23 *Juncus effusus – Galium,* palustre rush pasture	High dependency
M25 *Molinia caerulea-Potentilla erecta mire*, species-poor	Moderate dependency
M25 *Molinia caerulea-Potentilla erecta,* mire with frequent Myrica gale	Moderate dependency
M25 *Molinia caerulea-Potentilla erecta,* mire with frequent Calluna vulgaris	Moderate dependency
MG9 *Holcus lanatus Deschampsia cespitosa,* grassland	Moderate dependency

GWDTE are sensitive to changes in hydrology and hydrogeology and are a priority under the EU Water Framework Directive. The examples of these habitat types within the field study area are of varying condition and subject to a degree of modification but do include areas of increased diversity and naturalness. However, ecological surveying (Technical Appendix 7.3) identifies that these habitats are not rare and do not support plant species of conservation importance.

8.3 Potential Impacts on GWDTE areas

Given the very small footprint of the installed poles, the potential area of GWDTE vegetation that may be affected by installation of the wood poles is considered to be minimal and not significant, particularly given the widespread presence of such vegetation communities in the context of the ecological study area.

There is a potential, if poorly designed and unmitigated, for excavation of soil and bedrock during the construction phase of the proposed development to cause localised disruption and interruption to groundwater flow. Interruption of groundwater flow would potentially reduce the supply of groundwater r to GWDTEs thereby causing an alteration/change in the quality or quantity of and/or the physical or biological characteristics of the GWDTE. Contamination of groundwater may also cause physical or chemical contamination to the GWDTE. Therefore, there is a requirement to consider potential impacts associated with the construction of roads, tracks or trenches within 100 m of GWDTEs and foundations that require excavation to a depth of greater than 1 m within 250 m of such ecosystems.

A total of 70 proposed wood poles are found to be located within a potential GWDTE area. Of these, 20 proposed poles are found to be within areas classified as Highly GWDTE and the remainder are located within Moderately GWDTE. The proposed locations at which access routes and proposed poles lie within areas considered Moderately or Highly GWDTE are mapped in Figure 8.1.1.

There are three main areas where proposed poles are located on potentially groundwater dependent vegetation communities as follows:

- Land in close proximity to forestry plantations to the north of Barrhill, between poles 26 and 35;

- Grazed marshy grassland between Barrhill and the Arecleoch Forest,; and
- Peatland mire/wet heath habitats to the west of Arecleoch Forest.

Details of intersections between Moderately or Highly GWDTE are included in Table 8.1.2 below. These are described from north to south, matching Figure 7.5: GWDTE.

Table 8.1.2: Proposed Pole Locations within Potential GWDTE areas.

Pole_ID	X coordinate	Y coordinate	Potential GWDTE Classification	NVC Community
26	224292	583860	Moderate	Spp -poor M25 *Molinia caerulea-Potentilla erecta* mire
28	224342	583670	Moderate	Spp-poor M25 *Molinia caerulea-Potentilla erecta* mire
29	224368	583576	High/Moderate	M23b M25 mosaic *Juncus effusus - Galium palustre* rush-pasture and *Molinia caerulea-Potentilla erecta* mire
30	224393	583483	High	M23b *Juncus effusus - Galium palustre* rush-pasture
31	224418	583388	High/Moderate	M23b M25 mosaic *Juncus effusus - Galium palustre* rush-pasture and *Molinia caerulea-Potentilla erecta* mire
34	224324	583156	High/Moderate	M23b/M25 *Juncus effusus - Galium palustre* rush-pasture and *Molinia caerulea-Potentilla erecta* mire
34	224324	583156	High	M23b M25 mosaic *Juncus effusus - Galium palustre* rush-pasture and *Molinia caerulea-Potentilla erecta* mire
35	224263	583083	High/Moderate	M23b/M25 *Juncus effusus - Galium palustre* rush-pasture and *Molinia caerulea-Potentilla erecta* mire
35	224263	583083	High	M23b M25 mosaic *Juncus effusus - Galium palustre* rush-pasture and *Molinia caerulea-Potentilla erecta* mire
50	224091	581747	High	M23b *Juncus effusus - Galium palustre* rush-pasture
58	223516	581339	Moderately	M25 *Molinia caerulea-Potentilla erecta* mire
60	223338	581295	Moderately	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
61	223257	581237	Moderately	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community

Table 8.1.2: Proposed Pole Locations within Potential GWDTE areas.				
Pole_ID	**X coordinate**	**Y coordinate**	**Potential GWDTE Classification**	**NVC Community**
62	223178	581180	Moderately	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
63	223101	581124	Moderate	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
64	223026	581070	Moderate	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
65	222950	581015	Moderate	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
66	222878	580962	Moderate	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
67	222790	580924	Moderate	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
70	222520	580808	Moderate	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
71	222450	580738	Moderate	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
72	222378	580667	Moderate	MG10a *Holcus lanatus-Juncus effusus* rush pasture with typical sub-community
75	222164	580472	Moderate	M25 *Molinia caerulea-Potentilla erecta* mire
77	222004	580348	Moderate	M25 *Molinia caerulea-Potentilla erecta* mire
79	221945	580160	Moderate	M25 *Molinia caerulea-Potentilla erecta* mire
80	221917	580068	Moderate	M25 *Molinia caerulea-Potentilla erecta* mire
83	221956	579794	Moderate	M25 *Molinia caerulea-Potentilla erecta* mire
97	221289	578776	Moderate	M25 *Molinia caerulea-Potentilla erecta* mire
99	221193	578617	Moderate	M25 *Molinia caerulea-Potentilla erecta* mire
109	220662	577804	Moderate	M25 *Molinia caerulea-Potentilla erecta* mire

Table 8.1.2: Proposed Pole Locations within Potential GWDTE areas.				
Pole_ID	**X coordinate**	**Y coordinate**	**Potential GWDTE Classification**	**NVC Community**
110	220583	577743	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
111	220505	577681	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
112	220436	577629	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
113	220358	577568	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
115	220282	577382	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
116	220243	577288	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
117	220211	577210	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
118	220179	577133	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
119	220119	577079	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
120	220064	577029	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
121	220014	576983	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
122	219941	576997	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
123	219921	577001	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
124	220075	577017	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
125	220133	576955	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community

Table 8.1.2: Proposed Pole Locations within Potential GWDTE areas.				
Pole_ID	**X coordinate**	**Y coordinate**	**Potential GWDTE Classification**	**NVC Community**
126	220122	576864	High	M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire with *Juncus acutiflorus* sub-community
127	220110	576774	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
128	220059	576686	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
129	220008	576600	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
130	219957	576512	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
131	219904	576422	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
132	219852	576334	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
133	219803	576249	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
134	219751	576161	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
140	219337	575714	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
141	219271	575642	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
142	219201	575567	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
143	219133	575493	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
144	219068	575423	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
156	218150	574739	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community

Table 8.1.2: Proposed Pole Locations within Potential GWDTE areas.				
Pole_ID	**X coordinate**	**Y coordinate**	**Potential GWDTE Classification**	**NVC Community**
157	218117	574647	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
158	218081	574550	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
160	218010	574356	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
161	217962	574264	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
162	217915	574175	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
163	217870	574090	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
164	217820	573994	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
165	217771	573901	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
166	217722	573808	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community
169	217584	573546	Moderate	M15d *Scirpus cespitosus-Erica tetralix* wet heath with *Vaccinium myrtillus* sub-community

Ecological surveys confirmed that examples of these habitat types within the study area are of varying condition and subject to a degree of modification. Therefore, risks to potentially sensitive areas can be mitigated by micro-siting of the proposed development away from the most sensitive habitat areas.

Based on the implementation of mitigation and good practice measures as identified in Chapter 8 and below, it is not anticipated that utilisation of temporary tracks, construction of the OHL and installation of poles would lead to the impediment of groundwater supplies.

8.4 Mitigation

Construction methods and operational design of the access tracks should be developed in such a way that interruption to the flow of groundwater through compaction is minimised. Furthermore, the installation of footings or foundations should be conducted in such a way as to minimise interruptions to groundwater flow or reduction in the quality of groundwater.

Where possible, existing tracks or roads would be used to access the proposed wood pole locations. Where this is not possible, temporary floating bog mats and temporary track mats would be used to provide access and, in certain situations, helicopters may be used for pole delivery to point of installation. Access, delivery and assembling would be carried out using a tracked excavator and low ground-pressure vehicles (e.g. tractor, argocat, quad bikes). All access tracks would be temporary and therefore no direct loss of potential GWDTE habitats is anticipated. Such measures would ensure that no direct loss to habitat would occur as a result of the transport of plant or materials. It is therefore considered that the potential impact of temporary access routes on GWDTE areas would be negligible.

Construction areas would be established around individual poles (a 20x20 m area demarked by plastic cones). During construction, disturbance to soils or topsoils would be minimised and no welfare facilities or material storage and handling areas would be sited at the pole locations (these activities would be carried out at temporary construction compound locations). Activities to be carried out at the pole locations are therefore considered to be of a minimal risk to shallow groundwaters that may support potential GWDTE areas. Were minor spills or leaks to occur from plant during the construction phase, a suitable spill kit would be held by the construction team. It is therefore considered that potential risks to GWDTE from construction activity would be negligible.

Furthermore, the following measures are considered suitable to mitigate potential impacts of the proposed development on GWDTE:

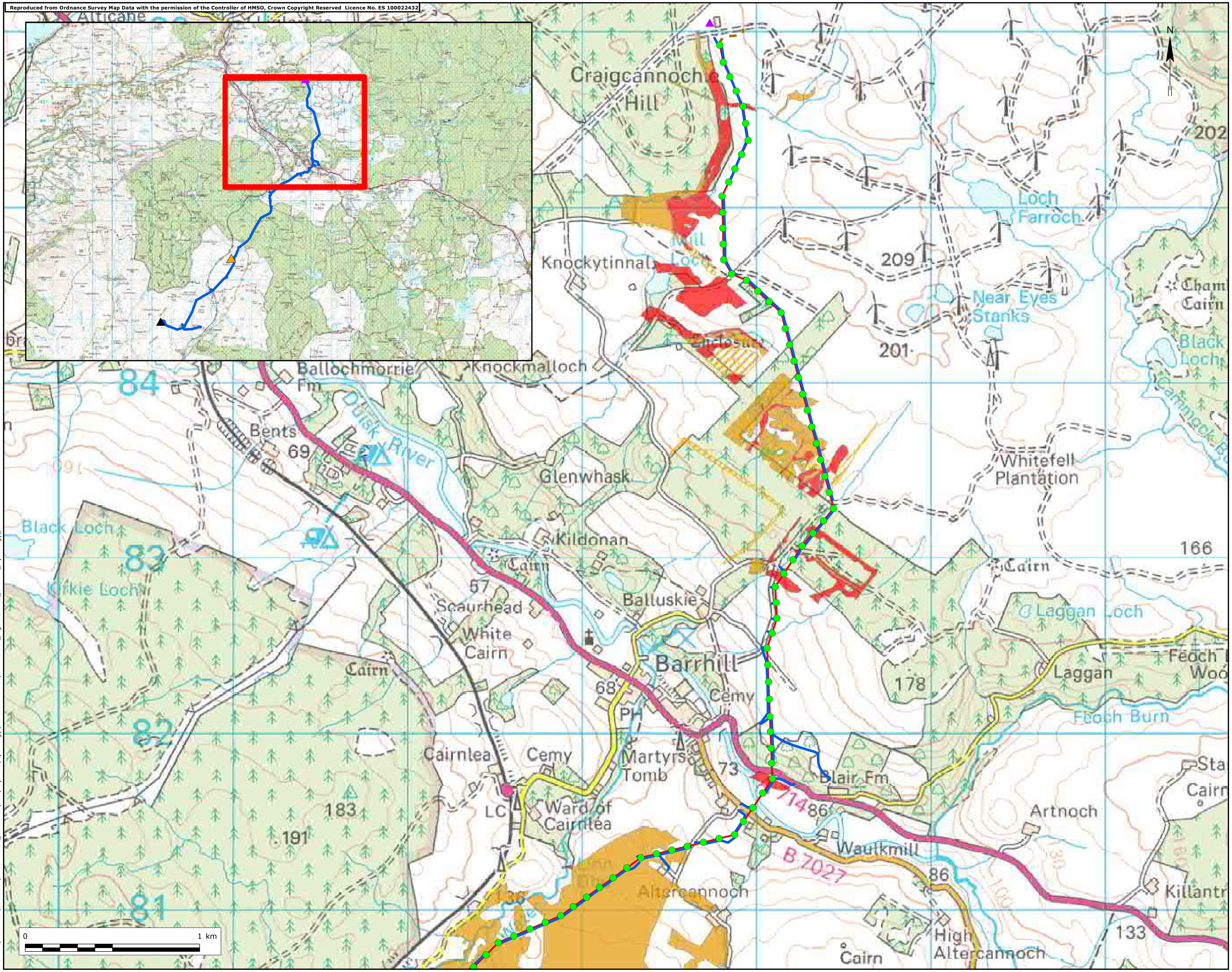
- At all construction works areas, clean runoff (i.e. non-silty surface water flow, including that which has not passed over any disturbed construction areas) would be kept separate from potentially contaminated water from construction areas as far as possible. Where required, interceptor ditches and other drainage diversion measures would be installed immediately in advance of any excavation works in order to collect and divert clean runoff away from construction disturbed areas;
- Incorporation of Highly and Moderately GWDTE within the Construction Environmental Management Plan (CEMP), with reference to high sensitivity locations as defined by NVC assessments;
- Where dewatering may be required, waters would be distributed to a suitable vegetated area, incorporating the use of silt traps to ensure distribution of waters across the vegetated surface;
- Minimising the extent of construction work within wetland and blanket bog habitat including GWDTE, considering both track and tower construction work. Excavation works, including the development of borrow pits, would be undertaken in accordance with PAN 50; and
- Clear delineation of areas supporting priority species through pre-construction protected species survey.

The following controls would be incorporated into the development of construction methodologies during detailed design stage in respect of works in all areas of peat:

- Appropriately experienced and qualified engineering geologist/geotechnical engineer would be appointed during the construction phase, to provide advice during the setting out, micro-siting and construction phases of the works;
- Careful micro-siting of pole bases and access track alignments would be undertaken to minimise effects on the prevailing hydrology;
- Reinstatement of excavated peat material to as-before conditions, avoiding the creation of preferential drainage paths;

- Turfs lifted from the pole installation locations shall be stored for a minimum period of time possible, to avoid drying, and reinstated to a slightly raised position to allow for settling of reinstated material; and
- Use of floating track and bog mats for access to pole installation sites and the use of tracked vehicles/ low ground-pressure vehicles during installation to prevent damage to vegetation communities and avoid compaction and alteration to shallow groundwater flows.

Taking in to account the proposed best practice and mitigation measures outlined, it is considered that there shall be no residual impacts to GWDTE during the construction phase. On this basis, the potential effects of the installation of wood poles in areas of potential GWDTE identified are considered to be negligible.



SP ENERGY NETWORKS

Key

GWDTE

NVC Class

- High Potential
- Moderate Potential
- Non-GWDTE
- Consented Chirmorie Substation
- Mark Hill Substation
- Proposed Pole Locations
- Consented Stranoch Substation
- Indicative
- Proposed Alignment
- Underground Cable (Permitted Development)

Title	Figure 8.1.1 (a) GWDTE
Project No.	UK12-22885
Site	Stranoch and Chirmorie Wind Farms Grid Connection
Client	SP Energy Networks
Date	September 2021
Scale	1:20,000 @ A3
Issue	2
Drawn by	JT

RAMBOLL

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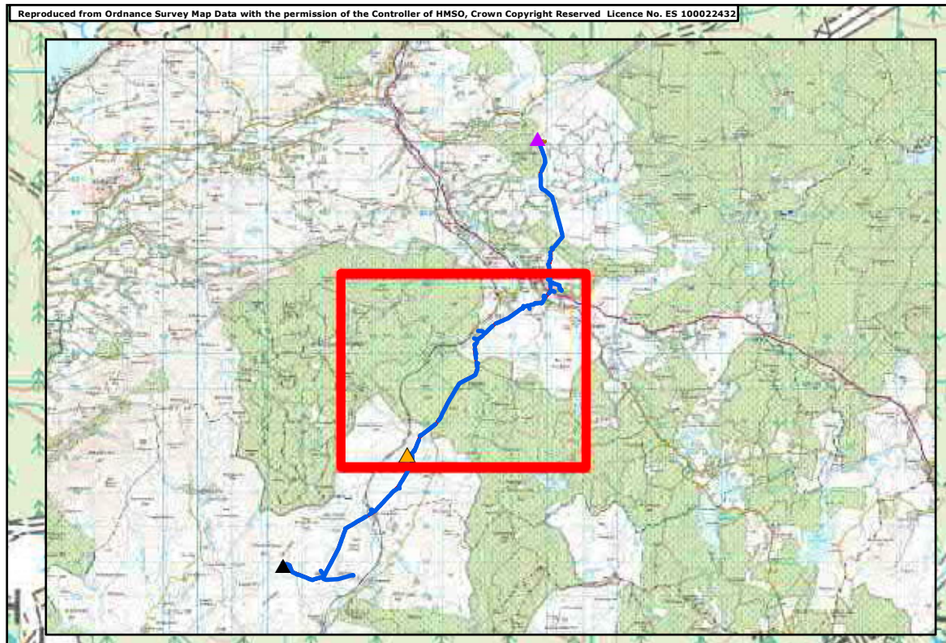

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SP ENERGY NETWORKS

Key

GWDTE

NVC Class

- High Potential
- Moderate Potential
- Non-GWDTE
- Consented Chirmorie Substation
- Mark Hill Substation
- Proposed Pole Locations
- Consented Stranoch Substation
- Indicative Access
- Proposed Alignment
- Underground Cable (Permitted Development)

Title	Figure 8.1.1 (b) GWDTE
Project No.	UK12-22885
Site	Stranoch and Chirmorie Wind Farms Grid Connection
Client	SP Energy Networks
Date	September 2021
Scale	1:20,000 @ A3
Issue	2
Drawn by	JT

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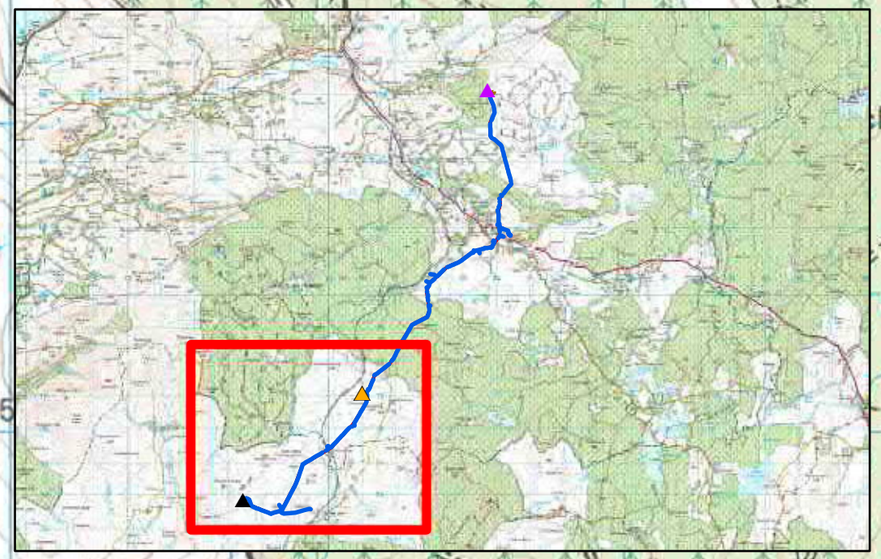

Standard Knowe
249
Chirmorrie
Chirmorie Cairn
260
221
195
Cairn
288
Ardnamoil
Craigoch Burn
Pilhatchie Burn
Cairn Kenny
Chambered Cairn
High Murdonochee
275
Drumahastie
Far Cairn
296
Near Cairn
Cairn
Studie Knowe
265
Mid Hill
230
Corly Craig
Craigoch
Cross Water of Luce
Pitwhirn Burn
Markdhu
LC
Miltonise
Liggat Hill
White
286
78
77
76
75
74
73
N
0
1 km

SP ENERGY NETWORKS

Key

GWDTE

NVC Class

- High Potential
- Moderate Potential
- Non-GWDTE
- Consented Chirmorie Substation
- Mark Hill Substation
- Proposed Pole Locations
- Consented Stranoch Substation
- Indicative Access
- Proposed Alignment
- Underground Cable (Permitted Development)

Title	Figure 8.1.1 (c) GWDTE
Project No.	UK12-22885
Site	Stranoch and Chirmorie Wind Farms Grid Connection
Client	SP Energy Networks
Date	September 2021
Scale	1:20,000 @ A3
Issue	2
Drawn by	JT

RAMBOLL

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TECHNICAL APPENDIX 8.2: WATERCOURSE CROSSING ASSESSMENT

8.1 Introduction

As part of the EA process, it was identified that several new watercourse crossings would be required. This Technical Appendix has been produced in order to meet the requirements of the Water Framework Directive (WFD)[1] as set out below.

The purpose of this Technical Appendix is to provide a conceptual assessment of watercourse crossings and to outline the strategic approach to proposed crossings. This Technical Appendix does not comment on the detailed engineering design. Post-consent of the proposed development, the Principal Contractor (the 'Contractor') would have overall responsibility for designing water crossings, for the production of a final Watercourse Crossing Plan and for compliance with Controlled Activity Regulations (CAR)[2] and the Scottish Environment Protection Agency's (SEPA's) good practice guidance (further described below).

Field surveys of likely watercourse crossings, based on the layout of the proposed development have been used to determine the bed width, channel depth, bed substrate and bankside vegetation to identify the likely level of authorisation required. This Technical Appendix also sets out the general principles of design which the Contractor would be required to follow in order to minimise changes to the hydrological regime and reduce any potential impacts on river morphology and aquatic ecology.

8.2 Legislation

The principal legislation with regard to the water environment is provided by the WFD which aims to protect and enhance the quality of surface freshwater (including lakes, rivers and streams), groundwater, Groundwater Dependent Terrestrial Ecosystems (GWDTEs), estuaries and coastal waters. The key objectives of the WFD relevant to this assessment are:

- to prevent deterioration and enhance aquatic ecosystems; and
- to establish a framework of protection of surface freshwater and groundwater.

The WFD has been transposed into Scottish legislation as the Water Environment and Water Services (Scotland) Act 2003 (WEWS Act), which gives Scottish Ministers powers to introduce regulatory controls over water activities, in order to protect, improve and promote sustainable use of Scotland's water environment. The water environment includes wetlands, rivers, lochs, transitional waters (estuaries), coastal waters and groundwater. The CAR came into force in 2011 and has since been amended in 2013 and 2017.

SEPA is the public body responsible for environmental protection in Scotland under both the Environment Act 1995 and the WEWS Act. Many SEPA policies relating to water are now delivered by the regulatory methods produced to implement the CAR. The CAR means it is an offence to undertake the following activities with regard to watercourse crossings without an authorisation under the CAR:

- discharges to all wetlands, surface waters and groundwaters (replacing the Control of Pollution Act 1974);
- impoundments (dams and weirs) of rivers, lochs, wetlands and transitional waters; and
- undertaking of engineering works in inland waters and wetlands.

[1] The Water Framework Directive (WFD) (2000/60/EC)
[2] Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR)

Any proposed access track water crossings would, therefore, require authorisation under the CAR. This Technical Appendix takes into account guidance provided by SEPA with regards to the implementation of CAR[3].

The SEPA Position Statement on Culverting of Watercourses (WAT-PS-06-02)[4] and Supporting Guidance on Sediment Management (WAT-SG-78)[5] have also been taken into account within this Technical Appendix, along with the supporting guidance provided in the River Crossings Good Practice Guide[6].

8.3 Identification of Watercourse Crossing Locations

Field surveys of potential watercourse crossings were carried out along the proposed alignment and proposed temporary access routes. The surveys were completed by Ramboll ecologists in August 2019 and further surveying was carried out on the proposed alignment to the north of Barrhill in June/July 2020 by Bowland Ecology ecologists. A total of twenty four potential watercourse crossings were identified and are presented in Figure 8.2.2.

Photographs of the identified locations are presented in Appendix 8.2.1. The average channel width and depth, as well as the bed substrate material and the species recorded on the channel banks, are presented in Table 8.2.1.

Table 8.2.1: Watercourse Crossing Details

WCC Reference	Grid reference	Stream Width (cm)	Channel Width (cm)	Stream Depth (cm)	Gradient	Substrate
1	NX 23907 85579	140	170	10	Gentle	Earth and pebbles.
2	NX 23917 85354	40	50	10	Gentle	Earth
3	NX 23807 85112	55	55	4	Gentle	Earth and pebbles.
4	NX 23698 84789	30	40	25	Gentle	Earth
5	NX 24411 83322	100	100	20	Steep	Pebbles and boulders
6	NX 24094 82565	60	90	10	Gradual	Cobbles and boulders
7	NX 24051 81746	30	30	8	Vertical	Silt and cobbles
8	NX 23997 81628	1000	1000	1500	Flat	Boulders and cobbles
9	NX23370 81295	100	70	15	Gentle	Pebbles and cobbles
10*	NX 23353 81299	Not Known	Not Known	Not Known	Not Known	Not Known

[3] SEPA (2019) The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended): A Practical Guide, Version 8.4, October 2019, https://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf [Last Accessed September 2020]
[4] SEPA (2015), SEPA Position Statement to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2011: WAT-PS-06-02: Culverting of Watercourses Position Statement and Supporting Guidance. Version 2.0, June 2015. https://www.sepa.org.uk/media/150919/wat_ps_06_02.pdf [Last accessed September 2020]
[5] SEPA (2012), Supporting Guidance (WAT-SG-78) Sediment Management Authorisation (replacing WAT-PS-06-03), Version 1, December 2012, https://www.sepa.org.uk/media/151062/wat-sg-78.pdf [Last accessed September 2020)
[6] https://www.sepa.org.uk/media/151036/wat-sg-25.pdf

Table 8.2.1: Watercourse Crossing Details						
WCC Reference	**Grid reference**	**Stream Width (cm)**	**Channel Width (cm)**	**Stream Depth (cm)**	**Gradient**	**Substrate**
11	NX23319 81249	150	100	5	Gentle	Mud
12*	NX 22972 81031	Not Known	Not Known	Not Known	Not Known	Not Known
13	NX22462 80766	400	100	10	Moderate	Pebbles and cobbles
14	NX22108 80548	200	200	100	Gentle	Mud
15	NX 20893 78011	30	30	40	Gentle	Earth
16	NX20355 77516	150	100	50	Gentle	Mud
17	NX19905 76393	100	50	25	Gentle	Peat/mud
17b*	NX 19718 76162	Not Known	Not Known	Not Known	Not Known	Not Known
18	NX18904 75330	500	500	100	Gentle	Boulders
19	NX18452 75054	50	50	50	Gentle	Peat
20	NX18156 74652	200	200	100	Gentle	Peat/mud
21	NX17990 74324	200	200	100	Gentle	Peat/mud
22	NX17812 74024	25	25	5	Gentle	Peat/mud
23	NX16850 73615	100	100	50	Gentle	Peat
*Direct survey not carried out due to change in layout following the site visit. Stream conditions were determined from nearby survey where appropriate and aerial photography for the site.						

8.4 Type of Crossings

All watercourse crossings would be temporary and limited to the construction phase of the proposed development. As set out in Chapter 2, crossings of minor streams and drains would be via bog mats laid to the stream bed. It is anticipated that such crossings would be micro-sited such that sensitive areas are avoided and damage to bank integrity is avoided. At some locations, temporary bridging locations may be employed. Where temporary bridging solutions are required, it is anticipated that such structures would require a minimum of bankside engineering and would be removed in their entirety following the successful crossing of watercourses.

Given the minor and temporary nature of the proposed crossings, it is considered highly unlikely that watercourse crossings installed during the construction of the OHL would impact stream ecology, stream hydromorphology or the passage of mammals along the watercourses.

8.5 CAR Authorisations

As set out previously, the CAR advise on which activities are regulated by SEPA. In particular, Section 6 of the Water Environment Regulation Practical Guide3 sets out that CAR requires authorisation for the carrying out of building or engineering works, or works other than impounding works in:

- inland surface water (other than groundwater) or wetland; or
- in the vicinity of inland water or wetlands and having, or likely to have, a significant adverse impact on the water environment.

In order to allow for proportionate regulation based on the risk an activity poses to the water environment, there are three types of CAR authorisation as described in the following paragraphs.

8.6 Levels of Authorisation

8.6.1 General Binding Rules

General Binding Rules (GBRs) represent a set of mandatory rules which cover specific low risk activities. Activities complying with the rules do not require an application to be made to SEPA, as compliance with a GBR is considered to be compliance with an authorisation.

SEPA uses its statutory role in the land use planning system to highlight GBRs that may apply to a given proposal. The individual GBRs are described in more detail in the appropriate regime-specific sections of the Water Environment Regulation Practical Guide. The GBRs are numbered according to Schedule 3 of the CAR.

8.6.2 Registrations

Registrations allow for the registration of small-scale activities that individually pose low environmental risk but, cumulatively, can result in greater environmental risk. The Contractor must apply to SEPA to register these activities. A registration will include details of the scale of the activity and its location, and there will be a number of conditions of registration that must be complied with.

8.6.3 Licences

These allow for site-specific conditions to be set to protect the water environment from activities that pose a higher risk. Licences can cover linked activities on a number of sites over a wide area, as well as single or multiple activities on a single site. SEPA has simple licences and complex licences for activities.

A key feature of CAR licences, unlike GBRs and registrations, is that they require an applicant to nominate a 'responsible person' (i.e. an individual/partnership/company) to be held accountable for securing compliance with the terms of the licence.

8.7 Requirements for Bridges and Other Crossings

The detailed design of crossings for the proposed development would include the application to SEPA for the necessary consents under CAR.

8.7.1 Likely Levels of CAR Authorisation

At the majority of crossings, it is anticipated that the use of bog mats to cross minor streams would constitute minor crossings of a low risk to the watercourses. Where watercourse flows

make crossings with bog mats minor, temporary crossings would be employed. Minor crossings with no construction on the bed or banks are authorised under General Binding Rules. Furthermore, temporary crossings that are less than 5 m wide are also authorised under General Binding Rule 6[3].

It is anticipated that, at locations for which a bridge crossing would be required, bridges would be designed with no construction on bed and ≤20 m of total bank affected. As such, the structure would be authorised under Registration (classified as Activity F according to CAR guidelines[3]).

Watercourse Crossings

Watercourse crossings would comprise fording of minor watercourses, with the use of bog mats and temporary bridging solutions also likely in places. The use of bog mats may be appropriate where crossings are required for very small watercourses, and for crossing features such as cut drains or small ditches. Where temporary crossings are necessary, SEPA good practice measures would be followed[7], as summarised below:

- Engineering would not be carried out on the river banks, and crossings would not impede their natural function or require their realignment;
- Crossings would take in to account fish passage (with the use of temporary culvert only if designed and constructed so that fish may pass);
- Particular attention would be paid to preventing silty or sediment laden run-off from temporary crossings entering watercourses (e.g. deck would be lined and an edge upstand installed).
- Crossing design would take in to account potential flood flows and would be designed to accommodate a 1 in 200 (0.5%) annual probability flow. The design of each watercourse crossing would seek to ensure hydraulic conveyance is maintained to prevent any restriction of flows, as well as allowing the free passage of mammals and aquatic ecology.

On removal of temporary crossings, the watercourse would be reinstated as close to the pre-installation situation as possible.

Measures preventing the release of sediments or pollutants would be set out according to SEPA requirements and construction best practice, and would be delivered by means of a detailed Construction Environmental Management Plan (CEMP) to be prepared by the Contractor post consent.

[7] SEPA, 2009. Engineering in the Water Environment Good Practice Guide Temporary Construction Methods (WAT_SG_29)

Photo 1. Crossing 1, Upstream

Photo 2. Crossing 1, Downstream

Photo 3. Crossing 2, Upstream

Photo 4. Crossing 2, Downstream

Photo 5. Crossing 3, Upstream

Photo 6. Crossing 3, Downstream

Photo 7. Crossing 4, Upstream, photo 180m downstream

Photo 8. Crossing 4, Downstream, photo 180m downstream

Photo 9. Crossing 5, Upstream

Photo 10. Crossing 5, Downstream

Photo 11. Crossing 6, Upstream

Photo 12. Crossing 6, Downstream

Title: TA8.2Watercourse Crossings, Appendix 8.2.1	**Client:** SP Energy Networks
Site: Stranoch and Chirmorie grid connection	**Date:** 24/11/2020

Photo 13. Crossing 7, Upstream

Photo 14. Crossing 7, Downstream

Photo 15. Crossing 8, Upstream

Photo 16. Crossing 8, Downstream

Photo 17. Crossing 9, Upstream

Photo 18. Crossing 9, Downstream

Photo 19. Crossing 11, Upstream

Photo 20. Crossing 11, Downstream

Photo 21. Crossing 13, Upstream

Photo 22. Crossing 13, Downstream

Photo 23. Crossing 14, Upstream

Photo 24. Crossing 14, Downstream

Photo 25. Crossing 15, Upstream

Photo 26. Crossing 15, Downstream

Photo 27. Crossing 16, Upstream

Photo 28. Crossing 16, Downstream

Photo 29. Crossing 17 a, Upstream

Photo 30. Crossing 17 a, Downstream (17b approximately 300m downstream on same watercourse)

Photo 31. Crossing 18, Upstream

Photo 32. Crossing 18, Downstream

Photo 33. Crossing 19, Upstream

Photo 34. Crossing 19, Downstream

Photo 35. Crossing 20, Upstream

Photo 36. Crossing 20, Downstream

Photo 37. Crossing 21, Upstream

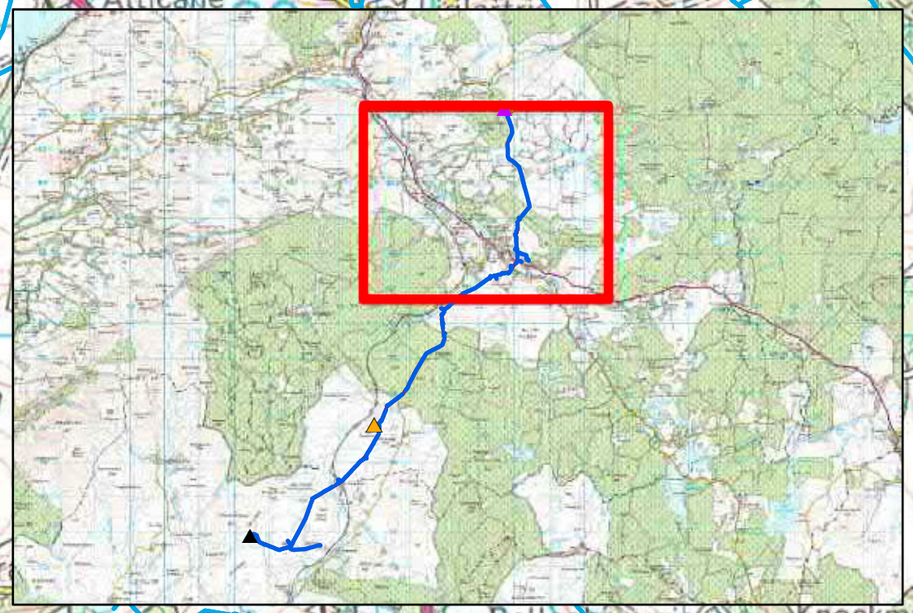
Photo 38. Crossing 21, Downstream

Photo 39. Crossing 22, Upstream

Photo 40. Crossing 22, Downstream

Photo 41. Crossing 23, Upstream

Photo 42. Crossing 23, Downstream



Craigcannochie Hill
Knockytinnal
Mill Loch
Enclosure
Knockmalloch
Ballochmorrie Fm
Bents
Duisk River
Glenwhask
Kildonan
Cairn
Scaurhead
White Cairn
Balluskie
Barrhill
Cemy
PH
Martyrs Tomb
Cairnlea
Ward of Cairnlea
LC
Linn Burn
Altercannoch
Loch Farroch
Near Eyes Stanks
Whitefell Plantation
Laggan Loch
Laggan
Feoch Burn
Blair Fm
Waulkmill
Artnoch
High Altercannoch
Black Loch
Kirkie Loch
Cairnmook Burn
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136
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SP ENERGY NETWORKS

Key

- Surface Water Features (OS 1:10k)
- Watercourse Crossings
- Consented Chirmorie Substation
- Mark Hill Substation
- Proposed Pole Locations
- Consented Stranoch Substation
- Indicative Access
- Proposed Alignment
- Underground Cable (Permitted Development)

Title	Figure 8.2.2 (a) Watercourse Crossings
Project No.	UK12-22885
Site	Stranoch and Chirmorie Wind Farms Grid Connection
Client	SP Energy Networks
Date	September 2021
Scale	1:20,000 @ A3
Issue	2
Drawn by	JT

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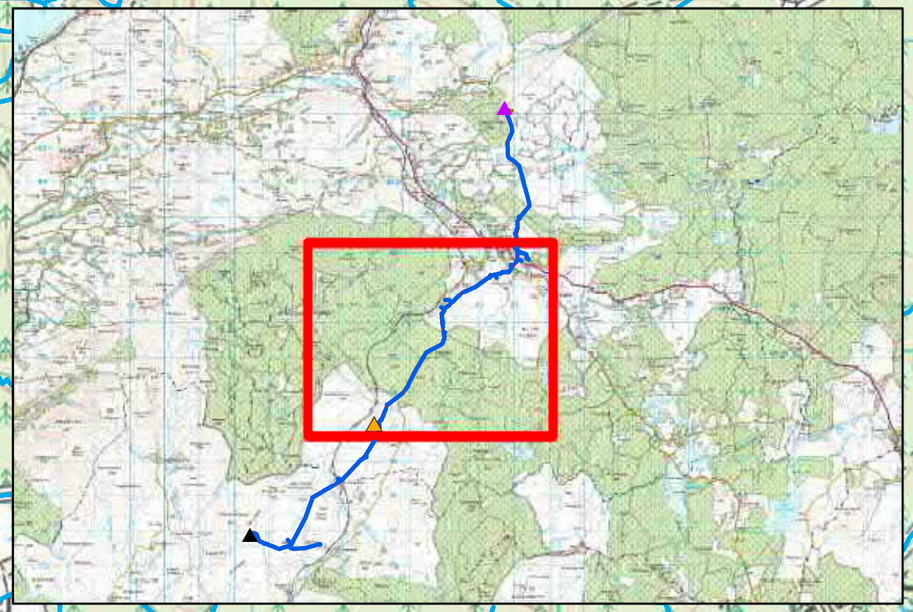

N

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SP ENERGY NETWORKS

Key

- Surface Water Features (OS 1:10K)
- Watercourse Crossings
- Consented Chirmorie Substation
- Mark Hill Substation
- Proposed Pole Locations
- Consented Stranoch Substation
- Indicative Access
- Proposed Alignment
- Underground Cable (Permitted Development)

Title	Figure 8.2.2 (b) Watercourse Crossings
Project No.	UK12-22885
Site	Stranoch and Chirmorie Wind Farms Grid Connection
Client	SP Energy Networks
Date	September 2021
Scale	1:20,000 @ A3
Issue	2
Drawn by	JT

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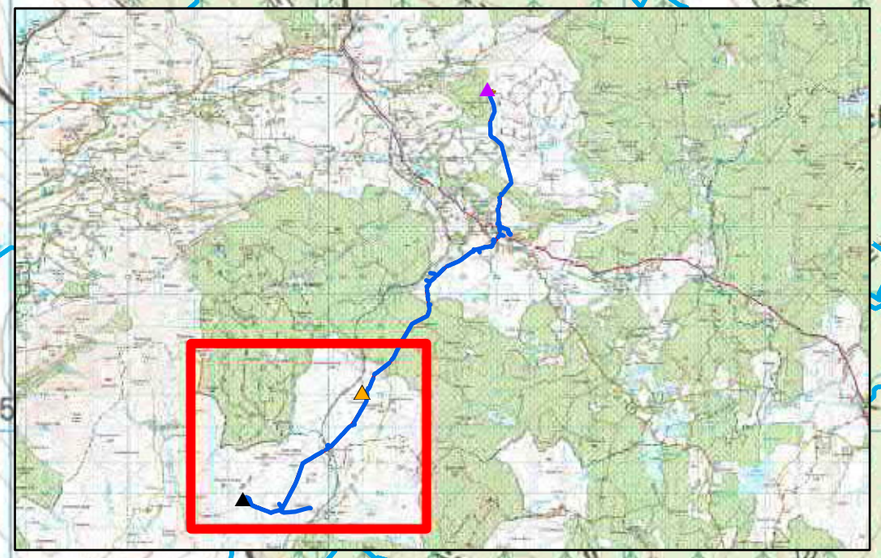

Standard Knowe
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Wee Chirmorie
Chirmorie Cairn
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22
23
Cairn
288
Ardnamoil
Craigoch Burn
Cairn Kenny
Chambered Cairn
High Murdonochee
275
Cairn
Drumahastie
Far Cairn
296
Near Cairn
Cross Water of Luce
Pilbatchie Burn
Studie Knowe
265
Mid Hill
230
Corly Craig
Craigoch
Markdhu
Mains Cairn
LC
Miltonise
Pitwhirn Burn
Liggat Hill
White
286
78
77
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75
74
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SP ENERGY NETWORKS

Key

- Surface Water Features (OS 1:10K)
- Watercourse Crossings
- Consented Chirmorie Substation
- Mark Hill Substation
- Proposed Pole Locations
- Consented Stranoch Substation
- Indicative Access
- Proposed Alignment
- Underground Cable (Permitted Development)

Title	Figure 8.2.2 (c) Watercourse Crossings
Project No.	UK12-22885
Site	Stranoch and Chirmorie Wind Farms Grid Connection
Client	SP Energy Networks
Date	September 2021
Scale	1:20,000 @ A3
Issue	2
Drawn by	JT

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9. FORESTRY APPRAISAL

9.1 Introduction

This chapter identifies the likely impacts on forestry and woodland associated with the construction and operation of the proposed development and provides details of control measures where appropriate. The specific objectives of the chapter are to:

- describe the baseline forestry environment;
- identify the potential direct and indirect impacts on forestry receptors; and
- describe any mitigation or control measures proposed to address likely impacts.

Figures 9.1 and 9.2 are referenced in the text where relevant.

This appraisal has been carried out by Norman O'Neill BSc For, MICFor, CEnv and Wojciech Dlugolecki MSc For, both of RTS Forestry.

9.2 Methodology

9.2.1 Study Areas

The proposed alignment is approximately 16 km in length, as shown on Figure 2.1. Non-forestry land areas within the Infrastructure Location Allowance (ILA) have been scoped out of this report. Open land areas were checked through the Scottish Forestry Public register to confirm whether any new planting applications were in place but works had not been started.

To guarantee the long-term operational resilience of the connection, a 60 m wide resilience corridor is proposed (30 m each side of the final alignment). This is an area of land secured by a landowner agreement in the form of a wayleave or a servitude and which prevents future development or planting within it which might affect the lifespan and operation of the OHL.

This appraisal identified that, of the 16 km connection length, 4.0 km passes through areas of forestry. Where the corridor passes through woodland these areas area identified within Figure 9.1 and coloured to identify the proposed treatment of the associated trees. In addition, desk study and site surveys identified a number of farm shelterbelts and occasional trees which would be impacted upon by the proposed development. The potential impact of windthrow to semi-mature and mature forest areas immediately adjoining the wayleave corridor have also been assessed.

The study area was taken as the wayleave corridor for all areas, with the exception of sites where the proposed alignment passes through areas of semi-mature or mature conifer forest. In these areas, the study area was extended out to windfirm boundaries.

9.2.2 Desk Study

The desk study reviewed the following data:

- Ordnance Survey and aerial photography (dated May 2017) mapping available for the area;
- Land Management Plans, compartment schedules;
- GIS data indicating the location of the proposed development, including proposed pole locations;
- Scottish Forestry – The Native Woodland Survey of Scotland data (NWSS 2014).

9.2.3 Field Survey

The field study site visits were undertaken on 18th and 20th March 2020 and comprised the following:

- ground truthing of existing desk study site information; and
- recording the main criteria of forestry blocks likely to be affected by the proposed development, including; tree species, height and tree stocking density, ground conditions (topography and soils) and the trees future potential heights at natural or commercial maturity. This information was then developed to deliver the proposed treatment of each area of trees and is described within Figure 9.1

9.2.4 Appraisal of Potential Impacts

The approach to this appraisal comprised the following stages:

- establish the existing conditions;
- identify likely impacts and effects on forestry;
- assess whether each likely effect is adverse or beneficial in nature; and
- where an effect is likely to be adverse, identify measures to avoid, reduce or mitigate such effects.

9.3 Baseline Conditions

The proposed alignment passes areas of open hill farmland, as well as a number of forest sites and areas with individual trees in farm hedgerows.

The baseline conditions of the woodlands within the ILA and associated wayleave corridor are described in Table 9.1 below.

Table 9.1: Baseline Conditions

Ref	Land use	Proposed pole numbers	Total area (ha)	Description
1	Mature or semi mature broadleaves	24-37; 47-57	1.73	Mature Birch/ Willow woodlands. 14-20 m height
2	Young broadleaves	2-11; 47-49; 90-94	4.37	2000-2015 planted. 1.5 m – 8 m high.
3	Individual predominately broadleaf trees	24; 35-39; 49-57	0.26	Mature individual trees.
4	Conifers forest	24-35; 92-104	5.92	Mature Conifers 20-30 m height
5	Conifer forest at risk of Windthrow	92-104	15.21	Mature conifers 20-30 m height outside of the 60 m corridor.
6	Young conifer forest	92	0.44	2015 planted. 1.5 m high.
7	Clearfelled forest 2015	83-92	3.28	2015 Clearfell with natural regeneration.
8	Clearfelled forest 2019	35; 104-108	2.76	Clearfell, stumps.
9	Open ground		2.65	Open ground within forest land.

Item 3 in Table 9.1 above comprises 13 mature or semi mature individual trees. Nine (9) of these individual trees are deemed to be of greater importance to the landscape and cultural heritage as they are over 50 years old and with diameter at breast height of over 60 cm.

Further details as to the location and nature of these individual trees is given in Table 9.2 below.

Table 9.2: Mature or Semi-Mature Trees within the Study Area

ID	Species	Height (m)	Diameter (cm)	Age
1	Sycamore	16	100	50
2	Beech	19	120	100
3	Sycamore	14	30	30
4	Ash	14	30	30
5	Ash	17	130	80
6	Beech	13	83	80
7	Beech	14	50	70
8	Beech	14	65	70
9	Beech	14	70	70
10	Beech	10	33	70
11	Beech	8	20	70
12	Beech	16	90	70
13	Beech	14	60	70

9.4 Potential Impacts and Mitigation

9.4.1 Construction

The preferred route has been chosen to avoid areas of forestry where possible. In addition, the Applicant has considered opportunities to reduce tree clearance by use of a vegetation management system whereby certain areas of trees would have their height limited by pruning and crown reduction through an ongoing programme of works. This proposal is limited to the higher valued areas of individual broadleaf trees within the wayleave corridor. For those trees where long-term pruning and/or crown reduction to avoid the need for complete removal has been considered, the assessment has taken into account the anticipated growth rates of the various tree species surveyed. This assessment has delivered the following grouped actions

- 25 m wide (12.5 m either side of centre line) corridor directly under the OHL to remain free of trees. This is grouped as "Remove" in Table 9.3, below.
- 25-48 m wide corridor (12.5 – 24 m sections each side of the centre line) with trees which will achieve a maximum height at maturity of 8 -20 m (Blackthorn, Hawthorn, Hazel, Juniper, Willow, Rowan, Cherry.) This is grouped in the "Monitor" or "Remove" classes in the Table 9.3, below, depending on tree species.
- 48-60 m wide corridor (24 – 30 m sections each side of the centre line) with trees 20-25 m in height. This would require ongoing topping of trees in the long term but with relatively slow growing species such as (Birch, Alder, Elm, Aspen, Lime, Chestnut, Sycamore, Ash, Oak, Beech). This is grouped as "Monitor" or "Remove" classes in the Table 9.3, below, depending on tree species.
- Conifer tree species: Spruce, Pine, Larch, Fir, Redwood are likely to grow to 25 m and taller and are not recommended to be allowed to grow within the 60 m wayleave corridor. This is grouped in the "Remove" class in the Table 9.3 below.

Table 9.3 below details the measures that would be applied to reduce the need for complete tree clearance.

Table 9.3: Tree Actions Summary			
Action	**Total areas 60 m corridor affected [ha]**	**Total areas windthrow affected [ha]**	**Registered NWSS [ha]**
Remove	**7.95**	15.21	0.28
Monitor	**4.77**	N/A	0.4
Sterilise (Felled, sterilise from future trees growth)	**6.04**	N/A	N/A
Open ground -within the forest area which the landowner does not propose to plant.	**2.65**	N/A	N/A

The proposed alignment would pass through 4.0 km of forestry land and would impact to varying degrees on 21.41 ha of forestry within the 60 m wayleave corridor. These areas are all detailed within Figure 9.1.

This area of forestry can be broken down as follows:

- 7.95 ha of existing trees which would be felled (5.52 ha of conifer forest and 2.43 ha of broadleaf forest);
- 4.77 ha of broadleaf scatter woodland where trees would be retained and managed by pruning and crown reduction to avoid felling;
- 6.04 ha of land awaiting replanting. This is recently felled forest where it is anticipated the landowner would replant these in the short term; and
- 2.65 ha of long-term open ground where it is anticipated the landowner would not replant.

In addition, 15.21 ha of mature Sitka Spruce outwith the wayleave corridor would be indirectly affected by windblow risk once the 60 m wayleave corridor is cleared. The Applicant has no mechanism to control felling and replanting outwith the resilience corridor. Felling and replanting of these areas would require the agreement of the landowner. Should the landowner not agree to fell the woodland in advance to mitigate the windthrow effects and the trees subsequently suffer from windthrow, it is within the control of Scottish Forestry (SF), using the Scottish Government Forestry and Land Management (Scotland) Act 2018, to ensure these areas are replanted (sections 34-37). The Act clearly states that should windthrow occur, SF has the authority to serve a 'Windblow Clearance Directive' to the landowner with an associated restocking direction. As such, the assessment has been undertaken on the basis that any windthrow resulting from the introduction of the OHL wayleave would require the relevant landowner to replant the same area of forest. Should the landowner agree to fell these same areas prior to windthrow occurring as part of the proposed development, then this would only be possible with the appropriate felling permissions in place with SF. As noted above, these permissions would include a similar restocking condition which would result in no net loss of forestry. As such, there is deemed to be no loss of forestry from the effect of windthrow.

Compensatory Planting

To fully address the long-term loss of forest resource, the project requires to address the felling of the existing 7.95 ha of trees and also the 6.04 ha of land awaiting replanting, as trees could not be re-planted in these areas following construction of the connection, a total of 13.99 ha.

Included in the total areas for compensatory planting is 0.28 ha of broadleaf planted woodland which is included in the Native Woodland Survey of Scotland (NWSS). It is clear that this area of

woodland was planted in the recent past and this is supported by its exclusion from the Ancient and Semi Natural Woodland Survey database. As such the loss of this area can be addressed within the compensatory planting proposal, which would incorporate a similar area of broadleaf new native woodland planting.

Operation

Future forest management effects during operation due to the proposed development include the requirement for the forest manager of the adjoining, retained forest areas to amend current objectives, plans and techniques for felling and restructuring the forest. This is achieved via the production of a Forest Management Plan. In particular, the effects assessed include those on future felling and restocking requirements, in land immediately adjacent to the OHL and the direct effect of the presence of the OHL in terms of safe working restrictions within the forests it passes through. These effects have been assessed using the professional judgement of the assessment team and vary according to the age and consequent level of forest management required for each site.

Operational effects of the felling required for the proposed development on forest management processes would include:

- taking account of the weakened nature of the new edge of the crop through areas of mature and semi mature forests;
- requirement to re-design felling coupes;
- amendments to harvesting techniques and extraction routes to take account of the presence of the OHL;
- relocation of timber loading areas to avoid working adjacent to the OHL
- the presence of the OHL during re-stocking which occurs after clear felling of the adjacent forest areas. In certain areas restructuring which may be necessary to take account of landscape design considerations.

9.5 Residual Effects

9.5.1 Construction

The commitment to undertake planting of a compensatory area of woodland to that felled within the proposed wayleave corridor is considered to reduce the magnitude of the effect to None. As such the effect on loss of forest resource from the construction post mitigation is none.

9.5.2 Operation

The Applicant is committed to delivery of a range of mitigation works to reduce the potential effects on forest management during operation of the OHL. Therefore, no potential effect on forest management during the operation of the OHL is predicted.

9.6 Summary

Potential impacts during construction and operation are summarised in Table 9.4 below, which also details the relevant mitigation or control measures.

Table 9.4: Summary of Impacts and Proposed Mitigation/Control Measures	
Potential Impact	**Mitigation/Control Measures Proposed**
Construction	
Selective felling within the wayleave corridor of approximately 5.52 ha of commercial conifer forest, 6.04 ha of forest land awaiting replanting and 2.43 ha of broadleaf woodland (including 0.28 Ha of planted broadleaf woodland recognised within the NWSS). All areas where there is an impact on forestry are detailed within Figure 9.1.	The Applicant is committed to compensatory planting of an equivalent area, in accordance with the Scottish Government, (2009), Policy on the Control of Woodland Removal and the Scottish Government's policy on control of woodland removal: implementation guidance (February 2019).
Operation	
Requirement to amend existing Forest Management Plans detailing current objectives, plans and techniques for felling and restructuring the forest within adjoining, retained forest areas.	The Applicant is committed to working with the various landowners where the proposed development would impact upon their future operational management of the forest. Further mitigation work would be undertaken in consultation with the landowners to address all potential operational impacts. These discussions would be undertaken along with financial compensation arrangements to address the loss of forestry. This would also include assistance to develop suitable access for future forest operations to address the presence of the OHL and review the financial impact on adjoining forest areas where there is a need to redesign the forest edge for landscape purposes.

10. SUMMARY AND SCHEDULE OF MITIGATION

10.1 Summary

This Environmental Appraisal has been prepared to:

- describe the proposed development;
- identify the potential direct and indirect impacts of the proposed development on the environment; and
- describe the mitigation or control measures proposed to address likely impacts.

The proposed development comprises a new overhead line connection to connect the consented Stranoch wind warm and the consented Chirmorie wind farm with the national grid at Mark Hill substation. The alignment of the proposed development was identified through an iterative process supported by desk-based analysis, ground conditions and field surveys, engineering studies and landowner-related assessments.

The proposed alignment is split into three sections. The Stranoch wind farm substation to pole 119 section begins at the consented Stranoch wind farm substation and generally runs northeast until pole 119 east of Chirmorie wind farm. A spur from the Chirmorie wind farm substation to pole 119 marks the second section, and the final section of the proposed alignment connects pole 119 to pole 001, approximately 100 m south of Mark Hill substation.

The underground cable section from pole 001 to Mark Hill substation is to be installed as permitted development.

Environmental appraisals of the proposed development have been undertaken considering: landscape and visual amenity, cultural heritage, ecology (including ornithology), hydrology and hydrogeology, and forestry. The appraisals identify the potential for some temporary disturbance during the construction phase. This temporary disturbance can be largely controlled through good construction management and, where necessary, micrositing the OHL and cable alignment to avoid direct impacts to ecological receptors or cultural heritage assets.

10.2 Schedule of Mitigation

The potential impacts and mitigation measures have been compiled into a "Schedule of Mitigation" which is presented in Table 10.1 below.

Mitigation measures which are 'by design', in other words, which have been incorporated into the final design as reflected on the application drawings provided for the proposed development, are not included here as they form part of the proposed development, as described in Chapter 2: Development Description.

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
Landscape and Visual	Site clearance; excavation of the ground for access track construction, pole base construction; placement of temporary construction compound; reinstatement works	Landscape fabric	• The proposed development will follow the alignment of existing tracks and forestry roads as far as practicable. The creation of new tracks across the landscape fabric will be minimised. • Reinstatement of the ground conditions following completion of construction activities in areas of temporary access, or earlier if possible within the work programme. • Temporary stone tracks associated with the construction of the OHL poles will be removed upon completion of construction and any damage to the landscape fabric will be restored. • All working areas would be restricted as far as practicable to the specified areas and demarcated to prevent incursion of site plant onto non-construction areas. Physical exclusion zones (e.g. crowd barriers or heras panels) where considered necessary (e.g. in any sensitive areas). • Public access along roads and paths will be retained throughout the construction period.	Construction
Landscape and Visual	Loss of mature vegetation within the proposed development site, and consequent construction of the poles.	Landscape character Visual amenity/ visual receptors	• The proposed alignment would route through approximately 4 km of forestry, it is estimated that 5.52 ha of existing forestry would need to be felled. • Additionally, approximately 2.43 ha of broadleaved woodland would require removal. • However, tree felling would be limited to only those necessary for the safe construction and operation of the grid connection. • The Applicant is committed to compensatory planting in accordance with Scottish Government Removal guidance.	Construction
Landscape and Visual	Presence of construction activity (including movement) and construction equipment such as excavators, tractors and scaffold tunnels	Landscape character Visual amenity/ visual receptors	• All construction equipment would be removed, and the landscape restored immediately following completion of the construction works. • Night lighting of construction sites/ compounds would be minimised within the requirements of health and safety, avoided wherever possible, and only in use at locations where activity is being carried out. Site working hours are restricted to daylight hours as preference. Where required, lighting to be inward towards the site activity and downward facing wherever possible.	Construction

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
			• Material storage/ stockpiles would be retained for the shortest duration practicable and would be sited to avoid visual intrusion to neighbouring receptor locations • Where possible, laydown areas would be located in areas that are already disturbed or cleared of vegetation.	
Landscape and Visual	Presence of new wood pole line (including conductor) within the landscape; presence of cleared wayleave	Landscape character Visual amenity/ receptors	• The height of the poles would typically be 12.1 m above the adjoining ground level (including steel work and insulators). Pole heights may be increased locally (up to a maximum height of 15.1 m) where required to safely cross features such as watercourses and access tracks. • Where possible, the proposed alignment has been routed to reduce its impact on the character of the landscape, and its prominence in views from the wider area.	Operation
Landscape and Visual	Disturbance, movement and activity associated with maintenance activities	Landscape fabric Visual amenity/ receptors	• Where maintenance activities are required, they would be programmed to ensure that they are undertaken in a timely and localised manner. • Significant works to be notified to local residents and unplanned emergency works to be completed as quickly as possible to minimise unavoidable disruption. • All maintenance equipment would be removed, and any disturbed ground reinstated (if applicable) immediately following completion of the maintenance works.	Operation
Cultural Heritage	Disturbance or destruction of features of cultural heritage interest due to construction activities	Heritage assets	Appointment of a professional archaeological contractor, or professional archaeologist, to act as an Archaeological Clerk of Works (ACoW) to prepare a Written Scheme of Investigation (WSI) and to monitor activities during pre-construction and construction works where required.	Pre-construction
Cultural Heritage	Disturbance or destruction of features of cultural heritage interest due to construction activities	Heritage assets	A walkover field survey would be carried out along the route of the proposed development (proposed alignment and indicative access track routes) between Poles 1 and 48, which could not be accessed (land access restrictions) during the walkover surveys carried out to date. The objectives of the field survey would be:	Pre-construction

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
			• to confirm the presence or absence of the heritage assets identified through the desk-based assessment; • to record the current baseline condition of these assets (where and if they survive); • to record any previously unknown heritage sites that may survive along this section; and • to identify measures to mitigate any predicted impacts on these assets.	
Cultural Heritage	Damage to known heritage assets during construction.	Heritage assets.	Written guidelines would be issued for use by all construction contractors, outlining the need to avoid causing unnecessary damage to known heritage assets. The guidelines would set out arrangements for calling upon retained professional support in the event that buried archaeological remains of potential archaeological interest (such as building remains, human remains, artefacts, etc.) should be discovered in areas not subject to archaeological monitoring. The guidelines would make clear the legal responsibilities placed upon those who disturb artefacts or human remains. ACoW to be in place in areas where this is thought possible, to be provided by the contractor. Site operatives to be advised on the presence, location and importance of heritage assets within the relevant daily briefings. Assets to be captured on the relevant OHL Tower/Pole Matrix to allow appointed contractor to plan ahead and ensure they do not encroach on these areas unintentionally.	Construction
Cultural Heritage	Disturbance or destruction of features of cultural heritage interest due to construction activities	Parish boundary (1);	Final pole position and construction area should be microsited to avoid the parish boundary. Site required to be marked out will be identified on the ground by the appointed ACoW and marking out of the asset will be undertaken by the appointed main contractor under the guidance of the ACoW. Such demarcation should be retained and maintained as required during the duration of construction works.	Construction
Cultural Heritage	Disturbance or destruction of features of cultural heritage interest	Water tank (6); Field bank (21a);	These heritage assets should be marked out for avoidance during the construction phase using high visibility fencing placed, wherever possible, a minimum of 5 m	Construction

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
	due to construction activities	Cup-marked boulder (38a); Clearance cairns (14, 18, 25); Sheep shelter (35).	from the edge of the identified heritage assets and these markers should be retained for the duration of the construction phase. Sites required to be marked out will be identified on the ground by the appointed ACoW and marking out of the assets would be undertaken by the appointed main contractor under the guidance of the ACoW. Such demarcation should be retained and maintained as required during the duration of construction works.	
Cultural Heritage	Disturbance or destruction of features of cultural heritage interest due to construction activities	An area of relict rig and furrow remains (21).	Keep disturbance of rig and furrow remains to a minimum. Use of temporary track mats for access where possible. Relevant regulatory assents to be gained in advance of access if required. Access to be taken in line with SPEN Land Code of Conduct. Contractor to account for seasonal ground conditions and programme works with consideration for potential soft ground.	Construction
Cultural Heritage	Disturbance or destruction of features of cultural heritage interest due to construction activities	Enclosure (22);	Final route of indicative access track should be microsited to avoid the enclosure remains. Site required to be marked out will be identified on the ground by the appointed ACoW and marking out of the asset will be undertaken by the appointed main contractor under the guidance of the ACoW. Such demarcation should be retained and maintained as required during the duration of construction works.	Construction
Cultural Heritage	Disturbance or destruction of features of cultural heritage interest due to construction activities	Cairnfields (23 and 38)	Microsite proposed development to avoid upstanding components of the cairnfields (individual cairns). A working corridor should be defined for the route of the indicative access tracks, where they cross cairnfields. Route to be identified on the ground by the appointed ACoW and marked out by the main contractor under the guidance of the ACoW. Such demarcation should be retained and maintained as required during the duration of construction works. Areas where disturbance to components of the cairnfields is unavoidable should be identified at the earliest opportunity and notified to the ACoW so that they can be recorded archaeologically prior to, or during, construction works as appropriate. The scope of the archaeological works to be undertaken should be set out in a WSI	Construction

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
			(see above) and agreed in advance with DGCAS and WoSAS prior to development works commencing. Foremen / gangers / chargehands to walk plant and machinery into position if considered necessary under the guidance of the appointed ACoW. Temporary track mats, where possible, should be employed where access tracks pass through the cairnfields to avoid disturbance of buried remains. Relevant regulatory assents to be gained in advance of access if required. Access to be taken in line with SPEN Land Code of Conduct. Contractor to account for seasonal ground conditions and programme works with consideration for potential soft ground. Archaeological watching brief to be carried out during any ground works where the works pass through the extent of these assets.	
Cultural Heritage	Disturbance or destruction of features of cultural heritage interest due to construction activities	Field bank (40b)	Route indicative access track along route of existing farm track where it already breaches the field bank. Keep disturbance to the field bank to a minimum.	Construction
Ecology and Ornithology	Habitat loss and/or modification from temporary access track construction, temporary construction areas around each pole location, temporary site compounds, maintenance of a resiliance corridor around the proposed alignment where it crosses through woodland, and excavation and burying	Sensitive and notable habitats (semi-natural broadleaved woodland, broadleaved woodland plantation, coniferous woodland plantation, scattered broadleaved trees, scattered scrub and species-rich hedgerows, wetland habitats that are potential GWDTEs and peatland habitats,	• Reinstatement of habitats as soon as possible following construction activities in areas of temporary access and construction; • Avoidance of the removal of species-rich hedgerow and tree felling, where possible. Where tree felling is required, the area removed would be replaced to ensure no net loss. • Where agreement can be reached with landowners and following assessment by the project Ecological Clerk of Works (ECoW), provision of areas of insect refugia to be considered from some felled trees (Small areas of log stacks). The majority of felled trees will be removed from site. • Habitat enhancement for amphibians, reptiles and invertebrates through the creation of three artificial refugia; • Avoidance of blanket bog, wet modified bog and GWDTEs, where possible. If not possible, floating access tracks/bog mats and low ground-pressure vehicles would be used to cross these habitats. Pre-construction surveys would be	Construction

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
	of the proposed underground cable.	such as wet modified bog and blanket bog)	conducted to detect habitats previously mentioned and allow contractor to plan for avoidance; • Peat probing surveys to identify areas of deeper peat to be avoided, where possible; • Correct storage of excavated peat; • Immediate reinstatement of blanket bog, wet modified bog and GWDTEs following construction activities to retain hydrological connectivity and hydrological connectivity to be disturbed as little as possible during construction; • Clean runoff (i.e. non-silty surface water flow, including that which has not passed over any disturbed construction areas) would be kept separate from potentially contaminated water as far as possible. Where required, interceptor ditches and other drainage measures would be installed to safeguard clean runoff from disturbed area.; All interceptor ditches and other drainage measures would be removed on completion; • Incorporation of highly and moderately GWDTEs within the CEMP; • Where pole installation is required within 30 m of a watercourse, silt traps or other mitigation would be put in place and outlined in the CEMP, with nearby watercourses checked during periods of high rainfall during construction activities. Ground excavation work would temporarily stop work during periods of high rainfall, where a risk to surface water quality is identified; • Wood pole line dewatering should be avoided where possible but in the unlikely event that it is required the preference will be to discharge to vegetation in a manner which prevents silted water entering watercourses. • Spill kits would be located and maintained at all oil storage and refuelling locations and on all site vehicles. Refuelling in the field to be minimised to avoid spills; • The construction areas around individual poles would be designed to avoid soil stripping, storage and other construction activity with the potential to cause pollution within 10 m of sensitive watercourses or waterbodies;	

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
			• Good practice guidance[1][2] should be followed when working close to watercourses; and • The CEMP would include standard pollution prevention guidelines, such as silt traps, during the construction phase to ensure that no water or air-borne pollutants reach ecological features.	
Ecology and Ornithology	Disturbance from lighting, noise and excavations	Habitats (semi-natural broadleaved woodland, broadleaved woodland plantation, coniferous woodland plantation, scattered broadleaved trees, scattered scrub and species-rich hedgerows); Protected species (red squirrel, otter, bat species, great crested newt and breeding birds)	• The CEMP would include measures to protect ecological and ornithological features. The ECoW and/or a suitably qualified ecologist would input into the CEMP to ensure appropriate mitigation measures are in place, and to reduce any disturbance effects; • The ECoW would have the power to stop works. • Avoidance of damage, pruning or felling of the bat roost potential tree shown by Target Note 1[3] on Figure 7.6b. Disturbance of this tree is considered to be unlikely as the nearest excavation would be greater than 30 m away. Care would be taken with any lighting in the vicinity of the tree and would avoid shining light directly on the tree itself or any potential commuting corridor, as assessed by the project ECoW. • eDNA testing of the field pond and Mill Loch in April 2021 to determine the presence or absence of great crested newt. If great crested newts are found to be present in one or both waterbodies, the ECoW or a suitably qualified ecologist would search all areas of vegetation to be cleared within a 500 m buffer of the waterbodies for the presence of great crested newt prior to vegetation clearance. Any great crested newts found during this search would be moved to an appropriate and safe habitat away from the construction area; • Pre-construction surveys for red squirrel, otter, badger, water vole and other protected species no later than eight months prior to construction. If the results indicate the presence of any protected species, an assessment of the impacts of the proposed development on the species would be completed and appropriate mitigation measures identified (if required), such as micro-siting of woodpoles and access tracks. For example, if tree felling is necessary, mature	Construction

[1] https://www.sepa.org.uk/media/150997/wat_sg_29.pdf
[2] http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/
[3] Labelled as number 1 on Figure 7.6b, not TN1 or TG1 on Figure 7.6a

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
			trees would be surveyed by a licensed bat surveyor to ensure no bats are roosting in the trees. At the same time, trees to be felled would be checked for the presence of red squirrel dreys. If bats are found to be roosting in the trees, felling would only occur under an NS licence with a licensed bat surveyor present. Similarly, if a red squirrel drey is found to be present, felling would only occur under an NS licence. Any species protection plans would be agreed with NS; • Camera trap monitoring of the otter holts under an NS licence during pre-construction survey to confirm breeding status, prior to construction; and • The CEMP would include measures to protect ecological features, which would involve covering excavations and providing ramps in excavations to allow any trapped species to escape. These measures would be implemented at the end of each work day. A suitably qualified ECoW would input into the CEMP to ensure appropriate mitigation measures are in place, and to reduce any disturbance impacts. Working hours would avoid dawn and dusk to minimise disturbance to protected species, such as bats. Working in the vicinity of the otter holts would avoid work during the hours of darkness and within two hours after sunrise and two hours before sunset, which could be reduced to one hour between November and February, inclusive[4].	
Ecology and Ornithology	Destruction of bird nests	Breeding birds	• Ground or vegetation clearance works would be undertaken outwith the main bird nesting season (March–September, inclusive), if possible. If this is not possible, a suitably experienced ecologist would survey the proposed development prior to construction, particularly vegetation clearance and tree felling, to determine if nesting birds are present, espcially Schedule 1 species such as crossbill, hen harrier and goshawk, which are afforded further protection from disturbance in comparison to other bird species. If nesting birds are found, a suitable buffer zone would be implemented around the nest, with no work in this zone until the young have fledged or the nest is no longer in use, as confirmed by a suitably qualified ECoW. The size of the buffer zone would be determined by the species of nesting bird recorded.	Construction

[4] https://www.nature.scot/sites/default/files/2020-06/Species%20Planning%20Advice%20-%20otter.pdf

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
Ecology and Ornithology	Disturbance and displacement due to maintenance activities.	Protected species (red squirrel, otter, bat species and breeding birds)	• Any security lighting would be motion activated; and • If any vegetation clearance is required, breeding bird and protected species surveys would be undertaken prior to the commencement of works, where appropriate. If the results indicate the presence of any protected species, an assessment of the impacts on the species would be completed and appropriate mitigation measures identified, if required.	Operation
Ecology and Ornithology	Pollution e.g. oil spill from vehicles accessing proposed development for maintenance activities.	Habitats	• Oil spill kits carried in vehicles, particularly when working in sensitive habitats such as blanket bog, wet modified bog, GWDTEs and close to running water or standing water.	Operation
Hydrology	Compaction and soil erosion along the proposed alignment, including temporary construction compounds.	Soils and peatland	• Best practice measures to control compaction and soil erosion caused by temporary access during construction would be set out in the Construction Environmental Management Plan (CEMP).	Construction
Hydrology	Siltation or pollution of watercourses during excavation and installation of wood poles.	Watercourses	• Where pole installation is required within 30 m of a watercourse, good practice silt management, which would be outlined in the CEMP, would be put in place, with nearby watercourses checked during periods of high rainfall during construction activities. • Ground excavation work would temporarily stop work during periods of high rainfall. • Following the reinstatement of ground conditions at the proposed pole locations the contractor shall remove mitigation measures (should they be required), such that the release or 'flushing' of sediments to watercourses is avoided.	Construction
Hydrology	Spills or contamination from materials/wastes handled or stored at the temporary construction compounds. Temporary construction compounds	Watercourses, peatland	• All excavated material would be carefully stored a minimum of 30 m away from any watercourse, with particular care taken to preserve the integrity of soil structure and prevent any risk of runoff or sediment blow-off into watercourses. Areas of exposed soils (excavations or stockpiles) would be bunded and diversion drains employed to prevent clean water entering the area and dirty water from leaving the area. Bunds and diversion drains would	Construction

Table 10.1: Schedule of Mitigation				
Topic	**Potential Impact**	**Receptor**	**Mitigation/Control Measures**	**Timing**
	causing pollution of watercourses.		be constructed of non-erodible material such as turf, straw bales or geotextiles. • Temporary construction compounds would be kept to the minimum necessary for safe implementation of the works. On-site storage of oil and fuels would be avoided if possible but where on-site storage is required, the volumes to be stored would be minimised and stored in accordance with all applicable legislation and good practice.	
Hydrology	Watercourse crossings leading to siltation or pollution if good practice not followed.	Watercourses	• Access would involve use of existing tracks and watercourse crossings as far as possible. Where required, temporary track mats and bog mats would be used to cross areas of soft ground. Bog mats would be used to cross minor watercourses without damage to bank integrity and temporary bridging solutions are also likely in places, under the relevant CAR registrations.	Construction
Hydrology	Modification of groundwater flows by location of wood poles and/or by excavation of cable trench, forming a preferential flow path for sub-surface flows. In addition, any excavations below the groundwater level along the length of the proposed alignment could lead to a localised groundwater drawdown.	Groundwater flow	• Drainage design measures to ensure no pollution to surface water would be set out in the CEMP; • Water within the excavations for footings would be dispersed to vegetated areas at a suitable distance from watercourses. As the excavations for installation of the wood poles and reinstatement of ground conditions shall be carried out within expeditiously, minimal disruption groundwater flows is predicted. • Were rock encountered, there is the potential excavations may be carried out over a longer timescale. Between stages of excavation, material would be backfilled and broken out on recommencing of excavation, until the desired depth is achieved.	Construction
Hydrology	Flood Risk	Contractors and Equipment	• Where working in close proximity to larger watercourses (particularly on lower lying areas close to the River Duisk) contractors shall sign up for SEPAs Floodline to receive flood warnings and shall not work in such areas should a flood warning be received. As set out in TA 8.2, larger, temporary watercourse crossings shall be designed to accommodate a 1 in 200 (0.5%) annual probability flood.	Construction

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Hydrology	Risk of minor leaks of fuel and hydraulic oil from maintenance vehicles.	Surface water, groundwater and soils	The design of the proposed development has avoided hydrologically sensitive areas where possible and has ensured appropriate buffer distances between construction elements and watercourses. This would minimise the risk of water pollution during the operational phases. Based on appropriate maintenance measures to vehicle and maintenance equipment, the potential for the release of pollutants is considered very unlikely.	Operation
Forestry	Selective felling within the wayleave corridor of approximately 5.52 ha of commercial conifer forest, 6.04 ha of forest land awaiting replanting and 2.43 ha of broadleaf woodland (including 0.28 Ha of planted broadleaf woodland recognised within the Native Woodland Survey of Scotland (NWSS)).	Conifer forest.	The Applicant would implement compensatory planting of an equivalent area, in accordance with the Scottish Government, (2009), Policy on the Control of Woodland Removal and the Scottish Government's policy on control of woodland removal: implementation guidance (February 2019).	Construction
Forestry	Requirement to amend existing Forest Management Plans detailing current objectives, plans and techniques for felling and restructuring the forest within adjoining, retained forest areas.	Forest.	The Applicant would work with the various landowners where the proposed development would impact upon their future operational management of the forest. Further mitigation work would be undertaken in consultation with the landowners to address all potential operational impacts. These discussions would be undertaken along with financial compensation arrangements to address the loss of forestry.	Operation