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SP Energy Networks

Date
October 2021

Project Number
UK12-22885

ENVIRONMENTAL APPRAISAL

A 132KV OVERHEAD LINE CONNECTION BETWEEN STRANOCH AND CHIRMORIE WIND FARMS TO MARK HILL SUBSTATION

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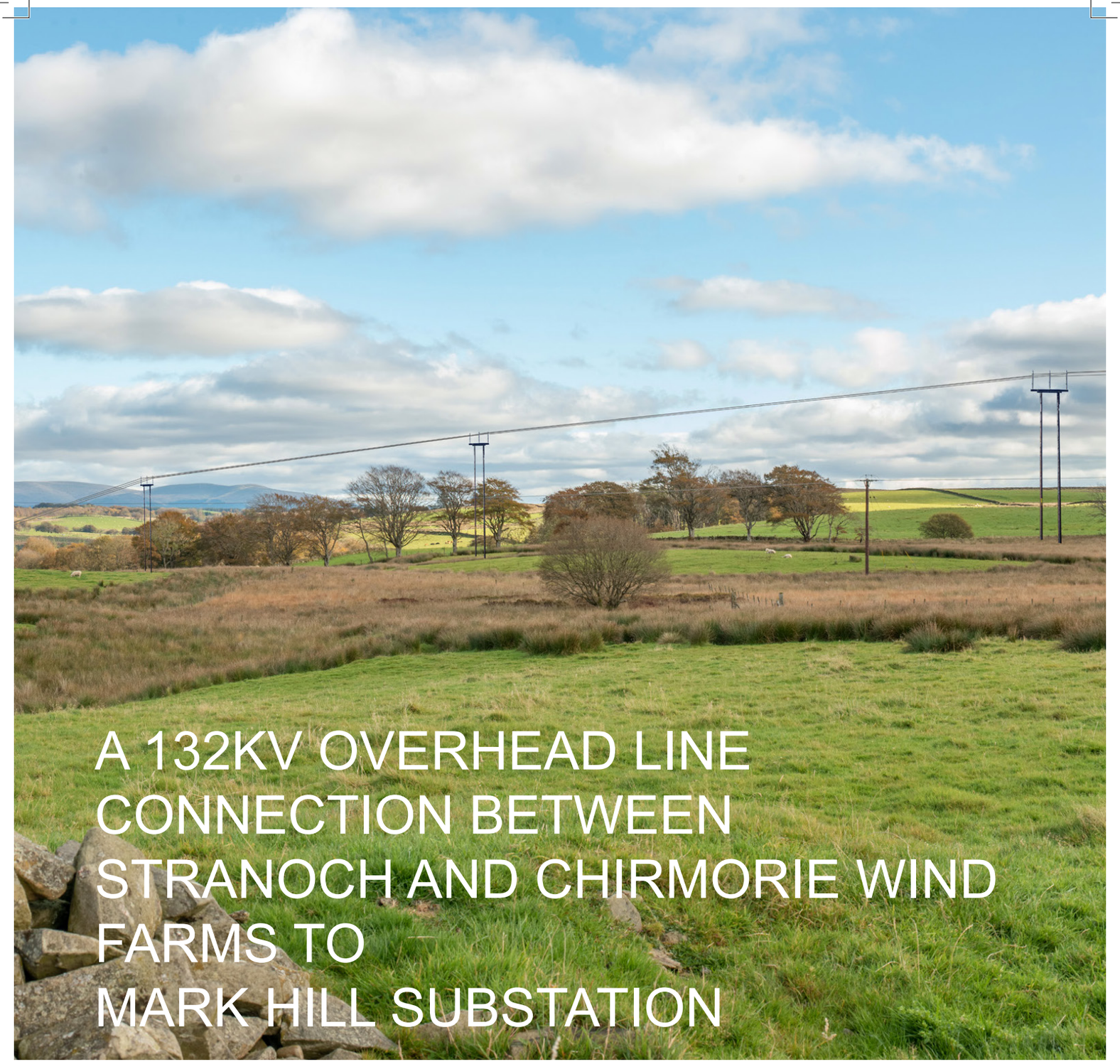

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Environmental Appraisal
Volume 1: Main Report and Appendices

October 2021

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SP ENERGY NETWORKS

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Project No.	**UK12-22885**
Issue No.	**4**
Date	**October 2021**
Made by	**Amanda Chan/ Catherine MacKenzie**
Checked by	**Peter Bruce**
Approved by	**Peter Bruce**

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VOLUME 1: MAIN REPORT AND TECHNICAL APPENDICES TABLE OF CONTENTS

1. INTRODUCTION

1.1 Preamble

Scottish Power Energy Networks (SP Energy Networks) is proposing to construct and operate a new 132 kV wood pole overhead line (OHL) to connect the consented Stranoch wind farm and the consented Chirmorie wind farm to the existing substation site at Mark Hill, north of Barrhill in South Ayrshire (hereafter, 'the proposed development'). The location of the proposed development, including the location of both the consented Stranoch and Chirmorie wind farms and the Mark Hill substation, is shown on Figure 1.1.

Scottish Power Transmission Plc (SPT) is the transmission license holder in south west Scotland and has a duty under Section 9 of the Electricity Act 1989 to develop and maintain an efficient, coordinated and economical system of electricity transmission and to facilitate competition in the generation and supply of electricity. The company also has obligations to offer non-discriminatory terms for connection to the transmission system, both for new generation and for new sources of electricity demand.

SPT is responsible for the delivery of the transmission network on behalf of SP Energy Networks. SP Energy Networks is also responsible for developing the transmission system and connecting new demand and generation to the grid network in accordance with the GB Security and Quality of Supply Standards. Under Section 37 of the *Electricity Act 1989*, SP Energy Networks is required to seek consent from the Scottish Ministers for the construction of any non-exempted OHL operating at a voltage greater than 20 kilovolts (kV).

This Environmental Appraisal provides information to support three applications for consent under *section 37 of the Electricity Act 1989*, as follows:

- one application to cover the section of the proposed development from Stranoch wind farm substation to pole 119;
- one application to cover the section of the proposed development from Chirmorie wind farm substation to pole 119; and
- one application to cover the section of the proposed development from pole 119 to pole 001 (less than 100 m south of Mark Hill substation.

The applications will be for the construction of a new 132 kV OHL under *section 37 of the Electricity Act 1989* and each consent application would seek deemed planning consent under *section 57(2) of the Town and Country Planning (Scotland) Act 1997*, as amended, for construction of the associated access arrangements.

The proposed development also includes a short section of underground cable for the final approach into Mark Hill substation which constitutes permitted development under Class 40 of the Town and Country Planning (General Permitted Development) (Scotland) Order 1992 (as amended).

In addition, environmental information is also provided in order to meet the applicant's obligations to preserve amenity and mitigate environmental effects under Schedule 9 of the *Electricity Act 1989*.

1.2 Background and Need for the Proposed Development

SPT has received a Grid Connection Application, via NGET, from the developers of the consented Stranoch wind farm. The proposed wind farm comprises up to 24 turbines and has a potential installed capacity of up to 72 MW. Stranoch wind farm was consented by the Scottish Ministers in July 2016 and SP Energy Networks is obliged to provide a connection for the wind farm which lies within the area covered by their license. SPT has also received a Grid Connection

Application, via NGET, from the developers of the proposed Chirmorie wind farm, which comprises 21 turbines and has a potential installed capacity of up to 80 MW. The proposed Chirmorie wind farm was consented by the Scottish Ministers in July 2018. SP Energy Networks is proposing to provide a consolidated grid connection solution for the proposed Chirmorie wind farm grid connection in parallel with Stranoch grid connection in order to deliver efficiency.

The Stranoch wind farm substation will be constructed at the northern end of the Stranoch wind farm site, while the Chirmorie wind farm substation will be constructed in north eastern area of the Chirmorie wind farm site (see Figure 1.1). In order to connect both wind farms to the transmission network, a 132 kV connection is required.

1.3 Environmental Appraisal Process

In March 2019 SP Energy Networks submitted a written request for an Environmental Impact Assessment (EIA) screening opinion from the Scottish Government Energy Consents Unit (ECU) under regulation 8 of the *Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended)* (the EIA regulations). A screening opinion was received from the ECU on 3rd June 2019, which confirmed that the proposed development does not constitute EIA development.

An Environmental Appraisal has been undertaken which provides environmental information, as set out in the request for a screening opinion, and addresses issues raised through pre-application consultation with statutory consultees. Further information on the pre-application consultation process is provided in Chapter 4. For the avoidance of doubt, this report does not form an "Environmental Impact Assessment Report" under the EIA regulations.

Environmental input into the report has been collated by Ramboll UK Ltd (Ramboll), with technical environmental appraisals carried out by the following consultants:

- Landscape and Visual – Ramboll;
- Cultural Heritage and Archaeology – CFA Archaeology Ltd;
- Ecology and Ornithology – Ramboll;
- Hydrology and Soils – Ramboll; and
- Forestry – RTS Ltd.

1.4 Structure of this Report

This report is structured as follows:

- Chapter 1 – Introduction: describes the background to the Stranoch and Chirmorie wind farms grid connections.
- Chapter 2 – Proposed Development: describes the proposed development and provides detail of typical construction methods.
- Chapter 3 – Route Selection and Alternatives: outlines the process by which the route and final alignment was selected and describes the alternative route options considered and the reasons why other route options were discounted.
- Chapter 4 – Consultation: describes the stakeholder consultation undertaken to date.
- Chapter 5: Landscape and Visual Appraisal: describes the potential landscape and visual impact of the proposed development and how this has been mitigated through design.
- Chapter 6: Cultural Heritage Appraisal: describes the potential impact of the proposed development on the historic environment and presents mitigation measures that will be implemented to reduce adverse effects.

- Chapter 7: Ecology and Ornithology Appraisal: describes the baseline ecological environment and information gathered from ornithology surveys, potential impacts on the ecological environment and ornithology and how these impacts will be mitigated.
- Chapter 8 – Hydrology and Hydrogeology Appraisal: describes the baseline environment, potential impact of the proposed development on water and soils, and how these impacts will be mitigated.
- Chapter 9 – Forestry Appraisal: describes the potential impact of the proposed development on surrounding woodland and presents mitigation measures.
- Chapter 10 – Summary and Schedule of Mitigation: provides a summary of the appraisals undertaken and lists the mitigation measures identified.

Technical Appendices included at the end of the report contain technical information relating to specific assessments as referred to in the text.

2. DEVELOPMENT DESCRIPTION

2.1 Introduction

This chapter describes the characteristics of the proposed development, including the proposed alignment for the OHL and underground cable (permitted development, see details below) and the nature of proposed construction works. More detailed descriptions of the baseline environment associated with the proposed alignment are described in Chapters 5- 9 of this report. The proposed alignment, including proposed wood pole locations, is shown on Figure 2.1. The alignment is split into three sections:

- Stranoch wind farm substation to pole 119 (approximately 5.9 km in total);
- Chirmorie wind farm substation to pole 119 (approximately 200 m in total); and
- pole 119 to pole 001 (less than 100 m south of Mark Hill substation) (approximately 11.25 km in total).

The underground cable section from pole 001 to Mark Hill substation is to be installed as permitted development under Part 13, Class 40 of the Town and Country Planning (General Permitted Development)1992, (Scotland) Order, as amended, as shown on Figure 2.1.

2.2 Infrastructure Location Allowance

The requested horizontal Infrastructure Location Allowance (ILA) is for 50 m along the proposed alignment, measured from each pole centre and 25 m in any other direction from each pole centre (Figure 2.2). It is requested that access tracks are permitted to be microsited relative to any microsited poles, as such, no specific distance is stated for track micrositing. However, all micrositing of poles within the ILA and tracks will be subject to ECoW review and approval as well as agreement with the relevant landowner(s) prior to any pole or track moves at site. These distances are requested to allow for micrositing of the wood pole locations and tracks, in order to avoid environmental or physical features as required.

Poles may vary in height in order to respond to local topographical variations, engineering and safety considerations. It is not expected that poles would vary more than 2 m above the maximum stated height in this context and where this occurs would be very limited in terms of the number of poles affected. The typical pole height above ground will be 12.1 m for this connection. The assessments carried out for this appraisal have assumed typical pole height of 12.1 m above ground. The pole length range for Trident wood poles is 10 m – 22 m. Once foundation depth (2.5 m) is subtracted and insulator height (1.6 m) included, the range of heights above ground is 9.1 m – 21.1 m. For this project the highest pole height above ground is proposed to be 15.1 m.

2.3 Summary of Alignment

The Stranoch wind farm substation to pole 119 section of the proposed development begins at the consented Stranoch wind farm substation (NGR NX 164738) from where it would run southeast to Maurs Cairn then turn northeast until Corly Craig. At northwest of Corly Craig, the proposed development then continues north-northeast cross a few watercourses and a train line until pole 119 east of Chirmorie wind farm.

The next section of the proposed development begins at Chirmorie wind farm substation to pole 119. From the consented Chirmore wind farm substation (NGR NX 199770), the proposed development runs slightly southeast then turn northeast into pole 119.

The final section of the proposed development connects pole 119 to pole 001 which is less than 100 m south of existing Mark Hill substation (NGR NX 237860). From pole 119, the proposed development travel northeast, after crossing Laggish Burn, the proposed development follows a

minor road through Arecloech Forest. 500 m after Arecloech Forest, the proposed development turn northeast towards Barrhill. After crossing both B7027 and A714 southeast of Barrhill, the proposed development travels north to follow a minor road into a strip of forestry. After the strip of forestry, the proposed development travels northwest until Mill Loch then tuns north/ northeast into pole 001.

The overall length of the proposed development is approximately 16 km, mostly OHL with approximately 100 m of underground cable connection for the final approach into Mark Hill substation.

2.4 Description of Development

2.4.1 Description of OHL

The proposed OHL would be constructed using approximately 181 wood pole structures, plus two gantries within the wind farm substations using only double 'trident' wood pole structures. Each pole is topped by galvanised steelwork cross-arm and insulators (likely to be grey plastic). The steel cross arm and insulators would carry a single three-phase circuit (three metal alloy conductors) in a flat formation (i.e. all at the same height). There is also fibre optic cable required: from Mark Hill substation to pole 119 and pole 119 to Chirmorie wind farm substation

Photo 2.1: Typical double 'trident' wood pole and 4 pole Tee set up

there would be an underslung ADSS (fibre optic) cable. From pole 119 to Stranoch wind farm substation one of the three-phase conductors would have a fibre optic cable incorporated within it. A typical double wood pole is illustrated in Photo 2.1, as well as a typical four pole 'tee-in' arrangement, which will be found at Chirmorie wind farm substation to allow consolidation of the two wind farm connections, prior to the connection advancing towards Mark Hill substation

The wood poles would be seasoned and treated with a suitable preservative, resulting in a dark brown appearance, which would weather to a silver/grey colour over a period of approximately five years following installation.

The height of the trident wood poles for this proposed development would typically be 12.1 m above the ground level (including steel work and insulators). Pole heights may be increased locally where required to safely cross features such as watercourses. The minimum required height clearance for 132 kV OHL is 6.7 m over normal land and roads, excluding heavy use roads where 7.1 m clearance is required.

The spacing between the poles would vary depending on topography, altitude and land usage. An average span of 100 m is estimated; however, the spans could range from 60 m to 110 m to accommodate technical and environmental considerations, following micrositing. Stays (guy lines) will be provided for additional stability for poles on changes in direction.

A proposed pole schedule is provided in Technical Appendix 2.1, which includes grid references for each proposed pole location.

The proposed OHL would be operational for 40 years.

The existing 11 kV, low voltage (LV) OHL in the field east of Lairg Altercannoch and south of the B7027 would be undergrounded between existing pole 21 and the south bank of the Duisk River. This connection would be replaced with a section of LV underground cable. Poles 22, 23 and 24 would be removed. 2 additional distribution poles will be erected between the farm road and pole 22 and a new high voltage (HV) distribution pole with stays would be erected between B7027 and south of the river to establish a new PTE location and a sealing end for the new HV cable and the LV cable for domestic use. Please see figure 2.3 for more information.

The changes to the LV OHL at this point would be undertaken in accordance with The Overhead Lines (Exemption) (Scotland) Regulations 2013 and the installation of the section of underground cable would be permitted development under Part 13, Class 40 of The Town and Country Planning (General Permitted Development) (Scotland) Order 1992 (As amended). The changes to the low voltage network here do not form part of the application for Section 37 consents for the proposed development.

2.5 Construction Methods

The construction methods and proposed environmental management measures are briefly described below for the purposes of informing this environmental appraisal. A Construction Environmental Management Plan (CEMP) would be developed by the appointed contractor at the pre-construction stage. The construction methodology can be found in Technical Appendix 2.2.

2.5.1 Site Establishment and Temporary Construction Compounds

Construction access would be from the A714 road and would use minor roads such as Gowlands Terrace and Forest Road to gain access to site. Existing roads have been used where possible with potential for proposed temporary access tracks required throughout. All sections of stone tracks used for construction are proposed as temporary in nature and would 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, and would be weather dependent. The use of low ground pressure vehicles and trackway panels also form the main part of the proposed access route strategy. The use of stone access tracks is considered unlikely to be necessary for a wood pole project and would be kept to a minimum

Around each pole location, a temporary construction area of 20 m x 20 m is required. This would be temporary for each pole and demarked by way of plastic cones and rope for safety purposes.

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.

The main construction compound would comprise site offices, welfare facilities, parking and limited materials storage. The contractor would obtain all the necessary consents and permits once the precise location of all temporary construction compounds is decided upon. The compounds would have workforce welfare facilities with material storage and handling areas.

Site compounds and storage areas 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.

Clearly defined areas for the storage of oil will be identified as part of the site establishment process. Spill kits would be located and maintained at all oil storage and refuelling locations and on all site vehicles. An emergency response procedure would be provided as part of the proposed CEMP.

All waste would be stored securely and disposed of through a licensed waste carrier, in accordance with waste regulations and the Site Waste Management Plan.

2.5.2 Forestry

The proposed alignment would pass through 4.0 km of forestry land and would impact to on 21.41 ha of forestry within the 60 m wayleave corridor. This is comprised of:

- 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.

SP Energy Networks would liaise with the landowners to agree a suitable felling strategy. It is anticipated that all timber would be extracted from the site and transported to an end user (e.g. sawmill, board/pulp mill or wood fuel processing depot). Compensatory Planting for trees removed from within the wayleave corridor will be provided as required following discussion with Scottish Forestry and the Scottish Government.

Further details of anticipated forestry removal are presented in Chapter 9: Forestry Appraisal.

Felling would be completed using a mechanical harvester, with timber extracted using an industry standard six or eight wheeled forwarder with telescopic boom and hydraulic grapple. Where, either due to tree size or location, it is not viable to use a mechanical harvester, manual chainsaw operators would complete the felling work.

2.5.3 OHL Construction

The following process would be followed for wood pole erection:

- A typical resilience corridor,60 m wide for OHL (30 m either side of the alignment) to ensure the electric line is resilient to disruption, as shown in Figure 2.4. This 60 m wide resilience corridor, will be sought and secured by a land agreement where there is no forestry. However, where there is forestry the distance either side from the centre of the OHL required will be measured as: Max. height of tree + safety distance (1.4 m taken from the ENA 43-8)

+ ½ width of OHL (2.5 m). This is to maintain the resilience of the connection by considering the falling distance of adjacent trees plus the industry applied safety distance and the width of the relevant pole type.

- Access, delivery and assembling would be taken using a tracked excavator and low ground-pressure vehicles (e.g. tractor, argocat, quad bikes). In certain situations, Helicopters may be used for pole delivery to point of installation.
- Bog mats and temporary track mats would be used to cross soft ground where existing access tracks are not available.
- Excavators may need to create a level pad to work from which would be reinstated upon completion.
- Turf and topsoil would be removed together to retain the turf root system and placed to one side for later reinstatement.
- A hole would be excavated to allow the pole brace block and/ or steel foundation braces to be positioned in place. A typical pole excavation is 3 m^2 x 2 m deep.
- The excavated material is then sorted into appropriate layers and used for backfilling.
- The poles are erected using normal agricultural machinery such as a digger with a lifting arm.
- The excavator(s) then hoists the assembled structure into position and, once the structure has been braced in position, the trench is backfilled.
- The hole would be backfilled with soil replaced in reverse order to the order of excavation.
- Backfilling would be progressed in layers of approximately 300 – 400 mm deep, with stone hardcore added as required around foundation blocks to ensure adequate compaction and suitable geotechnical conditions are maintained between each layer.
- When replacing the topsoil/turf around the pole it would be left slightly proud of ground level (approximately 150/ 300 mm) to allow for the excavation to naturally compact further through time

It is anticipated that all material excavated for the installation of the poles and stays would be used in backfilling the excavations.

Watercourse Crossings

The OHL construction would require the construction of new watercourse crossings. Access would use 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.

Where pole installation is required within 30 m of a watercourse, silt traps or other mitigation would be put in place on drainage arrangements (which would be 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.

2.5.4 Working Hours

- Unless otherwise agreed in writing with the local authority no construction activities are proposed outwith the hours 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays and Sundays during the months of April to September and 07:00 to 17:00 Monday to Friday and 07:00 to 13:00 on Saturdays and Sundays during the months of October to March (inclusive).

TECHNICAL APPENDIX 2 – DEVELOPMENT DESCRIPTION

2.1: Proposed Pole Schedule

2.2: Construction methodology of the Chirmorie / Stranoch 132kv OHL's

TECHNICAL APPENDIX 2.1: PROPOSED POLE SCHEDULE

OVERHEAD LINE SCHEDULE: Mark Hill - Chirmorie

ROUTE REFERENCE	132kV Mark Hill - Chirmorie

CONTRACT	CT1115
DRAWING NUMBER	CT1115-1-0000-CA-SPENEL-0106 Rev0C

CIRCUIT 1	FROM SS	Mark Hill	TO SS	Chirmorie	FROM	S001	VOLTAGE	132kV	MAX. OPER TEMP	190°C	CONDUCTOR	HTLS Eagle
					TO	S122(Gantry)					TELECOMS	ADSS

POLE NO	Structure Type				FOUNDATIONS				Stays (Grade 1150)				UTM COORDINATES				LINE ANGLE	AHEAD SPAN	CHAINAGE	WIND SPAN	WEIGHT SPAN	SUM OF ADJACENT SPANS	INSULATORS				Comments
	ENA 43-50 SPEC.	TYPE	Pole Length	Embedment Depth	Timber Baulks				No (slope)	Arreng.	Size	Spread	X	Y	Z	Z											
-	-	-	(m)	(m)	Type 1	Type 2	Type 3	Type 4	-	-	-	-	(m)	(m)	Ground level (m)	Conductor attachment point elevation (m)	(deg)	(m)	(m)	(m)	(m)	(m)	Post	Pilot	Strain	Discs 70kN	-
S001	435015	Pole Mounted Terminal H	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	223790.19	585953.74	195.19	207.19	0.00	100.258	0			100.258		3	6		
S002	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	223810.33	585855.53	193.32	205.32	-12.45	92.062	100.258			192.32		3	6		
S003	435008	Trident Intermediate H Pole	12	2					None				223847.83	585771.45	190.24	202.04	0.00	89.314	192.321			181.376	3				
S004	435008	Trident Intermediate H Pole	13	2.25					None				223884.22	585689.88	184.35	195.35	0.00	95.513	281.635			184.827	3				
S005	435011	Trident Angle Deviation / Section H Pole	15	2.25					4 (45°)	C+C Terminal	7/4.00	13	223923.13	585602.65	182.25	195.25	15.40	98.48	377.148			193.993		3	6		
S006	435008	Trident Intermediate H Pole	12	2					None				223937.92	585505.29	189.91	201.71	0.00	98.027	475.628			196.507	3				
S007	435011	Trident Angle Deviation / Section H Pole	16	2.5					4 (45°)	C+C Terminal	7/4.00	14	223952.65	585408.38	183.53	197.28	33.60	89.272	573.655			187.299		3	6		
S008	435008	Trident Intermediate H Pole	13	2.25					None				223914.99	585327.44	181.20	193.75	0.00	92.232	662.927			181.504	3				
S009	435008	Trident Intermediate H Pole	12	2					None				223876.08	585243.82	183.85	195.65	0.00	82.335	755.159			174.567	3				
S010	435008	Trident Intermediate H Pole	15	2.25					None				223841.34	585169.17	176.81	191.36	0.00	90.241	837.494			172.576	3				
S011	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	223803.27	585087.35	175.42	186.42	-26.40	92.914	927.735			183.155		3	6		
S012a	435008	Trident Intermediate H Pole	12	2					None				223805.62	584994.47	175.58	187.38	0.00	89.983	1020.65			182.897	3				
S013a	435008	Trident Intermediate H Pole	12	2					None				223807.89	584904.52	179.56	191.36	0.00	92.585	1110.633			182.568	3				
S014a	435008	Trident Intermediate H Pole	12	2					None				223810.24	584811.96	180.47	192.27	0.00	89.489	1203.217			182.074	3				
S015a	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	223812.50	584722.50	179.43	190.43	-27.908	91.788	1292.706			181.277		3	6		
S016a	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	223857.50	584642.50	179.99	190.99	-36.55	93.107	1384.494			184.895		3	6		
S017a	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	223942.50	584604.50	185.88	197.88	18.83	90.193	1477.601			183.3		3	6		
S018a	435008	Trident Intermediate H Pole	12	2					None				224008.56	584543.09	191.49	203.29	0.00	88.943	1567.794			179.136	3				
S019a	435008	Trident Intermediate H Pole	12	2					None				224073.70	584482.53	194.48	206.28	0.00	92.181	1656.737			181.124	3				
S020a	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	224141.21	584419.77	194.25	205.25	32.0596	94.122	1748.918			186.303		3	6		
S021a	435008	Trident Intermediate H Pole	12	2					None				224165.61	584328.86	189.18	200.98	0.00	96.162	1843.04			190.284	3				
S022a	435008	Trident Intermediate H Pole	12	2					None				224190.55	584235.99	187.76	199.56	0.00	97.602	1939.202			193.764	3				
S023a	435008	Trident Intermediate H Pole	12	2					None				224215.86	584141.72	188.48	200.28	0.00	96.938	2036.804			194.54	3				
S024a	435008	Trident Intermediate H Pole	12	2					None				224240.99	584048.10	186.69	198.49	0.00	97.687	2133.742			194.625	3				
S025a	435008	Trident Intermediate H Pole	12	2					None				224266.32	583953.76	183.38	195.18	0.00	97.463	2231.429			195.15	3				
S026a	435008	Trident Intermediate H Pole	12	2					None				224291.59	583859.63	181.82	193.62	0.00	97.686	2328.892			195.149	3				
S027a	435008	Trident Intermediate H Pole	12	2					None				224316.92	583765.28	181.95	193.75	0.00	98.436	2426.578			196.122	3				
S028a	435008	Trident Intermediate H Pole	12	2					None				224342.44	583670.21	181.33	193.13	0.00	97.687	2525.014			196.123	3				
S029a	435008	Trident Intermediate H Pole	12	2					None				224367.77	583575.86	180.49	192.29	0.00	96.688	2622.701			194.375	3				
S030a	435008	Trident Intermediate H Pole	12	2					None				224392.84	583482.48	177.58	189.38	0.00	97.945	2719.389			194.633	3				
S031a	435008	Trident Intermediate H Pole	12	2					None				224418.23	583387.89	176.89	188.69	0.00	93.588	2817.334			191.533	3				
S034	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	224442.50	583297.50	175.28	187.28	54.964	91.474	2910.923			185.062		3	6		
S035	435008	Trident Intermediate H Pole	13	2.25					None				224383.78	583227.36	171.19	183.74	0.00	93.403	3002.396			184.877	3				
S036	435008	Trident Intermediate H Pole	12	2					None				224323.82	583155.74	167.99	179.79	0.00	95.525	3095.799			188.928	3				
S036a	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	224262.50	583082.50	163.47	174.47	-6.34	95.264	3191.324			190.789		3	6		
S036b	435008	Trident Intermediate H Pole	13	2.25					None				224209.78	583003.15	159.13	171.68	0.00	96.082	3286.588			191.346	3				
S036c	435008	Trident Intermediate H Pole	13	2.25					None				224156.61	582923.12	153.18	165.73	0.00	88.597	3382.67			184.679	3				

S037	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	224107.58	582849.33	148.04	160.04	-36.72	91.326	3471.267			179.923		3	6		
S038	435008	Trident Intermediate H Pole	13	2.25					None				224112.56	582758.14	144.29	156.84	0.00	90.773	3562.593			182.099	3				
S039	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	224117.50	582667.50	137.69	148.69	21.34	88.955	3653.367			179.728		3	6		
S040	435008	Trident Intermediate H Pole	13	2.25					None				224089.69	582583.01	130.09	142.64	0.00	90.904	3742.321			179.859	3				
S041	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	224061.26	582496.66	123.81	135.81	-20.506	95.377	3833.225			186.281		3	6		
S042	435008	Trident Intermediate H Pole	12	2					None				224065.06	582401.36	121.70	133.50	0.00	98.704	3928.602			194.081	3				
S043	435008	Trident Intermediate H Pole	13	2.25					None				224069.00	582302.73	118.40	130.95	0.00	98.729	4027.306			197.433	3				
S044	435008	Trident Intermediate H Pole	12	2					None				224072.94	582204.08	117.43	129.23	0.00	99.501	4126.035			198.23	3				
S045	435011	Trident Angle Deviation / Section H Pole	14	2.25					None				224076.90	582104.66	116.61	128.61	0.00	87.646	4225.536			187.147		3	6		
S046	435011	Trident Angle Deviation / Section H Pole	14	2.25					None				224080.40	582017.09	109.38	121.38	0.00	93.696	4313.182			181.342		3	6		
S047	435011	Trident Angle Deviation / Section H Pole	15	2.25					None				224084.13	581923.46	101.87	114.87	0.00	85.786	4406.878			179.482		3	6		
S048	435011	Trident Angle Deviation / Section H Pole	16	2.5					None				224087.55	581837.75	89.50	103.25	0.00	90.937	4492.664			176.723		3	6		
S049	435011	Trident Angle Deviation / Section H Pole	18	2.5					4 (45°)	C+C Terminal	7/4.00	16	224091.18	581746.88	70.88	86.63	36.3054	99.415	4583.601			190.352		3	6		
S050	435008	Trident Intermediate H Pole	12	2					None				224035.56	581664.48	71.03	82.83	0.00	99.853	4683.016			199.268	3				
S051	435008	Trident Intermediate H Pole	14	2.25					None				223979.69	581581.72	71.10	84.65	0.00	96.235	4782.869			196.088	3				
S052	435011	Trident Angle Deviation / Section H Pole	14	2.25					None				223925.85	581501.96	78.38	90.38	0.00	90.313	4879.104			186.548		3	6		
S053	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	223875.32	581427.10	91.04	102.04	42.1899	91.896	4969.417			182.209		3	6		
S054	435011	Trident Angle Deviation / Section H Pole	16	2.5					None				223786.07	581405.20	96.35	110.10	0.00	92.816	5061.313			184.712		3	6		
S055	435011	Trident Angle Deviation / Section H Pole	13	2.25					None				223695.93	581383.07	106.39	117.39	0.00	95.7	5154.129			188.516		3	6		
S056	435008	Trident Intermediate H Pole	12	2					None				223602.99	581360.26	111.11	122.91	0.00	89.748	5249.829			185.448	3				
S057	435008	Trident Intermediate H Pole	13	2.25					None				223515.83	581338.87	112.01	124.56	0.00	91.471	5339.577			181.219	3				
S058	435008	Trident Intermediate H Pole	15	2.25					None				223426.99	581317.07	113.61	128.16	0.00	92.027	5431.048			183.498	3				
S059	435011	Trident Angle Deviation / Section H Pole	15	2.25					4 (45°)	C+C Terminal	7/4.00	13	223337.62	581295.13	112.68	125.68	-22.11	99.028	5523.075			191.055		3	6		
S060	435008	Trident Intermediate H Pole	13	2.25					None				223257.40	581237.07	117.80	130.35	0.00	97.518	5622.103			196.546	3				
S061	435008	Trident Intermediate H Pole	13	2.25					None				223178.40	581179.90	124.23	136.78	0.00	95.591	5719.621			193.109	3				
S062	435008	Trident Intermediate H Pole	13	2.25					None				223100.96	581123.85	132.11	144.66	0.00	92.274	5815.212			187.865	3				
S063	435008	Trident Intermediate H Pole	14	2.25					None				223026.21	581069.75	132.86	146.41	0.00	93.799	5907.486			186.073	3				
S064	435008	Trident Intermediate H Pole	16	2.5					None				222950.22	581014.76	131.56	146.86	0.00	89.447	6001.285			183.246	3				
S065	435011	Trident Angle Deviation / Section H Pole	13	2.25					None			11	222877.76	580962.32	139.01	150.01	12.5665	95.972	6090.733			185.419		3	6		
S066	435008	Trident Intermediate H Pole	12	2					None				222789.63	580924.31	142.69	154.49	0.00	96.162	6186.704			192.134	3				
S067	435008	Trident Intermediate H Pole	12	2					None				222701.33	580886.23	150.28	162.08	0.00	99.455	6282.866			195.617	3				
S068	435008	Trident Intermediate H Pole	12	2					None				222610.01	580846.85	149.59	161.39	0.00	97.575	6382.321			197.03	3				
S069	435011	Trident Angle Deviation / Section H Pole	16	2.5					4 (45°)	C+C Terminal	7/4.00	14	222520.41	580808.21	141.16	154.91	-21.51	99.287	6479.896			196.862		3	6		
S070	435008	Trident Intermediate H Pole	16	2.5					None				222450.00	580738.21	138.21	153.51	0.00	101.071	6579.183			200.358	3				
S071	435008	Trident Intermediate H Pole	14	2.25					None				222378.33	580666.95	142.34	155.89	0.00	102.247	6680.254			203.318	3				
S072	435008	Trident Intermediate H Pole	14	2.25					None				222305.82	580594.86	148.50	162.05	0.00	89.074	6782.501			191.321	3				
S073	435011	Trident Angle Deviation / Section H Pole	15	2.25					4 (45°)	C+C Terminal	7/4.00	13	222242.65	580532.05	149.10	162.10	7.24	98.984	6871.575			188.058		3	6		
S074	435008	Trident Intermediate H Pole	15	2.25					None				222164.22	580471.67	140.76	155.31	0.00	102.144	6970.559			201.128	3				
S075	435008	Trident Intermediate H Pole	12	2					None				222083.29	580409.35	147.19	158.99	0.00	100.417	7072.703			202.561	3				
S076	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	222003.72	580348.09	150.17	162.17	-35.1875	98.506	7173.12			198.923		3	6		
S077	435008	Trident Intermediate H Pole	13	2.25					None				221974.56	580254.00	154.23	166.78	0.00	98.579	7271.626			197.085	3				
S078	435008	Trident Intermediate H Pole	14	2.25					None				221945.38	580159.84	158.18	171.73	0.00	96.335	7370.205			194.914	3				
S079	435011	Trident Angle Deviation / Section H Pole	15	2.25					4 (45°)	C+C Terminal	7/4.00	13	221916.87	580067.82	161.20	174.20	-25.38	88.977	7466.54			185.312		3	6		
S080	435008	Trident Intermediate H Pole	14	2.25					None				221929.50	579979.74	163.90	177.45	0.00	96.293	7555.517			185.27	3				
S081	435008	Trident Intermediate H Pole	13	2.25					None				221943.17	579884.43	172.12	184.67	0.00	91.845	7651.81			188.138	3				
S082	435008	Trident Intermediate H Pole	13	2.25					None				221956.21	579793.51	174.18	186.73	0.00	92.579	7743.655			184.424	3				
S083	435008	Trident Intermediate H Pole	12	2					None				221969.35	579701.87	172.75	184.55	0.00	92.408	7836.234			184.987	3				

S084	435008	Trident Intermediate H Pole	12	2					None				221982.47	579610.40	173.30	185.10	0.00	91.834	7928.642			184.242	3				
S085	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	221995.51	579519.49	173.76	185.76	26.78	97.289	8020.476			189.123		3	6		
S086	435008	Trident Intermediate H Pole	12	2					None			10	221964.44	579427.30	174.94	186.74	0.00	100.034	8117.765			197.323	3				
S087	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	221932.50	579332.50	174.18	186.18	43.8034	100.052	8217.8			200.086		3	6		
S088	435008	Trident Intermediate H Pole	12	2					None				221843.81	579286.19	172.75	184.55	0.00	100.937	8317.851			200.989	3				
S089	435008	Trident Intermediate H Pole	11	2					None				221754.34	579239.46	172.91	183.71	0.00	101.817	8418.788			202.754	3				
S090	435008	Trident Intermediate H Pole	13	2.25					None				221664.09	579192.33	171.80	184.35	0.00	101.378	8520.605			203.195	3				
S091	435008	Trident Intermediate H Pole	12	2					None				221574.23	579145.40	170.89	182.69	0.00	103.483	8621.983			204.861	3				
S092	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	221482.50	579097.50	171.12	183.12	-31.3461	95.173	8725.466			198.656		3	6		
S093	435008	Trident Intermediate H Pole	12	2					None				221433.37	579015.99	172.64	184.44	0.00	96.154	8820.639			191.327	3				
S094	435008	Trident Intermediate H Pole	12	2					None				221383.73	578933.64	175.18	186.98	0.00	94.139	8916.793			190.293	3				
S095	435008	Trident Intermediate H Pole	12	2					None				221335.14	578853.01	176.67	188.47	0.00	90.057	9010.932			184.196	3				
S096	435008	Trident Intermediate H Pole	13	2.25					None				221288.65	578775.88	177.30	189.85	0.00	90.042	9100.989			180.099	3				
S097	435008	Trident Intermediate H Pole	12	2					None				221242.16	578698.77	179.50	191.30	0.00	95.016	9191.031			185.058	3				
S098	435008	Trident Intermediate H Pole	13	2.25					None				221193.11	578617.39	179.98	192.53	0.00	94.671	9286.047			189.687	3				
S099	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	221144.24	578536.31	180.36	192.36	-5.03	99.111	9380.718			193.782		3	6		
S100	435008	Trident Intermediate H Pole	12	2					None				221100.71	578447.27	181.30	193.10	0.00	98.176	9479.829			197.287	3				
S101	435008	Trident Intermediate H Pole	12	2					None				221057.59	578359.07	182.78	194.58	0.00	93.572	9578.005			191.748	3				
S102	435008	Trident Intermediate H Pole	13	2.25					None				221016.50	578275.00	182.48	195.03	0.00	100.218	9671.577			193.79	3				
S103	435008	Trident Intermediate H Pole	12	2					None				220972.48	578184.97	184.81	196.61	0.00	94.995	9771.795			195.213	3				
S104	435011	Trident Angle Deviation / Section H Pole	15	2.25					4 (45°)	C+C Terminal	7/4.00	13	220930.76	578099.63	183.99	196.99	12.21	105.97	9866.79			200.965		3	6		
S105	435011	Trident Angle Deviation / Section H Pole	15	2.25					4 (45°)	C+C Terminal	7/4.00	13	220865.13	578016.43	183.54	196.54	-10.65	104.127	9972.76			210.097		3	6		
S106	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	220816.87	577924.16	184.28	196.28	24.54	104.232	10076.887			208.359		3	6		
S107	435008	Trident Intermediate H Pole	12	2					None				220734.56	577860.21	187.51	199.31	0	91.754	10181.118			195.986	3				
S108	435008	Trident Intermediate H Pole	11	2					None				220662.11	577803.91	189.53	200.33	0.00	99.745	10272.872			191.499	3				
S109	435008	Trident Intermediate H Pole	12	2					None				220583.34	577742.71	193.78	205.58	0.00	99.893	10372.617			199.638	3				
S110	435008	Trident Intermediate H Pole	13	2.25					None				220504.46	577681.42	199.43	211.98	0.00	86.266	10472.51			186.159	3				
S111	435008	Trident Intermediate H Pole	13	2.25					None				220436.34	577628.49	200.01	212.56	0.00	98.827	10558.776			185.093	3				
S112	435011	Trident Angle Deviation / Section H Pole	15	2.25					4 (45°)	C+C Terminal	7/4.00	13	220358.30	577567.86	191.80	204.80	-29.7661	98.408	10657.603			197.235		3	6		
S113	435008	Trident Intermediate H Pole	12	2					None				220320.82	577476.87	191.68	203.48	0.00	102.909	10756.011			201.317	3				
S114	435008	Trident Intermediate H Pole	12	2					None				220281.63	577381.71	192.18	203.98	0.00	101.56	10858.92			204.469	3				
S115	435008	Trident Intermediate H Pole	14	2.25					None				220242.95	577287.81	194.71	208.26	0.00	84.705	10960.48			186.265	3				
S116	435011	Trident Angle Deviation / Section H Pole	14	2.25					None				220210.69	577209.48	204.55	216.55	0.00	82.767	11045.185			167.472		3	6		
S117	435011	Trident Angle Deviation / Section H Pole	15	2.25					4 (45°)	C+C Terminal	7/4.00	13	220179.17	577132.96	212.61	225.61	25.4087	80.787	11127.952			163.554		3	6		
S118	435011	Trident Angle Deviation / Section H Pole	16	2.5					None				220119.33	577078.68	220.31	234.06	0.00	74.112	11208.739			154.899		3	6		
S119		Tee 4-Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	220064.43	577028.90	225.14	237.14	0	68.618	11282.851			142.73		3	6		
S120	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	220013.60	576982.80	224.38	236.38	53.04	74.119	11351.469			142.737		3	6		
S121	435013	Trident Terminal H Pole	12	2					4 (45°)	C+C Terminal	7/4.00	10	219940.80	576996.73	226.27	236.52	0.33	19.877	11425.588			93.996		3	6		
S122	-	Gantry	10	-																							

Proposed conductor pull locations - TBC following landowner comments etc

OVERHEAD LINE SCHEDULE: Mark Hill - Chirmorie

ROUTE REFERENCE	132kV Chirmorie - Stranoch

CONTRACT	CT1103
DRAWING NUMBER	CT1103-1-0000-CA-SPENEL-0107 Rev0C

CIRCUIT 1	FROM SS	Chirmorie	TO SS	Stranoch	FROM	S123	VOLTAGE	132kV	MAX. OPER TEMP	75°C	CONDUCTOR	UPAS
					TO	S182(Gantry)					TELECOMS	UPAS OPPC

POLE NO	Structure Type				FOUNDATIONS				Stays (Grade 1150)				UTM COORDINATES				LINE ANGLE	AHEAD SPAN	CHAINAGE	WIND SPAN	WEIGHT SPAN	SUM OF ADJACENT SPANS	INSULATORS				Comments
	ENA 43-50 SPEC.	TYPE	Pole Length	Embedment Depth	Timber Baulks				No (slope)	Arreng.	Size	Spread	X	Y	Z	Z											
-	-	-	(m)	(m)	Type 1	Type 2	Type 3	Type 4	-	-	-	-	(m)	(m)	Ground level (m)	Conductor attachment point elevation (m)	(deg)	(m)	(m)	(m)	(m)	(m)	Post	Pilot	Strain	Discs 70kN	-
S123	435013	Trident Terminal H Pole	11	2					4 (45°)	C+C Terminal	7/4.00	9	220074.57	577016.54	222.47	231.72	0.00	85.26	8.19			85.26		3	6		
S124	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	220133.35	576954.78	219.44	230.44	50.97	91.27	93.45			176.52		3	6		
S125	435008	Trident Intermediate H Pole	11	2					None				220121.62	576864.27	223.06	233.86	0.00	91.37	184.71			182.63	3				
S126	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	220109.884	576773.659	223.46	235.46	23.00	101.47	276.08			192.83		3	6		
S127	435008	Trident Intermediate H Pole	11	2					None				220058.57	576686.13	221.86	232.66	0.00	100.36	377.54			201.82	3				
S128	435008	Trident Intermediate H Pole	11	2					None				220007.82	576599.55	220.49	231.29	0.00	101.10	477.90			201.46	3				
S129	435008	Trident Intermediate H Pole	11	2					None				219956.69	576512.33	218.08	228.88	0.00	104.81	579.00			205.91	3				
S130	435008	Trident Intermediate H Pole	11	2					None				219903.68	576421.91	217.40	228.20	0.00	101.96	683.81			206.77	3				
S131	435008	Trident Intermediate H Pole	11	2					None				219852.12	576333.95	215.72	226.52	0.00	98.15	785.77			200.12	3				
S132	435008	Trident Intermediate H Pole	11	2					None				219802.48	576249.27	215.35	226.15	0.00	102.23	883.93			200.38	3				
S133	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	219750.745	576161.097	212.037	223.037	0.00	104.94	986.16			207.17		3	6		
S134	435008	Trident Intermediate H Pole	11	2					None				219679.48	576084.06	210.48	221.28	0.00	99.94	1091.10			204.88	3				
S135	435008	Trident Intermediate H Pole	11	2					None				219611.62	576010.70	209.53	220.33	0.00	97.71	1191.04			197.65	3				
S136	435008	Trident Intermediate H Pole	11	2					None				219545.27	575938.98	205.80	216.60	0.00	103.56	1288.75			201.27	3				
S137	435008	Trident Intermediate H Pole	12	2					None				219474.95	575862.96	202.31	214.11	0.00	102.87	1392.30			206.43	3				
S138	435008	Trident Intermediate H Pole	12	2					None				219405.09	575787.44	203.06	214.86	0.00	100.27	1495.17			203.14	3				
S139	435008	Trident Intermediate H Pole	12	2					None				219337.00	575713.84	201.40	213.20	0.00	97.82	1595.45			198.10	3				
S140	435008	Trident Intermediate H Pole	11	2					None				219270.57	575642.03	201.36	212.16	0.00	102.01	1693.27			199.84	3				
S141	435008	Trident Intermediate H Pole	11	2					None				219201.30	575567.14	201.41	212.21	0.00	100.43	1795.28			202.45	3				
S142	435008	Trident Intermediate H Pole	11	2					None				219133.10	575493.41	202.52	213.32	0.00	96.60	1895.72			197.04	3				
S143	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	219067.5	575422.5	198.769	210.769	16.68	91.23	1992.32			187.83		3	6		
S144	435011	Trident Angle Deviation / Section H Pole	14	2.25					None				218988.93	575376.13	189.11	201.11	0.00	92.99	2083.55			184.22		3	6		
S145	435008	Trident Intermediate H Pole	12	2					None				218908.85	575328.88	184.78	196.58	0.00	90.20	2176.54			183.18	3				
S146	435008	Trident Intermediate H Pole	12	2					None				218831.17	575283.03	184.53	196.33	0.00	102.23	2266.73			192.43	3				
S147	435008	Trident Intermediate H Pole	12	2					None				218743.13	575231.08	188.37	200.17	0.00	106.01	2368.96			208.24	3				
S148	435008	Trident Intermediate H Pole	11	2					None				218651.83	575177.20	196.64	207.44	0.00	105.34	2474.97			211.36	3				
S149	435008	Trident Intermediate H Pole	12	2					None				218561.10	575123.66	203.84	215.64	0.00	100.48	2580.32			205.82	3				
S150	435008	Trident Intermediate H Pole	13	2.25					None				218474.57	575072.59	200.05	212.60	0.00	99.52	2680.80			200.00	3				
S151	435008	Trident Intermediate H Pole	12	2					None				218388.86	575022.01	199.15	210.95	0.00	99.82	2780.31			199.34	3				
S152	435008	Trident Intermediate H Pole	12	2					None				218302.89	574971.28	208.79	220.59	0.00	100.53	2880.14			200.35	3				
S153	435011	Trident Angle Deviation / Section H Pole	15	2.25					4 (45°)	C+C Terminal	7/4.00	13	218216.316	574920.188	212.311	225.311	-39.39	95.62	2980.67			196.15		3	6		
S154	435008	Trident Intermediate H Pole	12	2					None				218183.52	574830.37	220.70	232.50	0.00	97.23	3076.28			192.85	3				
S155	435008	Trident Intermediate H Pole	14	2.25					None				218150.16	574739.04	220.14	233.69	0.00	98.19	3173.51			195.42	3				
S156	435008	Trident Intermediate H Pole	12	2					None				218116.48	574646.81	221.07	232.87	0.00	102.67	3271.71			200.86	3				
S157	435008	Trident Intermediate H Pole	12	2					None				218081.26	574550.37	220.33	232.13	0.00	103.70	3374.37			206.37	3				
S158	435008	Trident Intermediate H Pole	12	2					None				218045.69	574452.96	218.85	230.65	0.00	102.80	3478.08			206.50	3				
S159	435011	Trident Angle Deviation / Section H Pole	14	2.25					4 (45°)	C+C Terminal	7/4.00	12	218010.429	574356.399	217.269	229.269	7.69	104.70	3580.87			207.49		3	6		

S160	435008	Trident Intermediate H Pole	13	2.25					None				217961.67	574263.75	220.92	233.47	0.00	100.62	3685.57			205.32	3				
S161	435008	Trident Intermediate H Pole	12	2					None				217914.81	574174.70	224.28	236.08	0.00	95.95	3786.19			196.57	3				
S162	435008	Trident Intermediate H Pole	11	2					None				217870.13	574089.79	219.71	230.51	0.00	108.15	3882.14			204.09	3				
S163	435008	Trident Intermediate H Pole	12	2					None				217819.77	573994.09	216.65	228.45	0.00	105.57	3990.29			213.72	3				
S164	435008	Trident Intermediate H Pole	11	2					None				217770.61	573900.66	220.27	231.07	0.00	104.75	4095.86			210.32	3				
S165	435008	Trident Intermediate H Pole	13	2.25					None				217721.83	573807.97	222.50	235.05	0.00	98.20	4200.60			202.95	3				
S166	435008	Trident Intermediate H Pole	12	2					None				217676.10	573721.06	226.03	237.83	0.00	97.35	4298.81			195.55	3				
S167	435008	Trident Intermediate H Pole	12	2					None				217630.76	573634.92	226.90	238.70	0.00	100.81	4396.15			198.16	3				
S168	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	217583.814	573545.702	226.28	237.28	43.03	103.70	4496.97			204.51		3	6		
S169	435008	Trident Intermediate H Pole	12	2					None				217485.90	573511.57	228.05	239.85	0.00	105.39	4600.67			209.09	3				
S170	435008	Trident Intermediate H Pole	12	2					None				217386.38	573476.87	227.37	239.17	0.00	105.66	4706.06			211.06	3				
S171	435011	Trident Angle Deviation / Section H Pole	13	2.25					4 (45°)	C+C Terminal	7/4.00	11	217286.60	573442.09	226.15	237.15	42.77	102.23	4811.72			207.89		3	6		
S172	435008	Trident Intermediate H Pole	12	2					None				217192.89	573482.94	225.74	237.54	0.00	111.02	4913.95			213.25	3				
S173	435008	Trident Intermediate H Pole	12	2					None				217091.12	573527.30	224.15	235.95	0.00	110.12	5024.97			221.14	3				
S174	435008	Trident Intermediate H Pole	12	2					None				216990.17	573571.30	221.42	233.22	0.00	110.46	5135.09			220.57	3				
S175	435008	Trident Intermediate H Pole	11	2					None				216888.92	573615.43	216.84	227.64	0.00	105.62	5245.55			216.08	3				
S176	435008	Trident Intermediate H Pole	11	2					None				216792.09	573657.64	216.37	227.17	0.00	96.24	5351.17			201.86	3				
S177	435011	Trident Angle Deviation / Section H Pole	12	2					4 (45°)	C+C Terminal	7/4.00	10	216703.867	573696.093	218.882	229.132	45.51	104.25	5447.41			200.49		3	6		
S178	435008	Trident Intermediate H Pole	11	2					None				216666.62	573793.46	220.13	230.93	0.00	105.97	5551.66			210.21	3				
S179	435011	Trident Angle Deviation / Section H Pole	12	2					4 (45°)	C+C Terminal	7/4.00	10	216628.76	573892.43	222.70	232.95	-44.38	93.92	5657.62			199.88		3	6		
S180	435011	Trident Angle Deviation / Section H Pole	12	2					4 (45°)	C+C Terminal	7/4.00	10	216543.42	573931.64	225.41	235.66	-45.87	78.70	5751.54			172.62		3	6		
S181	435013	Trident Terminal H Pole	12	2					4 (45°)	C+C Terminal	7/4.00	10	216470.033	573903.199	226.82	237.07	-0.46	23.63	5830.24			102.33		3	6		
S182		Gantry Longburn	10																								

Proposed conductor pull locations - TBC following landowner comments etc

SP ENERGY NETWORKS

Feb / 2021

Construction methodology of the Chirmorie / Stranoch 132kv OHL's

CONSTRUCTION METHOD STATEMENT

1. PROJECT OVERVIEW

This project relates to the applications received via NGET for the connection of Chirmorie and Stranoch Windfarms into Mark Hill 275/132kVSubstation in Dumfries and Galloway

Chirmorie Windfarm is located ~12km south west of Mark Hill Substation and Stranoch Windfarm is located ~18km south west of Mark Hill Substation. Stranoch Windfarm will connect to the tee point on the Mark Hill to Chirmorie 132kV circuit, and both windfarms will connect further to the new autotransformer, SGT3 installed at Mark Hill Substation.

Chirmorie OHL.

Approximately 12km of 132kV Trident overhead line will be installed between Mark Hill 275/132kV Substation and Chirmorie Windfarm Substation. The overhead line will be strung with ACCR Lark and Eagle conductors at a maximum operating temperature of 190°C with Aerial All-Dielectric Self Supporting (ADSS) telecoms.

Stranoch OHL.

Approximately 6km of 132kV Trident overhead line will be installed between the Tee junction near Chirmorie Windfarm substation and Stranoch Windfarm substation. The overhead line will be strung with Poplar and OPPC Poplar equivalent at a maximum operating temperature of 75°C.

2. CONSTRUCTION METHODOLOGY

The process of construction for an overhead line project (OHL) such as the one being constructed between Stranoch, Chrimorie and Markhill sub-station involves several key areas.

This document will highlight the relevant key areas associated with the construction phase and will provide information on typical methodologies to be deployed by the construction teams.

The contractor will be responsible for the timing of all activities and will be required to take account of seasonal influences, such as but not limited to weather, environmental and ecological constraints which will be detailed in the Project Documentation. These could include but are not limited to any Traffic Management Plan, Environmental Management Plan, Peat Management Plan and all relevant Health & Safety Legislation.

Construction works shall be in compliance with all of the relevant Planning Permissions and Section 37 consents.

2.1 Description of overhead line

The proposed overhead line will be constructed using 'Trident' wood poles. Each pole structure will be topped by a galvanised steelwork cross-arm and insulators. The steel cross arm and insulators will carry a single three-phase circuit of Poplar conductor. (Appendix1)

The wood poles will be seasoned and treated with a suitable preservative, resulting in a dark brown appearance. This will weather to a silver/grey colour over a period of approximately five years following installation.

The respective heights of the wood poles will vary in height (including steel work and insulators) in relation to the topography of the land to ensure suitable ground clearance from the conductors or any associated apparatus. The minimum required height clearance for 132kv OHL is 6.7m over normal land and roads, excluding heavy use roads where 7.1m clearance is required.

The spacing between the poles will also vary depending on topography of the land.

The distance between the poles will be finalised prior to application for consent and will take into account all environmental considerations along

the route as well as construction requirements. Stays (guy lines) will be required to provided additional structural stability for poles that are being used to create changes in direction.

3. ON SITE CONSTRUCTION WORKS

3.1 Project Timeline

Subject to approval of the relevant Section 37 applications, it is currently anticipated that the OHL to Chirmorie will be completed by September 2023 and the OHL to Stranoch by September 2024.

3.2 Site Compound

Establishment of the site compound include the setting up of the contractor's compound and offices for use by the Contractor and Engineers. This includes cabins, stores, welfare facilities and a car park. Temporary work compounds would normally be installed as permitted development under Part 4, Class 14 of the Town and Country Planning (General Permitted Development) (Scotland) Order 1992 (As amended). This approach includes a requirement for the ground to be reinstated to its original condition as soon as reasonably practicable.

Preparatory works for the temporary site establishments will involve some site clearance work, minor earthworks operations to level the site, drainage works for the car park and service installation.

Due to the size of the project, it is anticipated that other smaller mobile welfare units will be established at different locations along the route.

Services to the site cabins and offices will include electrical, communications, water and sewerage facilities.

The site compounds will to be erected, maintained and subsequently removed in a manner that will have minimum impact on the area and in accordance with permitted development requirements.

Project Management and Site Operatives will use the site establishment on a daily basis once the facilities are completed, and access is available for personal vehicles and other forms of transport.

Construction plant and materials will be delivered to the site compound however, where appropriate it will be delivered directly to the working areas of the OHL route.

Pole storage will be in a defined bunded area away from any water courses and take into consideration the control of any creosote from the poles which may cause potential contamination.

Typically, this will be by storage on a hardstanding area, with a nonpermeable membrane to prevent leaching. This will be agreed with site management and environmental advisors.

All waste will be stored securely and disposed of through a licensed waste carrier in accordance with waste regulations and the Site Waste Management Plan. The waste hierarchy will be followed to keep waste to a minimum.

3.3 Service Diversions

It is possible that some service diversions will be undertaken in advance of the main construction works. This can include already existing distribution and transmission overhead lines.

Services are either located above or below ground. For works above ground poles, towers or pylons will have to be either temporarily or permanently undergrounded to allow the erection of the Overhead line.

3.4 Pre-Construction surveys

Prior to any work commencing on site, environmental, archaeological and topographical surveys will be undertaken to identify any hazards and/or constraints. Pre-construction hydrological studies will need to be carried out to inform the construction phase, as there are Ground Water Dependant Terrestrial Ecosytems (GWDTEs) in the area.

The information gathered during these surveys will be used to develop the project environmental, quality and health & safety plans and associated documents. These documents are live documents and will be updated regularly in accordance with the project requirements.

3.5 Project Management

The Chirmorie and Stranoch Overhead Lines Project will have an extensive project management team who will be responsible for ensuring the project is delivered in line with the consents and permissions obtained to allow the construction to be undertaken. In addition, the management team will ensure the industry best practise standards and guidance is followed where practicable.

3.6 Construction Mitigation

In accordance with the Construction (Design and Management) Regulations 2015, construction of the project (and hence management of "construction mitigation") will be detailed in a Construction Phase Plan, prepared by the Principal Contractor. This Plan will then be reviewed by the Principal Designer prior to works commencing.

The Contractors Environmental Performance Requirements (CEPR) establishes the requirements to be followed by SP Energy Networks Projects (SPEN Projects) contractors for the tender, planning and execution of their works. This document will allow each Contractor to bid, plan, cost and resource in line with its requirements and fulfil requirements during delivery. This document should be read in conjunction with the Environmental Management Plan (EMP).

3.7 Pre-works Activities

Prior to the commencement of any construction activities, method statements detailing the particular activities, timetable and working methods which will be undertaken will be written by each contractor and submitted to SPEN for review and comment. This requirement is embedded within the management of health, safety and environmental risk.

3.8 General Best Practice

The following best practice measures (Table 1) in relation to the control of mud, noise, vibration, fire and dust are industry expected standards and will be monitored by SPEN.

Table 1: Best Practice Measures

	Source	Best Practice
Mud	Access tracks and haul roads – vehicle movements on wet days, excavation works in particular overburden, loading of wet material; Excavations – removal and loading of wet material; Restoration works – unloading of materials, placement of material.	Undertake the construction works such that the generation of mud is minimised at all times, by adopting methods of working that eliminate the potential for mud to be transferred offsite by vehicles leaving the Site.
		Road cleaning or sweeping measures will be implemented to remove any mud deposited on the public highway.
Vibration	Access tracks and haul roads – vehicle movements, excavation works in rock material; compaction of road construction materials; Excavations – removal and loading of rock material;	Undertake the construction works such that vibration will be minimized at all times, by adopting methods of working that eliminate the potential for vibration to be detected offsite.
		Disturbance from Vibration is considered to be a minimal risk due to the type of works and remote location.

	Source	Best Practice
Dust	The prime sources of dust on the site are: Haulage vehicles, both on-site and road licensed; Handling of soils; Overburden and stone; Overburden and site stockpiles; Un-seeded topsoil and subsoil stockpiles; Loading of vehicles (with soil, overburden or stone); Excavation areas;	Operatives should be especially watchful in dry conditions, and should either avoid actions likely to generate airborne dust, or alternatively ensure appropriate dust suppression measures are in place prior to commencing operations. The use of water bowsers is proposed as the method for dust suppression,
		Construction works will be undertaken in accordance with industry best practice standards and as such ensure that the generation of dust is minimised at all times.
Noise	During the construction works the main sources of noise are considered to be: Access tracks and haul roads – vehicle movements, excavation works in rock material; compaction of road construction materials Excavations – removal and loading of rock material; Restoration works – placement of rock material.	Undertake the construction works in accordance with The Control of Noise at Work Regulations 2005 such that the generation of noise is minimized at all times.
Fire	A fire caused by either a discarded cigarette or by hot works could result in smoke pollution being emitted from the site.	Implementation of a "no smoking" policy whilst in vulnerable areas of the site. Smoking will only be permitted within designated areas where all discarded cigarettes can be extinguished in a safe and proper manner.
		Hot works will only be permitted where a "Hot Works Permit" has been allocated for that specific task.
		An Emergency Response Procedure will be produced prior to construction commencing which will details the procedures to be carried out in the event of an emergency occurring, including a fire.

3.9 Activity Specific Environmental Controls

The environmental and ecological risks specific to the route and work activities have been identified by SPEN and control measures have been developed and documented. Table 2 outlines the environmental risks associated with work activities and the documentation that outlines the approach/controls to be adopted by contractors. These documents are in addition to general best practice as outlined above and will include a constraints plan that will be produced for construction, identifying sensitivities and appropriate steps to be taken (fencing off/identifying on ground where necessary in liaison with ecologist).

Table 2 Summary of activities, associated environmental risks and SPEN documentation			
Stage	**Activities**	**Environmental Risks**	**SPEN Document**
Felling	Felling and Mulching	Protected and notable species (UK and EPS)	• Environmental Management Plan (EMP), which will include the requirements of further ecological pre-construction checks. • Contractors Environmental Performance Requirements (CEPR)
		Private Water Supplies	• Environmental Management Plan (EMP) – This document will include information on Private Water Supplies and Pollution Prevention Plan requirements. • Contractors Environmental Performance Requirements (CEPR)
		Public Water supplies	• Environmental Management Plan (EMP) – This document will include information on Public Water supplies and Pollution Prevention Plan requirements. • Contractors Environmental Performance Requirements (CEPR)
		Surface water	• Environmental Management Plan (EMP) – This document will include information on the requirement of a Surface Water Monitoring Strategy and Pollution Prevention Plan requirements. • Contractors Environmental Performance Requirements (CEPR)
		Watercourse crossings	• Environmental Management Plan (EMP) – This document will include information on the requirement of a Watercourse Assessment and Pollution Prevention Plan requirements. • Contractors Environmental Performance Requirements (CEPR)
		Waste Management	• Waste Forecasting is required at tender stage. • Contractors Environmental Performance Requirements (CEPR)
		Peat Management	• Environmental Management Plan (EMP) – This document will include information on the requirement of a Temporary Peat Storage Area. • Contractors Environmental Performance Requirements (CEPR)
		Biosecurity	• Environmental Management Plan (EMP) – This document will include information on the Biosecurity requirements and Invasive Non-Native Species Requirements.

Table 2 Summary of activities, associated environmental risks and SPEN documentation			
Stage	**Activities**	**Environmental Risks**	**SPEN Document**
			• Contractors Environmental Performance Requirements (CEPR)
		Ground Water Dependent Terrestrial Ecosystem (GWDTE)	• Environmental Management Plan (EMP) – This document will include requirements to adopt Ground Water Dependant Terrestrial Ecosystems (GWDTE) requirements. • Contractors Environmental Performance Requirements (CEPR)
Construction	Temporary Access Roads - Cut and Fill	Surface water	• Environmental Management Plan (EMP) – This document will include requirements to adopt a Surface Water Monitoring Strategy. • Contractors Environmental Performance Requirements (CEPR)
		Ground Water Dependent Terrestrial Ecosystem (GWDTE)	• Environmental Management Plan (EMP) – This document will include requirements to adopt Ground Water Dependant Terrestrial Ecosystems (GWDTE) requirements. • Contractors Environmental Performance Requirements (CEPR)
		Peat Management	• Environmental Management Plan (EMP) – This document will include information on the requirement of a Temporary Peat Storage Area. • Contractors Environmental Performance Requirements (CEPR)
		Protected and notable species (UK and EPS)	• Environmental Management Plan (EMP), which will include the requirements of further ecological pre-construction checks. • Contractors Environmental Performance Requirements (CEPR)
		Private Water Supplies	• Environmental Management Plan (EMP) – This document will include information on Private Water Supplies and Pollution Prevention Plan requirements. • Contractors Environmental Performance Requirements (CEPR)
		Public Water supplies	• Environmental Management Plan (EMP) – This document will include information on Public Water supplies and Pollution Prevention Plan requirements. • Contractors Environmental Performance Requirements (CEPR)

Table 2 Summary of activities, associated environmental risks and SPEN documentation			
Stage	**Activities**	**Environmental Risks**	**SPEN Document**
	Culverts	Watercourse crossings	• Environmental Management Plan (EMP) – This document will include requirements to develop a Watercourse assessment. • Contractors Environmental Performance Requirements (CEPR)
		Surface Water	• Environmental Management Plan (EMP) – This document will include requirements to adopt a Surface Water Monitoring Strategy. • Contractors Environmental Performance Requirements (CEPR)
		Fisheries	• Environmental Management Plan (EMP) – This document will include information on Fisheries requirements. • Contractors Environmental Performance Requirements (CEPR)
		Biosecurity	• Environmental Management Plan (EMP) – This document will include information on the Biosecurity requirements and Invasive Non-Native Species Requirements. • Contractors Environmental Performance Requirements (CEPR)
		Protected and notable species (UK and EPS)	• Environmental Management Plan (EMP), which will include the requirements of further ecological pre-construction checks. • Contractors Environmental Performance Requirements (CEPR)
	Establishment of working areas, excavation and pole installation	Ground Water Dependent Terrestrial Ecosystem (GWDTE)	• Environmental Management Plan (EMP) – This document will include requirements to adopt Ground Water Dependant Terrestrial Ecosystems (GWDTE) requirements. • Contractors Environmental Performance Requirements (CEPR)
		Private Water Supplies	• Environmental Management Plan (EMP) – This document will include information on Private Water Supplies and Pollution Prevention Plan requirements. • Contractors Environmental Performance Requirements (CEPR)
		Public Water supplies	• Environmental Management Plan (EMP) – This document will include information on Public Water supplies and Pollution Prevention Plan requirements.

Table 2 Summary of activities, associated environmental risks and SPEN documentation			
Stage	**Activities**	**Environmental Risks**	**SPEN Document**
			• Contractors Environmental Performance Requirements (CEPR)
		Surface Water	• Environmental Management Plan (EMP) – This document will include requirements to adopt a Surface Water Monitoring Strategy. • Contractors Environmental Performance Requirements (CEPR)
		Protected and notable species (UK and EPS)	• Environmental Management Plan (EMP), which will include the requirements of further ecological pre-construction checks. • Contractors Environmental Performance Requirements (CEPR)
		Waste Management	• Waste Forecasting is required at tender stage. • Contractors Environmental Performance Requirements (CEPR)
		Peat Management	• Environmental Management Plan (EMP) – This document will include information on the requirement of a Temporary Peat Storage Area. • Contractors Environmental Performance Requirements (CEPR)
	Stringing	Protected and notable species (UK and EPS)	• Environmental Management Plan (EMP), which will include the requirements of further ecological pre-construction checks. • Contractors Environmental Performance Requirements (CEPR)
		Private Water Supplies	• Environmental Management Plan (EMP) – This document will include information on Private Water Supplies and Pollution Prevention Plan requirements. • Contractors Environmental Performance Requirements (CEPR)
		Watercourse crossings	• Environmental Management Plan (EMP) – This document will include requirements to develop a Watercourse assessment. • Contractors Environmental Performance Requirements (CEPR)
		Waste Management	• Waste Forecasting is required at tender stage. • Contractors Environmental Performance Requirements (CEPR)
		Biosecurity	• Environmental Management Plan (EMP) – This document will include

Table 2 Summary of activities, associated environmental risks and SPEN documentation			
Stage	**Activities**	**Environmental Risks**	**SPEN Document**
			information on the Biosecurity requirements and Invasive Non-Native Species Requirements. • Contractors Environmental Performance Requirements (CEPR)
		Earthworks (GWDTE)	• Environmental Management Plan (EMP) – This document will include requirements to adopt Ground Water Dependant Terrestrial Ecosystems (GWDTE) requirements. • Contractors Environmental Performance Requirements (CEPR)
		Public Water supplies	• Environmental Management Plan (EMP) – This document will include information on Public Water supplies and Pollution Prevention Plan requirements. • Contractors Environmental Performance Requirements (CEPR)
		Surface Water	• Environmental Management Plan (EMP) – This document will include requirements to adopt a Surface Water Monitoring Strategy. • Contractors Environmental Performance Requirements (CEPR)

3.10 Access and enabling works

To facilitate the access to the site at various locations along the OHL route it may be necessary to install sections of temporary stone tracks, bellmouths and working areas as part of the overall infrastructure.

If sections of temporary stone access tracks are required, they would be installed using predominately crushed stone placed on a synthetic geotextile membrane or grid (Appendix 2). It is also possible that some areas may be accessed utilising Trackway panel installation where possible as this is a less invasive form of access routing (Appendix 3).

To facilitate the access from the public road into the site, bellmouths may be required to be installed.

Bellmouths and temporary stone access tracks will be designed in accordance with the approved details submitted by condition, Traffic Management Plans, or separate planning applications, whichever is required.

Initial site investigation works will be undertaken to establish the make-up of the ground and its bearing capacity.

The initial objective is to establish a base surface which establishes a route profile which is appropriate to the type of vehicles anticipated to utilise the road.

Dependant on the design which is created utilising the site investigation works; the temporary stone access tracks will be built up in layers typically on compacted crushed stone placed on a synthetic geotextile membrane or grid.

The temporary access track depth and width will vary depending on the type of vehicle's intended to utilise the road.

Some temporary access tracks will be wider in places to accommodate passing places located at a suitable frequency to provide a line of sight between passing places.

Road Maintenance.
Inspection works and maintenance is proposed for all roads used by construction traffic. Routine maintenance will include works such as surface rehabilitation, drainage works, safety barrier works, structural inspections and repairs. All of these may require traffic management measures to be implemented to ensure the safety of the workforce and road users during the works.

Winter maintenance will involve gritting and snow clearing to ensure the road surface is safe to drive on.

The main items of plant required for the Road Construction / Maintenance activities will include but is not limited to:

- Excavators for cut and fill operations and to extend the material.
- HGV lorries to dispatch stone or for off-site disposal of unsuitable and surplus when required.
- Vibrating rollers to compact the fill in layers.
- Snowploughs and gritters during the winter for snow clearance operations.

3.11 Temporary Works

Temporary works are generally described as the parts of a construction project that are needed to enable the permanent works to be undertaken. Usually the temporary works are removed after use; however, items such as environmental mitigation or drainage may be required to be left permanently, particularly where they result in betterment, subject to agreement with landowners and the consenting authority.
These may include:

- Scaffold erection
- Formwork
- Excavations
- Temporary support systems
- Bridge erection

Temporary traffic management will be in place during construction at works on private and public roads and at site access and egress points.

Such measures will include combinations of the following:

- Traffic cones
- Traffic signals
- Temporary signs
- Temporary lighting
- Temporary speed restrictions
- Temporary diversions
- Narrow lanes
- Lane closures
- Partial or full road closures (to be agreed with the relevant authority) with appropriate diversion signing in place.

3.12 Tree felling and removal

Tree clearance may be required to be undertaken along the route of the OHL to create the wayleave corridor, although trees which do not affect the connection will be retained. In practice this requires felling to a wind firm edge within forestry and will involve felling identified tree blocks. Landowner agreement will be reached for this and in most cases private felling licenses are already in place. Where this is not the case, felling license will be sought where required, prior to any felling works taking place. Advice will also be sought from a qualified arborist to retain trees which would not impact on the operational resilience of the overhead line. Approval of the Section 37 with deemed planning permission will allow for

removal of identified trees included within the application submission without requiring felling licenses.

This will be a mixture of commercial mechanical harvesting, and hand felling.

3.13 Temporary Fencing

The land area occupied by the works will be identified accurately on the ground by surveying and installing appropriate pegs and posts, prior to the works commencing. The area defined will be the area of land acquired through the consent process and any other areas the contractor has acquired by agreement to facilitate construction of the works due to their own method of working.

This will involve the installation of temporary fencing where it is necessary by project needs, for example at areas where land will be returned to agriculture following completion of the works, or if the contractor considers that there is a safety issue or risk of damage to the permanent works during construction.

Temporary fencing will generally be a post and wire type.

Other specific fencing that may be required temporarily will include silt/sediment fences to prevent sediment from reaching watercourses and higher security fences at compounds or where additional security of the works is required.

3.14 Construction methods for wood pole overhead line erection

The following process would be followed for the erection of a wood pole overhead line:

- Access, delivery and assembly would be taken using a tracked excavator and low ground-pressure vehicles (e.g. tractor, Argo cat, quad bikes). In certain situations, Helicopters may be used for pole delivery to point of installation.
- Bog mats and temporary track mats would be used to cross soft ground where existing access tracks are not available.
- Excavators may need to create a level pad to work from which would be reinstated upon completion.
- Turf and topsoil would be removed together to retain the turf root system and placed separate for later reinstatement.

- A hole would be excavated to allow the pole, brace block and/ or steel foundation braces to be positioned in place. A typical pole excavation is 3m2 x 2m deep with a maximum excavation of 3m depth.
- The excavated material is then sorted into appropriate layers and used for backfilling.
- The poles are erected using normal agricultural machinery such as a digger with a lifting arm.
- The excavator(s) would then hoist the assembled structure into position and, once the structure has been braced in position, the trench is backfilled.
- The hole would be backfilled with soil replaced in reverse order to the order it was excavated to ensure environmental continuity.
- Backfilling would be progressed in layers of approximately 300 – 400 mm deep, with stone hard core added as required around foundation blocks to ensure adequate
  compaction and suitable geotechnical conditions are maintained between each layer.
- When replacing the topsoil/turf around the pole it would be left slightly proud of ground level (approximately 150/ 300 mm) to allow for the excavation to naturally compact further through time.
- It is anticipated that all material excavated for the installation of the poles and stays would be used in backfilling the excavations.

3.15 Method for overhead line conductor stringing

On completion of the pole structure erection in a given section of the overhead line, the installation of the overhead line conductors can commence.

The conductor drums and associated installation plant will be transported to the site from the site compound.

Each pole type will have different requirements in terms of plant and equipment; typically, a line or intermediate pole would require a small amount of plant and equipment whereas a tension or terminal pole would require significantly more.

Tension or Terminal Poles

Typically, a conductor winch, conductor drums & tensioner will be located at each end of the section of the overhead line that is getting strung whether it be a tension or terminal tower. Additionally, mobile elevated

working platforms, conductor fittings, mechanical presses and insulators will be required at these locations.

Line Poles

At line pole locations only the running out blocks, insulators and conductor fittings are required. A mobile elevated work platform may also be required.

3.16 Commissioning

Overhead line commissioning is generally confined to inspection of the installation works, each pole will be independently inspected, and a report submitted to the project manager. A snagging list of any reported detail will be compiled and rectified before the line is commissioned.

4. Appendices

- **Appendix 1 -** Typical 132kv Wood Pole Overhead line

- **Appendix 2** - Stone road installation using geomembrane

- **Appendix 3** – Trackway Panel Installation

3. ROUTE SELECTION AND ALTERNATIVES

3.1 Introduction

This chapter describes the principal alternatives considered as part of the design process, the approach adopted in identifying and assessing the alternatives and the reasons that led to the confirmation of the proposed development.

3.2 Aim of the Process

SP Energy Networks is obliged under *section 9 of the Electricity Act 1989* 'to develop and maintain an efficient, co-ordinated and economical system of electricity transmission and to facilitate competition in the supply and generation of electricity'. In addition, SP Energy Networks has a duty under *Schedule 9 of the Electricity Act 1989* to take account of 'the desirability of preserving natural beauty, of conserving flora, fauna, geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic interest and sites and structures of archaeological interest'. It is also required to take reasonable steps to mitigate the effects of its proposals.

Under the Electricity Act 1989, SP Energy Networks is required to consider environmental, technical and economic matters, and reach a balance between them. This means that a proposed route will be the one, selected after an appraisal of a number of route options, which balances technical feasibility and economic viability with the least disturbance to people and the environment. Following engagement with relevant stakeholders, including local communities, professional judgement is used to establish the balance.

3.2.1 Routeing Objective

In accordance with SP Energy Networks' 'Major Electrical Infrastructure Projects – Approach to Routeing and Environmental Impact Assessment' document, the routeing objective was "to identify a technically feasible and economically viable route for a continuous 132 kV overhead line connection, supported on wood poles. This route should, on balance, cause the least disturbance to the environment and the people who live, work and enjoy recreation within it".

3.3 Alternatives

The following alternatives have been considered during project development, including:

- The "Do Nothing" Scenario;
- Alternative technical options; and
- Alternative routes for the Proposed Development.

3.3.1 The "Do Nothing" Scenario

The "do nothing" scenario is a hypothetical alternative considered which provides a context for understanding the implications of the proposed development. SPT, as the electricity transmission license holder in the south of Scotland, has a duty under Section 9 of the Electricity Act 1989 to facilitate competition in the generation and supply of electricity and to offer non-discriminatory terms for connection to the transmission system, both for new generation and for new sources of electricity demand.

The proposed development was initiated in April 2016 upon receipt of the grid connection application from the developer, via National Grid Electricity Transmission for the consented Stranoch wind farm.

SP Energy Networks is a regulated business, regulated by the government's Office of Gas and Electricity Markets (Ofgem). The connection of renewable energy developments to the network

are at the connecting party and GB consumers' cost depending on the asset. SP Energy Networks is not licensed by Ofgem to build infrastructure assets which would cost more (for a larger capacity) where there is no identified need to do so, as infrastructure assets are funded by the GB consumer. For this reason, it is usually not possible to obtain funding to allow for additional capacity to be incorporated into a new connection. SP Energy Networks, as a regulated business, has a licence obligation to deliver the most economic and efficient solution as any infrastructure costs will have a direct impact on electricity bill payers.

The nearby existing Arecleoch and Kilgallioch wind farm grid connections were confirmed as not having sufficient capacity to allow the Stranoch wind farm connection to be connected to either. The Arecleoch wind farm connection is already consolidated with the Glen App wind farm connection. A direct connection into the existing 275 kV steel tower line somewhere other than Mark Hill substation was also discounted at the engineering design stage due to the necessity for a new substation and the comparative cost of this. Therefore, it was determined that Stranoch wind farm would require its own separate connection to the transmission grid network. However, an opportunity to consolidate connections arose following receipt of the grid connection application for the consented Chirmorie wind farm. SP Energy Networks committed to identifying a combined grid connection solution for the proposed Chirmorie and Stranoch wind farms.

Doing nothing would lead to a breach of SPT licence obligations, in failing to provide connection options to generators and leaving the network vulnerable to unreliability.

3.3.2 Alternative Technical Options

SP Energy Networks' established approach is to base the initial route selection on the assumption that a new connection would be made using OHL. This is in order to meet the obligations under the Electricity Act 1989 to provide an economic solution. An underground cable would only be considered where all OHL options had been fully considered and discounted for either technical, environmental or economic reasons. This decision takes into account the benefit, in planning terms, that could be achieved through undergrounding, without incurring excessive cost, and the effects of the technical issues associated with undergrounding on the overall reliability and availability of the connection, the risks to economic viability, including capital and maintenance costs, and deliverability of the project.

In this case, no technical, environmental or economic reason has been identified for the connection to be made by underground cable and a single circuit wood pole OHL is considered to be the appropriate connection option for the entirety of the route, other than a short section of underground cable used to access the substation for technical reasons.

3.4 Alternative Routes

The route selection study was completed in four main stages:

- Stage 1: An initial route selection study was completed in 2017, which identified a preferred route for the proposed Stranoch wind farm grid connection only, having considered three main routeing options. This was followed by a programme of consultation carried out between March and April 2017.
- Stage 2: On the basis of feedback received during the first consultation period, SP Energy Networks made the decision to consolidate the proposed Chirmorie wind farm grid connection with Stranoch wind farm grid connection, although Chirmorie wind farm was not yet consented at that time. Approximately 1.5 km of additional route was identified to combine the two connections and a second programme of consultation was carried out between June and July 2017.
- Stage 3: Based on consultation and feedback received in 2017, some further route selection work was undertaken in 2018 to examine alternative route options through Arecleoch Forest.

Six alternative options were discussed. In addition, the location of the proposed Stranoch substation was confirmed in summer 2018 as being further north than originally proposed. Following detailed consideration of all of this information, a revised, preferred route was identified in 2019 and a programme of consultation was carried out between May and June 2019.

- Stage 4: Following consultation on the revised, preferred route, the proposed route was confirmed and further engineering design and environmental assessment was completed throughout 2020 to confirm the proposed alignment and pole locations.

3.4.1 Stage 1: Identification of OHL route options and selection of preferred OHL route

Stage 1 of the OHL route selection process comprised an initial strategic review of the area of search, between the Stranoch wind farm site and Mark Hill substation. This was supported by desk-based analysis, ground conditions and field surveys and engineering studies. Engineering and cost factors required the identification of the most direct route options possible, taking due account of major high-level engineering restrictions including the railway line.

Stage 1 was completed in accordance with SP Energy Networks guidance[1]. The guidance recommends appropriate application of the 'Holford Rules' to inform routeing. These rules advocate the application of a hierarchical approach to routeing which first avoids major areas of highest amenity, then smaller areas of high amenity, and finally considers factors such as backdrop, woodland and orientation. The Holford Rules also promote the most direct route, all other things being equal.

A desk-based study was undertaken to gather baseline information on the following potential constraints within the area of search:

- areas, sites and features which are designated or otherwise protected at the international, national and local level for landscape, cultural heritage and ecological sensitivity;
- known areas outside of designated areas, which support species of high or moderate conservation concern (particularly in relation to ornithology);
- residential amenity (dwellings, curtilage);
- access;
- topography and gradient;
- areas prone to flooding (1:200 year return);
- watercourses and bodies;
- private water supplies;
- agricultural land;
- wind farms (operational and proposed); and
- existing infrastructure (roads, railways, footpaths).

The initial desk studies were generally carried out with reference to the following information:

- Publicly available satellite imagery;
- Current 1:50,000 Ordnance Survey (OS) mapping;
- British Geological Survey, 2013. Geoindex Onshore 1:50 000 geological map;
- British Geological Survey, Hydrogeological map of Scotland; and
- Historic Environment Scotland, Scottish Natural Heritage, Sustrans and Forestry Commission databases.

[1] SP Energy Networks (May 2015) *Major Electrical Infrastructure Projects: Approach to Routeing and Environmental Impact Assessment*, available here: http://www.spenergynetworks.co.uk/userfiles/file/SPEN_Approach_to_Routeing_FINAL_20150527.pdf

The baseline information collected was used to compile a map of potential constraints to be considered in the OHL route selection process (Figure 3.1). Applying professional judgement, a traffic light system was used to indicate the relative sensitivity of constraints mapped.

As a result of this process, three feasible route options were identified for consideration, as shown on Figure 3.2. The initial route options were identified based on the following key considerations:

- Avoidance, where possible, of key environmental constraints identified;
- Minimising exposure to high altitudes (over 200 m Above Ordnance Datum);
- Avoidance, or identification of most suitable crossing locations of roads and watercourses;
- Proximity to access tracks and roads;
- Configuration of and approach to termination points;
- Identification of main topographical and geotechnical features; and
- General landscape and visual amenity (backcloth and screening).

To inform the comparative analysis of the three route options, the following field surveys were completed:

- a site walkover was undertaken by landscape specialists from Ramboll in May 2016. The Duisk River valley was surveyed from the A714 and B7027. Its upper slopes were accessed using local tracks, with no access restrictions. The plateau moorland area was assessed from the minor road which runs between Barhill and New Luce. The valleys of Water of Tig and Dunnack Burn were accessed via the farm track of Balkissock.
- a field visit to gain a more detailed understanding of the survival of designated cultural heritage assets and the surrounding landscape was also undertaken by cultural heritage specialists from CFA Archaeology in May 2016. The visibility, prominence and setting of scheduled monuments within the study area were examined using public roads.

The environmental analysis comprised a qualitative appraisal of each route option, which involved professional judgement regarding the sensitivity of individual environmental features. The appraisal considered the potential interaction of transmission infrastructure with key environmental features and sensitivities, focussing on factors which differentiate the route options.

Route option 1 was identified as having advantages in terms of landscape and visual amenity and cultural heritage as it was located at the furthest distance from the public road and railway and from designated cultural heritage features. However, it also lay adjacent to the internationally designated Glen App and Galloway Moors Special Protection Area (SPA), with associated potential to support significant levels of hen harrier activity. In addition, Route 1 included a greater extent of sensitive marshy grassland/peatland habitat, with the potential to support groundwater dependent terrestrial ecosystems (GWDTE), than the other options. In terms of capital and operational/maintenance costs, it was also less preferred as it represented the longest route option.

Route option 2 was similar to Route option 1 in terms of potential impact on peatland habitat but was located at greater distance from the designated SPA. Two alternative variants were identified within Arecleoch Forest, with the variant lying adjacent to the existing Arecleoch wind farm grid connection OHL recognised as having advantages in terms of the potential for more enhanced peatland restoration and habitat connectivity as well as the potential for a lesser impact on the landscape. Further north, to cross the Duisk valley, Route option 2 was considered to be least constrained in landscape and visual amenity terms, subject to suitable detailed routeing that would conserve and take advantage of the screening effect of woodland cover. In

addition, Route option 2 represented a more direct and shorter orientation between the northern and southern connection points.

Route option 3 was least preferred in terms of its proximity to designated cultural heritage assets (scheduled monuments and listed buildings) and the presence of more extensive non-designated assets within the route, as well as its potential impact on the landscape and visual amenity of the Duisk valley. There would be visual impact to road users on the A714, the B7027 and the minor road southwards from Barrhill to New Luce, as well as to residential receptors in Barrhill and further south, towards Chirmorie and Glenwhilly.

Based on the above analysis Route option 2 was identified as the preferred route, as presented on Figure 3.3.

The preferred route was presented for public consultation in March-April 2017 to seek an early understanding of public opinions about the proposals. Feedback from this consultation was collated and used to inform subsequent design iterations.

3.4.2 Stage 2: Addition of the Chirmorie Wind Farm Grid Connection

During the public consultation on the preferred route for the Stranoch wind farm grid connection in March-April 2017, consultee feedback requested that the Stranoch and Chirmorie wind farm grid connection projects should be progressed simultaneously, where possible. Therefore, SP Energy Networks made the decision to consider the proposed Chirmorie wind farm grid connection in parallel with Stranoch grid connection, although Chirmorie wind farm was not yet consented at the time. This would ensure the development of a coordinated and economical system of electricity transmission, with minimisation of new transmission infrastructure.

A route selection exercise was completed in order to identify a preferred route to connect the proposed Chirmorie wind farm with the preferred route for the Stranoch wind farm grid connection. This involved examination of the environmental and technical constraints identified in the area between the proposed Chirmorie wind farm substation and the preferred route for the Stranoch wind farm grid connection. The main environmental and technical constraints in the area between these two points were identified as:

- areas of carbon-rich soil, deep peat and priority peatland habitat;
- water bodies, including a tributary of Laggish Burn; and
- buffer distance from wind turbines, to avoid technical issues (turbulence, etc).

A preferred route for an OHL connecting the proposed Chirmorie wind farm substation to the preferred route for the Stranoch wind farm grid connection was identified, as shown on Figure 3.4. This figure also illustrates the key environmental and technical constraints referred to above.

This preferred route was presented for public consultation in July-August 2017 and feedback from this consultation was collated to inform subsequent design refinements.

3.4.3 Stage 3: Consideration of Alternative Routes within Arecleoch Forest

In response to feedback received from Forestry Enterprise Scotland (FES) (Now Forestry Land Scotland) and Scottish Power Renewables (SPR), further routeing work was completed in 2018 in relation to the location of the preferred route within Arecleoch Forest. FES and SPR expressed concern over the preferred route for the proposed development, based on its potential to inhibit development of an extension to the existing Arecleoch wind farm. The potential for the overhead line to prejudice the wind farm option on this land raised the very real prospect of a significant economic impact on the connection project. For this reason, alternatives were discussed with FES

and additional routeing work was undertaken to find an alternative OHL route which, amongst other considerations, would avoid conflict with the wind farm and would minimise tree loss.

Following a consultation meeting with FES in March 2018, three alternative routes put forward by FES were reviewed to inform the wider routeing discussion:

- Alternative 1 – Underground cable route departing from the preferred route to the east of Arecleoch Wind Farm and progressing north through the wind farm to meet and run adjacent to the wayleave of the existing 275 kV OHL. Alternative 1 would then change to overhead line to run directly east along the northern edge of Arecleoch Forest to the A714, re-joining the preferred route to the south of Craigcannochie Hill;
- Alternative 2 – An OHL route where it initially departs from the preferred route to the west of Standard Knowe summit, changing to underground cable through Arecleoch Forest, where it would run adjacent to, and west of, the railway line. Option 2 would change back to OHL on exiting FES land to re-join the preferred route where it crosses the railway line to the south of Queensland Holiday Park;
- Alternative 3 – An OHL departing from the preferred route and heading eastwards to cross the railway line north of Wee Chirmorie, then turning northwards to meet and run adjacent to the minor road. Alternative 3a comprised an alternative underground cable scenario on the same route, where it crosses Arecleoch Forest. As OHL, Alternative 3 would cross the A714 at Barrhill then progress directly north to re-join the preferred route to the south of Craigcannochie Hill.

These alternative options are shown on Figure 3.5.

A two-step appraisal process was then followed. Firstly, an environmental appraisal of the alternative routes was undertaken in order to confirm the environmentally preferred alternative route. Thereafter, a comparative analysis of the environmentally preferred alternative route against the original preferred route for the proposed development was completed.

Alternative 1 was developed to explore the potential for crossing the northern part of the existing Arecleoch wind farm, then follow the northern perimeter of Arecleoch Forest and cross the Duisk valley north west of the original preferred route. Alternative 1 was identified as having advantages in terms of its lesser potential for impact on ecology, landscape and cultural heritage features. However, it was identified as having greater potential for impact on bird species associated with Glen App and Galloway Moors SPA/SSSI than other alternatives. In addition, it was recognised that Alternative 1 would have potential for disruption to the existing wind farm infrastructure and to any future re-powering of the project, as well as potential for disruption to the existing 275 kV OHL immediately north of Arecleoch Forest.

Alternative 2 was developed to explore the potential for installing an underground cable connection within Arecleoch Forest, before re-joining the original preferred route to cross the Duisk valley. It was identified as having advantages in terms of the lesser potential for impact on landscape and visual amenity and cultural heritage, from an underground cable, although a greater potential for impact from an underground cable on hydrology and ecological habitat was identified. In technical terms, it was also recognised that Alternative 2 was located within the area identified for potential expansion of Arecleoch wind farm and may come into conflict with any future wind farm project, by sterilising land west of the railway line.

Alternative 3 was developed to explore the potential for retaining an OHL connection within Arecleoch Forest, by locating this alongside the public road as an area with lesser potential for impact on forestry operations. It was identified as having greater potential for impact on landscape and visual amenity in this location, while having a lesser potential for impact on hydrology and ornithology than the other options. An underground cable option (Alternative 3a) on the same route was also examined, which was identified as having greatest potential for

impact on sensitive peatland habitat, while having lesser potential for impacts on other environmental topics than the other alternative routes. Further north, Alternative 3 was identified as having greatest potential for impact on the landscape and visual amenity of the Duisk valley.

In solely environmental terms, Alternative 1 was identified as the preferred alternative route, if an underground section was to be taken forward; this was also compared with the original preferred route and identified as the new preference in environmental terms. However, in also balancing the wider technical aspects and likely capital and operational/maintenance costs, Alternative 3 was identified as the overall preference. The overall preferred route is shown on Figure 3.6.

A final step in the Stage 3 analysis followed the Stranoch wind farm developer's decision (in summer 2018) to re-locate the proposed Stranoch substation to a new location further north, to the south east of Studie Knowe summit. This step focussed on examining the potential for realigning the preferred route, to cross the Chirmorie wind farm site rather than skirting round the western perimeter of the site, before connecting to the proposed Chirmorie substation. The alternative route option shown on Figure 3.7 was compared to the preferred route. In environmental terms, the preferred route was identified as the overall preference on the basis of lesser potential for impact on the settings of cultural heritage features and for impact on visual amenity. However, it was acknowledged that the area that the analysis considered is relatively small; therefore, the differences identified within the analysis were slight. In technical and cost terms, the alternative route was identified as the preference on the basis of its shorter length, its requirement for fewer angle towers and lower altitude. Therefore, on balance, the alternative route emerged as the overall preference, as it represented a shorter, more direct overhead line which would be favoured in terms of the Holford Rules and would be in keeping with the Applicant's approach to routeing of overhead lines.

The new preferred route shown on Figure 3.8 was presented for public consultation in May-June 2019 to gain an understanding of landowner and public opinion about the revised proposals. As before, feedback from this consultation was collated and used to inform subsequent design refinements.

3.4.4 Stage 4: Confirmation of Proposed Alignment

Once the proposed route was identified, SP Energy Networks' engineering team developed a draft OHL alignment, as shown in Figure 3.9.

In March 2019, the Applicant submitted an EIA Screening Request to the Scottish Government, and the project was subsequently determined to be non-EIA development. However, the Screening Request confirmed that an Environmental Appraisal (EA) should form part of any consent application and identified the following topics for consideration within the EA:

- Landscape and Visual Amenity;
- Cultural Heritage;
- Ecology and Ornithology;
- Hydrology; and
- Forestry.

Due to ongoing concerns in the community regarding the proposed route, the local Community Council requested that a community meeting be set up to allow SPEN to explain the routeing history and rationale for determining the preferred route. A community meeting was held on 30th October 2019 and visualisations prepared as part of the EA were presented at the meeting.

Following the meeting, the proposed route and alignment were finalised as follows:

- Ecological habitat surveys were completed on the northern section of the proposed route, which identified two ponds with the potential to support great crested newt. Further consultation was undertaken with NatureScot (formerly Scottish Natural Heritage) to confirm suitable mitigation for any potential impacts, namely that the proposed alignment would be moved to at least 250 m distance from the ponds. Further detail is provided in Chapter 7: Ecology and Ornithology Appraisal;
- Minor changes to the indicative pole locations were made in order to ensure sufficient distance from watercourses and to avoid other sensitive habitat and cultural heritage assets as much as possible; and
- The proposed alignment was altered along a stretch of some 800 m to the north of Barrhill, in order to reduce the requirement for tree felling.
- The route was altered to allow clearance from an existing meteorological mast near to pole no.15.

The final proposed alignment is shown on Figure 2.1.

As described above and in Chapter 2: Development Description, the proposed development will consist of an OHL, supported on wood poles. The proposed alignment is considered to provide the optimum balance of technical, economic and environmental factors.

Based on the context of the site, key factors in determining the alignment of the new wood pole OHL included:

- minimising visual impact on residential properties and from the public road network;
- making use of existing access tracks as much as possible and minimise the construction of new tracks;
- minimising the need for woodland removal, as far as possible;
- minimising impact on cultural heritage assets; and
- minimising impact on protected species, as far as possible.

Further assessments of the proposed development are considered in Chapters 5 to 9.