Callisterhall Wind Farm Connection

Routeing and Consultation Document

EXECUTIVE SUMMARY

Following a formal request from developer via the NESO, Scottish Power Energy Networks (SPEN) proposes to construct a new 132 kilovolt (kV) single circuit wood pole overhead line (OHL) to connect the proposed Callisterhall Wind Farm to Gretna substation, approximately 3km north of Gretna green and approximately 1km west of the England/Scotland border.

This document presents information on the approach taken in the identification of route options for the proposed connection, appraisal methodology, and the findings of the appraisals and assessments, concluding in the selection of the preferred option.

The approach to developing and assessing the route options follows SPEN's two stage approach to routeing[1], as follows:

- Stage 1: Identification and appraisal of route options to select a preferred route including consultation with stakeholders and the wider public to establish a proposed route.
- Stage 2: EIA of the proposed alignment and any associated infrastructure. This is an important stage in that the EIA process is used to further refine the route alignment to avoid and reduce potential environmental effects. Confirmation of the alignment for application purposes.

Stage 1 has been completed and a preferred route has been selected which provides a technically feasible and economically viable continuous OHL between Callisterhall Wind Farm and Gretna substation whilst taking into consideration environmental constraints. This means that the proposed route would be the one that on balance, causes the least disturbance to the environment and the people who live, work and enjoy outdoor recreation within it.

SPEN attach great importance to the effect the work could have on the environment and local communities and are keen to engage with key stakeholders so that views can be taken into account through the development of the project.

The proposed route will be taken forward for more detailed environmental assessments prior to submission of an application to Scottish Ministers for consent under Section 37 of the Electricity Act 1989 to install, and keep installed, the overhead line. At the same time, SPEN will also apply to Scottish Ministers for deemed planning permission under Section 57(2) of the Town and Country Planning (Scotland) Act 1997.

[1] SPEN Approach to Routeing 2nd Version - https://www.spenergynetworks.co.uk/userfiles/file/SPEN_Approach_to_Routeing_Document_2nd_version.pdf

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1 INTRODUCTION

1.1 Callisterhall Wind Farm Grid Connection

1.1.1 This Routeing and Consultation Document (RCD) has been prepared by RSK on behalf of SPEN as part of the identification of a Preferred Route for the grid connection required for Callisterhall Wind Farm. The grid connection, comprising a new wood pole 132 kilovolt (kV) overhead line (OHL) will connect Callisterhall Wind Farm to the electricity transmission system at Gretna Substation. Callisterhall Wind Farm is located on land north of the B7068, with the grid connection extending south c16km to Gretna Substation. The proposed development is entirely within the Dumfries & Galloway administrative area. **Figure 1.1** illustrates the location of Callisterhall Wind Farm and Gretna Substation.

1.1.2 The RCD explains the background to the grid connection and describes the approach to and results of the first stage of development.

1.2 Need for the Grid Connection

1.2.1 As part of their commitments to tackling climate change the Scottish and UK Governments have set legally binding targets to reach net zero in their greenhouse gas emissions by 2045 in Scotland. In delivering net zero, the electricity system - how electricity is generated, transmitted, distributed and used - is undergoing transformational change.

1.2.2 The grid connection is needed to connect the Callisterhall Wind Farm to the transmission network. As Transmission Licence Holder SP Transmission (represented by SPEN) is legally obliged under the Electricity Act 1989 to provide a grid connection.

1.3 SP Transmission's Duties and Licence Obligations

1.3.1 SP Transmission plc (SPT), the Transmission Owner (TO) and Licence Holder under the Electricity Act 1989 ('the Act'), is responsible for the electricity transmission network in central and southern Scotland including throughout Dumfries & Galloway where Callisterhall Wind Farm and the grid connection are located. As the holder of a transmission licence under the Act, SPT is subject to a number of statutory duties and licence obligations.

1.3.2 These include a requirement *"to develop and maintain an efficient, coordinated and economical system of electricity transmission"* and *"to facilitate competition in the supply and generation of electricity".* This requires SPT to provide for new electricity generators wishing to connect to the transmission system in its licence area; to make its transmission system available for these purposes and to ensure that the system is fit for purpose through appropriate reinforcements to accommodate the contracted capacity.

1.3.3 In addition, in formulating proposals for network reinforcements or grid connections such as that proposed for the Callisterhall Wind Farm Grid Connection, SPT is subject to duties under Schedule 9 of the Act: *"(a) to have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest; and, (b) to do what it reasonably can to mitigate any effect which*

the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects."

1.3.4 SPEN acting on behalf of SPT, is undertaking further studies including this routeing study to connect the Callisterhall Wind Farm to the transmission network. This work is undertaken in accordance with SPT's statutory duties and licence obligations with the objective of ensuring that the grid connection is technically feasible, economically viable and on balance, causes the least disturbance to both the environment and the people who live, work and enjoy recreation within it.

1.4 The Development and Consenting of the Grid Connections

The development of the grid connection will comprise the following key phases:

1.4.1 **Phase 1.** Routeing and Consultation. Phase 1 comprises a routeing study in which a number of route options for the grid connection are identified and assessed taking into account a range of environmental, technical and economic considerations. It concludes with the identification of a Preferred Route for the OHL which is then subject to consultation. SPEN is committed to ongoing consultation with interested parties, including statutory and non-statutory consultees and local communities. Whilst there is no statutory requirement to consult during the early routeing stages, SPEN nonetheless considers it good practice to introduce consultation at this stage. Responses to the consultation will be evaluated and inform confirmation of a proposed route to be taken forward to Phase 2.

1.4.2 **Phase 2.** Detailed Route Design and EIA The grid connection will require to be subject to EIA under the Electricity Works (EIA) (Scotland) Regulations 2017. Through Phase 2 the EIA process seeks to identify, assess and mitigate the likely significant adverse effects of the grid connection on the environment. Following confirmation of the Proposed Route, SPEN will submit a request for an EIA Screening Opinion to the Scottish Ministers in accordance with Regulation 8(1) of the EIA Regulations to determine whether the project is considered EIA development. Following screening, if EIA is required a Scoping report and subsequent EIA report will be prepared to accompany the application for consent. If EIA is not required, an Environmental Appraisal will be undertaken, and an Environmental Appraisal Report will instead accompany the application for consent. During this phase SPEN will also undertake a second round of public consultation (referred to as Phase 2 Consultation) on the detailed design of the grid connection.

1.4.3 **Phase 3.** Applications for Consent. SPEN will be applying to the Scottish Ministers for consent under Section 37 of the Electricity Act 1989, as amended, to install, and keep installed, the grid connection. The EIA Report will accompany the application for Section 37 consent. At the same time, SPEN will also apply to Scottish Ministers for deemed planning permission under Section 57(2) of the Town and Country Planning (Scotland) Act 1997, as amended, for the grid connection including ancillary development. While the Scottish Ministers will be responsible for the decision to approve the grid connection or not, in reaching their decision they will consult with statutory stakeholders and members of the public.

1.5 Stakeholder Engagement

1.5.1 Stakeholder engagement, including public involvement, is an important component of the Scottish planning and consenting system. Legislation and government guidance aim to ensure that the public, local communities, statutory and other consultees and interested parties have an opportunity to have their views taken into account throughout the planning process.

1.5.2 SPEN recognises the importance of consulting effectively on proposals and is keen to engage with key stakeholders including local communities and others who may have an interest in the grid connection. This engagement process continues through to the construction of SPEN projects.

1.5.3 SPEN's approach to stakeholder engagement for major electrical infrastructure projects is outlined in Chapter 2 of the SPEN document 'Approach to Routeing and Environmental Impact Assessment'. SPEN aims to ensure effective, inclusive and meaningful engagement with the public, local communities, statutory and other consultees and interested parties through four key engagement steps:

- Pre-project notification and engagement: Discussions are undertaken with consenting bodies, planning authorities, and statutory consultees such as NatureScot and SEPA. Early and proactive engagement enables the views of these consultees to inform project design, assessment methodologies and further engagement. It also provides consultees with an early understanding of the likely programme to submission of the application for consent.
- Information gathering: To inform the routeing stage, information on relevant environmental and planning considerations and proposed data gathering techniques (e.g. for seasonal ecological surveys) is requested from statutory consultees and other relevant organisations.
- Obtaining feedback on emerging route options: This RCD has been prepared to gather feedback on the emerging project details. It will be issued to statutory consultees, and made available on SPEN's website, at Council offices and in public libraries, with its availability advertised in the press. Local exhibitions and/or public meetings may also be arranged. SPEN will look to virtual methods of informing consultation and gathering feedback from stakeholders such as project specific websites to host virtual consultations to share relevant information and broaden its accessibility.
- The EIA stage: The results of stakeholder engagement are taken into consideration and used to confirm the 'proposed route' for progression to EIA/EA. Further consultation is carried out during the EIA stage, including additional information gathering, and the preparation of a publicly available Screening/Scoping Report which accompany either a 'Request for a Screening or Scoping Opinion' to the consenting authority.

1.5.4 In addition, and as noted above, SPEN as a holder of a transmission licence, has a duty under section 38 and Schedule 9 of the Electricity Act 1989, when formulating proposals for the new electricity lines and other transmission development, to have regard to the effect of work on communities, in addition to the desirability of the preservation of amenity, the natural environment, cultural heritage, landscape and visual quality.

1.6 Purpose of the Routeing Consultation Document

1.6.1 The primary purpose of this RCD is to report on Phase 1 of the grid connection; the routeing study which has been undertaken and the preferred Route Option which has been identified for the grid connection. The objective of this is to seek feedback on the preferred Route Option from statutory and non-statutory consultees as well as local communities and use this feedback to inform subsequent stages of the grid connection.

1.6.2 The structure of the RCD is set out below. It describes the approach taken to identifying and assessing alternative route options in a clear, systematic manner in accordance with SPEN's statutory duties and licence obligations and taking into account industry-recognised approaches to the routeing of OHLs.

1. **Introduction**: Provides an introduction to the grid connection, SPEN's statutory obligations and an outline of the purpose and structure of the RCD.
2. **Description of the Grid Connection**: Provides an overview of the grid connection and its key physical components including details of construction requirements.
3. **Routeing Strategy Methodology:** Provides an overview of the route development and assessment methodology.
4. **The Study Area**: Identifies and describes the Study Area in which the routeing study is undertaken as well as key constraints or features within it.
5. **Routeing Strategy**: Describes the Routeing Strategy applied specifically to the Callisterhall Wind Farm grid connection to the identification and assessment of alternative route options.
6. **Route Options**: Describes the identification and assessment of alternative route options within the Study Area.
7. **Preferred Route Option**: Identifies and describes the preferred route option including the reasons for its selection.
8. **Next Steps**: Describes the key next steps in the grid connection including consultation on the preferred route option and how to provide feedback.

2 DESCRIPTION OF THE GRID CONNECTION

2.1 Introduction

2.1.1 This section provides a brief description of the infrastructure which would be required for the grid connection. The grid connection comprises a new 132 kV wood pole OHL which is required between the proposed Callisterhall Wind Farm and Gretna Substation. No substation works are to be consented or assessed as part of the grid connection for Callisterhall Wind Farm. It should be noted that given the early stage in the grid connection's development, this information is not confirmation of a final design, however, it is considered appropriate for the purposes of the routeing study and to inform the first round of consultation.

2.2 Overhead Lines

General Description

2.2.1 OHLs transmit electricity by conductors (or wires) which are suspended at a specified height above ground and supported by wood poles, spaced at intervals.

2.2.2 The conductors can be made of aluminium or steel strands. The Project will include a single circuit at 132 kV and is proposed to be carried on Trident wood poles. A typical trident wood pole is shown below in Figure 2.1.

Figure 2.1: Typical Trident Wood Pole

2.3 Wood Pole Types

2.3.1 The OHL will be supported on Trident wood poles with galvanised steelwork cross-arms supporting aluminium conductors on insulators. These are suitable for supporting single circuit lines operating at 132 kV.

2.3.2 Wood poles are fabricated from pressure impregnated softwood, treated with a preservation to prevent damage to structural integrity.

2.3.3 There are three types of wood pole structure, in terms of appearance:

- **Intermediate:** where the pole is part of a straight line section.
- **Angle**: Single poles can support changes in direction up to a maximum of 30 degrees and H-Poles up to 70 degrees. All angle structures will require to be back stayed.
- **Terminal**: Where the OHL terminates before entry into a substation or on to an underground cable section via a cable sealing end compound or platform.

Wood Pole Heights and Span Lengths

2.3.4 Whilst wood poles have a standard height above ground of between 14 and 16 m, they can be extended or reduced in height, with a range between 10m and 21m as required. Pole heights may require to be increased where circumstances dictate, e.g. over elevated land, structures or features.

2.3.5 The section of OHL between wood poles is known as the 'span', with the distance between them known as the 'span length'. Span lengths between wood poles average between 65m to 100m but the span length will vary depending on factors such as size of the conductor, size of the structures, terrain, altitude, ice and wind loadings etc.

2.3.6 Wood poles are used to regulate the statutory clearances required for conductor height, which is determined the voltage of the OHLs (the higher the voltage, the greater the safety clearance that is required) and the span length between wood poles.

Wood Pole Appearance

2.3.7 Wood poles are fabricated from pressure impregnated softwood, treated with a preservative to prevent damage to structural integrity. New wood poles are dark brown in colour and weather over time to a light grey. The wood pole top cross-arms are galvanised steel and support the aluminium conductors on stacks of grey insulator discs. Both the steelwork and aluminium will weather and darken after a few years.

Typical Construction Requirements

2.3.8 The construction of OHLs follows a well-established process. As well as the OHL it also requires additional temporary land-take and infrastructure, for example temporary accesses and temporary construction compounds to store materials. There may also be a requirement to construct bellmouths to the public highway where narrow farm tracks are utilised.

Construction

2.3.9 Key Phases of construction comprise the following activities:

- Tree felling or lopping (where required);
- Construction of temporary construction compounds;
- Preparation of accesses (where required);
- Assembly and erection of poles;
- Insulator and conductor erection and tensioning; and
- Clearence and reinstatement.

2.3.10 Construction of a wood pole takes place in one single operation, i.e., the hole is dug and the pole erected within the same day depending on ground conditions and location. Angle poles can take longer due to the need for “stay wires” to stabilise the pole in the ground.

2.3.11 Prior to constructing the OHL, temporary accesses will be constructed, as necessary, and laydown/storage areas established, usually mid-way along the route. Any trees which may impact on safety clearances will be removed or lopped. Following commissioning of the OHL, all equipment and temporary access of construction areas will be removed with the land being reinstated to its former use/condition.

2.3.12 The construction programme for the grid connection will be confirmed at detailed design stage and prior to project start following the granting of statutory consents and after all necessary land purchase/wayleave arrangements have been concluded. At this stage it is considered that construction of the proposed connection would be approximately 18 months with works scheduled to be complete by Q2 2029 as per current contract arrangements with NESO.

Operation and Maintenance

2.3.13 OHLs require minimal maintenance. The condition of the wood poles will be inspected regularly for early identification of any unacceptable deterioration and to ensure action can be taken to maintain the security and safety of all components of the OHL. Poles which have deteriorated significantly may be removed and replaced. Access arrangements for maintenance will be agreed in advance with landowners and will be undertaken within the agreed wayleave. There is also an ongoing requirement to ensure that any vegetation within proximity to the OHL does not impact on safety clearances.

Decommissioning

2.3.14 If an OHL line is to be decommissioned, wood poles will be removed with components re-used where possible. Foundations/supports are removed to a minimum depth of 1 m below ground level and the ground reinstated to the satisfaction of the landowner.

Overhead Line design

2.3.15 SPEN’s policy is to seek a continuous overhead line solution for all transmission connections and only where there are exceptional constraints are underground cables considered an acceptable design option. Such constraints can be found in urban areas and in rural areas of the highest scenic and amenity value. Whilst underground cables have visual benefits, there are associated technical and environmental and economic disadvantages including:

- the physical extent of land required;
- the fault repair time;
- difficulties associated with general maintenance;
- increased cost;
- greater ground disturbance from excavating trenches;
- the restriction of development and planting within the underground transmission cable corridor;

- requirements for cable sealing end compounds or platforms at each end of each section of underground cable; and the fact that underground cabling is a less efficient means of transporting electricity.

2.3.16 On this basis, the key design assumption is that this will be a continuous OHL connection throughout. Should the appraisal identify any areas where a proposed OHL is likely to give rise to unacceptable effects, alternative options (such as underground cables and alternative routes) will be considered.

If, in certain circumstances, it is determined that an underground cable is required instead of an overhead line, the approach is to minimise the length of underground cable necessary to overcome the constraint to overhead line routeing, consistent with a balance between technical and economic viability, deliverability and environmental considerations. It is not uncommon for a length of cable to be required to enter or exit a substation.

Wood Poles

2.3.17 The size of poles and span lengths will vary depending on several factors, in line with industry standard ENA Specification 43-50 ISSUE 3. The northern part of the site is covered by land above 200m AOD, which will affect some of the potential routes and will therefore be likely to require construction using H poles (rather than single poles), with a span length of around 70m - 100m and pole heights ranging from 10m – 22m with a typical height of 13m. This has been used as the basis for identification of the preferred route, however, the precise pole configuration, height and the spans will be determined after a detailed line design following confirmation of the proposed route.

The wood pole will support three conductors (wires) in a horizontal flat formation. Typical trident wood pole specifications are shown in **Figure 2.2.**

Subject to confirmation of the proposed route for the new OHL, detailed survey work will be carried out to inform the proposed positions and heights of each individual wood pole.

Overhead Line Construction and Maintenance

2.3.18 OHL construction typically follows a standard sequence of events as follows:

- prepare access to the pole locations using existing access tracks (farms, wind farms, etc.,) as appropriate;
- erect wood poles;
- string conductors; and
- reinstate pole sites and remove temporary accesses.

2.3.19 Temporary accesses will be constructed, as necessary, and laydown /storage areas established to facilitate development depending on ground conditions, it may be possible to access work locations by tracked/low ground pressure vehicles, however trackway panels or temporary stone roads may be required in some circumstances. Following commissioning of the overhead line, all equipment and temporary access of construction areas will be removed with the land being reinstated to the satisfaction of the landowner.

2.3.20 For wood pole line construction, the ‘poles’ are typically erected using normal agricultural machinery such as an excavator with a lifting arm. A tracked excavator and low ground-pressure vehicles, (e.g. tractor, ATV, quad bikes) are used to deliver, assemble and erect

each wood pole structure at each location. The erection of the wood poles requires a typical excavation of $3m^2$ x 2m deep. The excavated material is segregated into appropriate layers and used for backfilling. It is relatively rare for concrete or other backfill to be used in the foundations of wood poles. This would normally only be used where ground conditions are particularly unstable (identified by site investigations). An excavator is typically used to hoist the assembled structure into position and once the structure has been braced in position the trench is backfilled.

2.3.21 Stringing of conductors. The conductors would be winched to/pulled from section poles; these poles therefore require access for heavy vehicles to transport the conductor drums and large winches. Where the overhead line crosses a road a scaffold tunnel would be used to protect the vehicles from the works. Existing distribution lines would be either switched off, deviated or protected using 'live line' scaffolds.

2.3.22 Reinstatement of pole sites and removal and reinstatement of temporary infrastructure sites.

2.3.23 In all cases, every effort is made to cause the least disturbance to landowners and local residents during construction. Following completion all ground disturbance resulting from the construction of the new line is reinstated.

3 ROUTEING STRATEGY METHODOLOGY

3.1 Overview

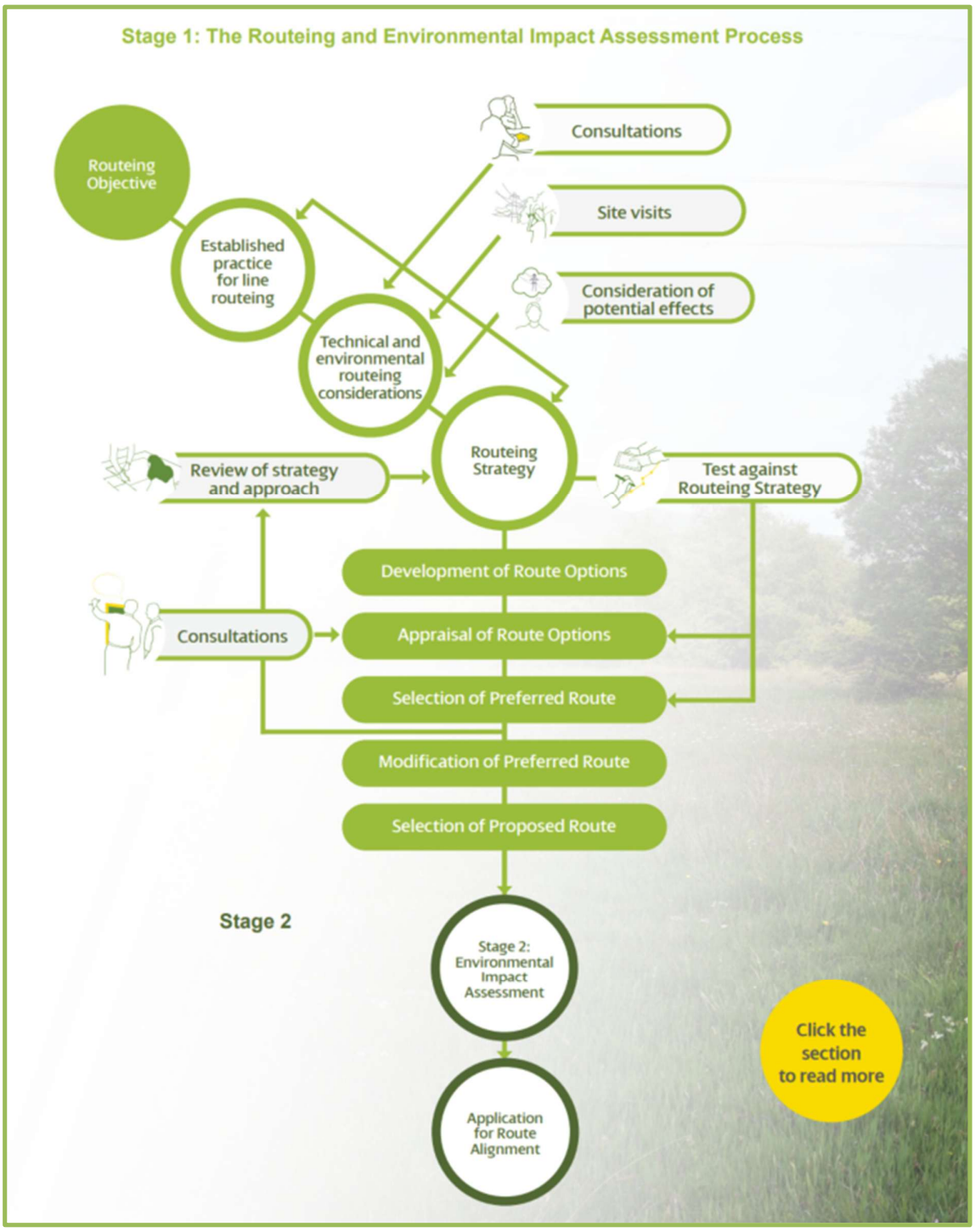
3.1.1 SPEN's approach to routeing was reviewed in 2020. This review led to the publishing of an updated version of their "Approach to Routeing and Environmental Impact Assessment[2]", which describes their general approach to routeing new electricity transmission infrastructure. This Approach to Routeing guidance has formed the basis for the methodology used for the Callisterhall Wind Farm Connection project.

3.1.2 The overall approach is based on the premise that the major effect of an overhead line is visual and that the degree of visual intrusion can be reduced by careful routeing. A reduction in visual intrusion can be achieved by routeing the line to fit the topography, by using topography and trees to provide screening and/or background, and by routeing the line at a distance from settlements and roads. However, the importance of environmental issues, including matters such as biodiversity and cultural heritage, also play a significant role in this process.

3.1.3 **Figure 3.1** illustrates the process flow which SPEN adopts for OHL routeing, and which has been applied to this project. The following sections describe the key stages in this process.

[2] SPEN – "Approach to Routeing and Environmental Impact Assessment" chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.spenergynetworks.co.uk/userfiles/file/SPEN_Approach_to_Routeing_Document_2nd_version.pdf

Figure 3.1: SPEN Approach to Routeing Flow Chart



3.2 Established Practice for Overhead Line Routeing

The Holford Rules

3.2.1 It is generally accepted across the electricity industry that the guidelines developed by the late Lord Holford in 1959 for routeing overhead lines, 'The Holford Rules', should continue to be employed as the basis for routeing high voltage overhead lines. The Holford Rules were reviewed circa 1992 by the National Grid Company (NGC) Plc (now National Grid Transmission (NGT)) as owner and operator of the electricity transmission network in England and Wales, with notes of clarification added to update the Holford Rules. A subsequent review of the Holford Rules (and NGC clarification notes) was undertaken by Scottish Hydro Electric Transmission Limited (SHETL) in 2003 to reflect Scottish circumstances. A summary of the Holford Rules are contained in Appendix 3.

Forestry Guidelines

3.2.2 In their Approach to Routeing and Environmental Impact Assessment (2nd version) contains guidance on the approach to routeing OHL's through forested areas. Wherever possible, overhead lines should be routed to avoid forestry and woodland areas. Where this isn't possible, OHL's should be routed to follow open space and to run alongside, not through woodland. When routeing through forestry can't be avoided:

- minimise landscape impacts;
- avoid the line of sight of important views;
- be kept in valleys and depressions;
- not divide a hill into two similar parts where it crosses over a summit;
- cross skyline or ridges where they drop to a low point;
- follow alignments diagonal to the contour as far as possible;
- vary in the alignment to reflect the landform by rising in hollows and descending on ridges.

3.2.3 The SPEN guidance requires standard application of the Holford Rules, as well as The UK Forestry Standard (UKFS) guidelines (2017). The UKFS is a high level document which provides a standard for managing forests in the UK. Scottish forestry have previously produced detailed guidelines for designing forests and accompanying development in forest design planning, which remain consistent with the latest UKFS requirements and include the 'Design techniques for forest management planning: practice guide'.

3.2.4 The Scottish Government has developed the 'Control of Woodland Removal' Policy (last updated November 2019) to guide decisions on woodland removal for the purpose of conversion to another land use.

3.2.5 SPEN's approach to routeing OHL is primarily based on the idea that any major effect of an overhead line will be visual, and that the degree of visual intrusion can be reduced by carefully routeing the development. Techniques to reduce visual intrusion of OHLs include using the topography and trees to provide screening and background, as well as ensuring the OHL is routed at a distance away from settlements and roads where

possible. Particularly sensitive and valued natural and man-made features should also be avoided, with a well-routed OHL also taking into account any other technical and environmental considerations.

Routeing Objective

3.2.6 In accordance with SPEN's approach to routeing, the Routeing Objective for the Callisterhall Wind Farm Connection Project is:

"To identify a technically feasible and economically viable 132kV overhead line route, supported on wood poles, from the proposed Callisterhall Wind Farm substation to the existing Gretna substation. This route should, on balance, cause the least disturbance to the environment and the people who live, work and enjoy recreation within it"

General Routeing Considerations

3.2.7 Overhead lines are linear elements in the landscape. They potentially affect, to varying degrees, visual and other environmental aspects of the area through which they run. This part of the process predominantly comprises information gathering and consideration of the potential for effects.

3.2.8 The initial stage is to determine a study area and gather baseline information within this area through desk-based studies, site visits, and consultations in order to identify potential constraints and opportunities to routeing.

3.2.9 To define a route that meets the requirements of the Electricity Act, a balance must be struck between three sets of considerations:

- Economic
- Technical
- Environmental

3.2.10 Routeing considerations must also take into account guidance contained in the Holford Rules and relevant notes or clarifications.

Economic Considerations

3.2.11 In compliance with Schedule 9 of the Electricity Act the routeing objective requires the proposed connection to be economical. It is understood that this is interpreted by SPEN as meaning that as far as possible, and all other things being equal, the connections should be as direct as possible and the route should avoid areas where technical difficulty or compensatory schemes would render the connection uneconomical.

Technical Considerations

3.2.12 Technical considerations potentially include existing infrastructure (in this case wind farms and overhead lines), altitude and slope angle, and physical constraints such as large water bodies.

3.2.13 These technical considerations are not considered as being absolute constraints but are a guide to routeing. The approach taken is to identify preferred environmental options informed by a staged review of technical issues.

Environmental Considerations

3.2.14 Statutory duties imposed by Schedule 9 of the Electricity Act require licence holders to seek to preserve features of natural and cultural heritage interest and mitigate where

possible, any adverse effects which a development may have. Experience across the electricity industry shows that an overhead transmission line is likely to affect to varying degrees the following:

- Landscape and visual amenity;
- Ecology, ornithology and nature conservation;
- Geology, hydrogeology and hydrology;
- Peat;
- Cultural heritage; and
- Ancient woodland and forestry.

3.2.15 Other considerations which may affect routeing to a greater or lesser degree include:

- Planning allocations and major applications;
- Noise (construction and operational);
- Traffic and Transport (access for construction);
- Land Use (agriculture); and
- Socio-Economics (tourism and recreation);

3.3 Consideration of potential effects, technical & environmental routeing options

Study Area

3.3.1 An initial study area (**Figure 3.2**) was defined for this routeing process – large enough to accommodate all likely route options. The purpose of defining the study area is as follows:

- The study area comprises the area within which various options for locating the proposed development are identified and assessed;

Collection of Background Information

3.3.2 Following the establishment of the study area, an initial evaluation of environmental and technical constraints was undertaken. Key constraints were initially mapped for the study area and buffer zone using Geographical Information Systems (GIS), and collated from sources in the public domain and via external consultation with stakeholders where required. This data was supplemented where required by field survey. Constraints and potential issues considered when collecting background information have been outlined within Table 2.1.

Table 2.1 – Key constraints

	Constraints/Issues
Environmental	Ecology
	Ornithology
	Landscape (designations and character)
	Visual Amenity
	Archaeology and cultural heritage
	Recreation and tourism
	Hydrology, hydrogeology and geology (including peat)
	Residential dwellings and land use
	Other land uses (e.g., forestry, transmission lines, mineral operations, wind farms, agricultural, and roads)
Technical	Slope/gradient (topography) Existing infrastructure (or in the planning process) Altitude
	Ground Conditions
	Presence of large waterbodies
Economic	Ensure viability – as far as reasonably possible, the line should be direct and avoid areas where technical difficulty or compensatory requirements would render the scheme unviable on economic grounds.

4 THE STUDY AREA

4.1 Overview

4.1.1 The study area for the proposed development was initially informed primarily by desk-based analysis, coupled with an understanding of the need to balance potential adverse environmental effects with technical feasibility and economic viability:

- Identification of the start and end points for the connection, which represent the fixed geographical elements of the route. In this case, these comprise the Callisterhall Wind Farm and Gretna Substation;
- Identification of the technical and environmental drivers which exist in the area between these two points. These drivers include topography, landscape character and areas of environmental value and historical interest. This responds to the requirements of the Holford Rules 1 and 2, recognising that there is no requirement to take the most direct route between the start and end points and that routes must respond to the constraints identified.

4.1.2 The Study Area has mainly been defined by the location of Callisterhall Wind Farm in the north and the approximately 13km distance to Gretna Substation in the south. The M74 motorway borders the study area to the south west. The national border with England demarcates the study area to the south and Langholm Hills Local Landscape area defines the border to the west. The Study Area lies exclusively within Dumfries and Galloway. The refined Study Area is shown on **Figure 4.1.**

4.2 Environmental and Technical Baseline

4.2.1 Baseline information that identifies key environmental constraints within the study area has been used as the basis of analysis and to inform the identification and appraisal of route options. The details of the environmental and technical baseline data sources and information is presented in Appendix 1 and the key issues are summarised as follows.

- Raeburn Flow Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) and Bell's Flow SSSI, located within the Study Area. Ecological Designations are shown on Figure 4.2;
- Presence of existing and planned wind farms – Built Minsca and Solwaybank Wind Farms are shown on Figure 4.3, as well as planned Callisterhall, Loganhead and Bloch wind farms;
- Presence of village of Chapelknowe, as well as scattered individual dwellings;
- Several areas of ancient woodland from the Ancient Woodland Inventory (AWI) within the Study Area. The most significant parcel is located in the west of the study area, east of Eaglesfield, with another parcel north of Cadgill and smaller parcels scattered throughout the study area. Ancient Woodland and Forestry is shown on Figure 4.4;
- Presence of watercourses and waterbodies, including Kirtle Water, River Sark, Black Sark, Logan Water, Mein Water. Hydrology Features are shown on Figure 4.5;

- Presence of Listed Buildings and SAM's within the study area. Cultural Heritage features are shown on Figure 4.6; and
- Areas of peat, most prominently located in the centre of the study area but with smaller areas in the southwest. Areas of peat are shown on Figure 4.7.

4.2.2 The constraints analysis was undertaken using Geographical Information Systems (GIS). A project specific WebGIS service based on ArcGIS Online (AGOL) was developed specifically for the Callisterhall project. This allowed spatial data, such as environmental constraints and protected sites to be overlaid with basemapping and project-specific data to provide the project team with a web-accessible and updatable means of interrogating environmental and project details in a single place.

4.3 Planning Considerations

The proposed Callisterhall Wind Farm Connection contributes to the growth of energy infrastructure, without which new energy generation projects are unable to contribute towards achieving these targets.

National Planning Policy

4.3.1 The Scottish Government has adopted NPF4 (adopted in February 2023) which sets out the priorities for the planning system up to 2045 with an emphasis on the transition to a net zero sustainable Scotland by 2045.

4.3.2 NPF4 sets out a number of priorities to guide the planning system. The need for increased renewable energy generation and the associate grid infrastructure is highlighted within the identified National Developments to Deliver Sustainable, Liveable Places, noting:

4.3.3 *"Additional electricity generation from renewables and electricity transmission capacity of scale is fundamental to achieving a net zero economy and supports improved network resilience in rural and island areas."* Annex B National Developments Statements of Need, pg. 103.

4.3.4 The aim of the grid connection supports Scotland's renewable energy targets by facilitating the connection of Callisterhall Wind Farm.

Local Planning Policy

4.3.5 The proposed development is covered by Dumfries and Galloway local planning policy, which is set out within the Local Development Plan 2 (LDP2), adopted in October 2019. As the most recent plan, NPF4 takes priority if policies in LDP2 and its associated supplementary guidance contradict policies in NPF4.

4.3.6 LDP2 sets out policies for sustainable development in the region, including provisions for electricity infrastructure to support renewable energy, grid upgrades and energy efficiency.

4.3.7 LDP2 encourages renewable energy projects and recognises the need for associated electricity infrastructure such as grid connections, substations and transmission lines to facilitate these projects. Policy also recognises the need for such projects to minimised landscape and visual impacts.

4.4 Landscape Character

4.4.1 Landscape character within the Study Area is covered by the following Landscape Character types:

- Southern Uplands with Forest - Dumfries & Galloway
- Southern Uplands - Dumfries & Galloway
- Foothills - Dumfries & Galloway
- Upland Fringe - Dumfries & Galloway
- Flow Plateau
- Narrow Wooded River Valley - Dumfries & Galloway
- Coastal Flats - Dumfries & Galloway

4.4.2 The majority of the study area is covered by "Foothills – Dumfries and Galloway, Flow Plateau and Upland Fringe - Dumfries & Galloway". The majority of the northern section is covered by the Foothills – Dumfries and Galloway landscape type, whose characteristics are:

- Generally undulating land between 170 and 250 metres, with rounded peaks. Higher in the west, up to nearly 550 metres with craggier peaks.
- Foothills dissected by incised valleys.
- Semi-improved pasture enclosed in medium-large fields by stone walls. Grazed by sheep and cattle. Some rough pastures and heath on higher ground.
- Trees in sheltered pockets with some copses on top of hills.
- Many scattered farmsteads and small settlements.
- Network of minor roads.
- Numerous archaeological sites particularly Bronze Age funerary and ritual sites and Iron Age settlements and forts.

4.4.3 The central part of the study area is covered by the Upland Fringe - Dumfries & Galloway LCT type, its key characteristics are:

- Elevated rolling pastures.
- Improved and rough grassland in close proximity.
- Hedgerow banks and treelines along roads in some lower areas.
- Dry stone dykes.
- Squared areas of forestry.
- Contrast between wide open areas and more intimate landform.
- Panoramic views over valley and coastal lowlands.
- Small bridges over incised burns.
- Notable landmark features, including Iron Age fortifications, designed landscapes and grand houses.

4.4.4 The southern part of the study area is mainly covered by the Flow Plateau LCT type, its key characteristics are:

- Mostly flat and gently rolling topography with an incline towards the Solway.
- Occasional long views over the Solway.
- Waterlogged rush infested pastures, ochre green and brown.
- Large fields with hedgerows in poor condition and fences.
- Cattle grazing.
- Shelterbelts and small informally shaped forests.
- Riparian woodlands.
- Scattered farmsteads.

4.4.5 Landscape Character Areas are shown on Figure 4.8 and Landscape Designations are shown on Figure 4.9.

4.5 Baseline Visual Amenity

4.5.1 The study area predominantly consists of mountainous areas to the north east, with the centre consisting of Upland and Hills and the south Lowland landscape.

4.5.2 Local roads are located all across the study area, with a few regional roads crossing the northern and southern sections of the study area. Chapelknowe, Evertown, Waterbeck and Eaglesfield are among the settlements in the study area, which is sparsely populated.

4.5.3 The M74 travel corridor skirts around the west of the study area, with the A7 doing the same to along the eastern edge. Several Core Paths are located throughout the study area. Existing turbines are a common feature in the northern section.

5 ROUTEING STRATEGY

5.1 Overview

5.1.1 In accordance with SPEN's approach to routeing, the routeing strategy for the Callisterhall project has been developed taking into account the routeing objective identified in Section 3 and the key considerations in Section 4.

5.1.2 The purpose of the Routeing Strategy is to ensure a consistent approach in identifying a technically feasible and economically viable route between Callisterhall Wind farm and Gretna Substation whilst taking into consideration environmental, technical and economic constraints. The route should, on balance, cause the least disturbance to the environment and the people who live, work and enjoy outdoor recreation within it.

5.1.3 To help minimise landscape and visual effects, in accordance with the Holford Rules and SPEN's routeing methodology, the proposed overhead line has also sought to avoid high ground and ridgelines, responding to the grain of the landscape, subject to avoiding areas of highest amenity and environmental values far as practicable (as above). To help assess temporary and permanent cumulative effects, careful consideration has also been given to the relationship of the proposed OHL with other electricity infrastructure within the study area. Existing SPEN electricity infrastructure is shown on Figure 5.1.

5.2 Grid Connection Routeing Strategy

5.2.1 Route Options will be developed so that they:

- Are as direct as possible between the consented Callisterhall Wind Farm and Gretna 132kV substation;
- Minimise as far as possible potentially adverse effects on residential and visual amenity by taking account of the pattern and distribution of settlement and individual/clustered properties;
- Minimise potential effects on:
  - All other statutory and non-statutory sites within the study area;
  - Habitats and protected species;
  - Recreational and access routes;
- Take account of existing and planned land use and infrastructure as far as possible including extension of settlements, proximity to existing OHL's and wind farms.

6 ROUTE OPTIONS

6.1 Identification of Route Options

6.1.1 The first stage of the procedure requires the identification of potential route options from which a preferred option can then be selected. Prior to the identification of potential route options for Callisterhall OHL, further refinement of the Study Area was undertaken on the basis of removal of the most significant constraints to development.

6.1.2 The study area was initially determined around Callisterhall Wind Farm to the north and Gretna substation to the south. A number of routes were identified, taking into account the effect on the environment, amenity, people and technical feasibility. The route options are shown on **Figure 6.1**, which should be referred to in review of the summary table below (Table 6.1) and in the detailed appraisal in Appendix 2.

6.1.3 The options identified have been selected with regard to the key routeing considerations identified, including existing wind farms, settlements and environmental constraints. All route options have been developed to avoid both built and in planning wind farms, aside from Route Option D, which has been routed through the planned Bloch wind farm due to the presence of other constraints in that part of the study area. **Figure 6.2** shows RAG constraints used to determine potential Route options. Combined constraints are shown in Figure 6.3

Route Option A

6.1.4 Route option A begins at the point of connection (Callisterhall Wind Farm) and extends south west along the western side of Winterhope Reservoir before intersecting an existing 132kV OHL connecting Ewe Hill Wind Farm to Gretna substation. The route then crosses the B7068 and B722 southwards before diverting in a south easterly direction across Kirtle Water. The route is dictated to the east by areas of ancient woodland.

6.1.5 From here the route proceeds south and will have to intersect the existing ZV route 400kV OHL, the corridor then extends south along the western side of this line. There are a number of residential properties as the route travels south but these are relatively well spread out. Cowgarth Flow Local Nature Conservation Site is located in the very south of the corridor close to the substation.

Route Option B

6.1.6 Route option B extends south west, crossing the 132kV Ewe Hill - Gretna OHL and the B7068. The route is sparsely populated with residential properties for the most part, aside from where it intersects the B6357 around Cadgill, diverting around the Cadgill Flow Local Nature Conservation Site.

Route Option C

6.1.7 Route Option C extends south from the connection point at Callisterhall before crossing the B7068 and entering commercial forestry. Further south the route is bordered closely by the Ewe Hill – Gretna 132kV OHL to the west, and to the east by Bells Flow SSSI. The route is sparsely populated.

Route Option D

6.1.8 Route Option D is the longest of the route corridors, travelling south from the connection point before crossing the B7068 and veering east. The corridor encounters a very narrow pinch point shortly after due to the presence of ancient woodland to the north and areas of steep slope to the south.

6.1.9 The corridor is then forced to route through the planned Bloch Wind Farm becoming narrower as it does so, before widening again and diverting west away from the eastern edge of the study area. At the point where the route travels south it borders the River Sark along its eastern boundary before joining with the southern element of Route Option C.

Table 6.1 Summary of the detailed analysis of each route undertaken by technical specialists

RAG rating key

Red rating indicates hard constraint or high sensitivity	Amber rating indicates medium constraint or medium sensitivity	Green rating indicates soft constraint or low sensitivity

Category	Route Option A	Route Option B	Route Option C	Route Option D	Preferred Route
Ecology and Ornithology	Option A is the most westerly of the proposed route options, and therefore is located the furthest away from the Langholm – Newcastleton Hills SPA/SSSI and Bell's flow SSSI. However, of the four route options, option A is in closest proximity to the Raeburn Flow SAC/SSSI, passing within 1.3km of the protected site, and to the protected sites of the Solway Firth. In the central and southern areas of the route option, Route Option A also passes in close proximity to several areas of unnamed ancient woodland, though these would not be not intersected by the route. Route Option A passes through Cowgarth Flow, a raised bog that is listed as a Local Wildlife Site. Raised bog is a priority habitat, listed on Annex 1 of the European Habitats Directive, on the Scottish Biodiversity List, and on the citations for several of the local statutory sites. For this reason, along with the proximity of Route Option A to the Raeburn Flow SAC/SSSI, it is the least preferred route option with regard to ecology and ornithology.	Route option B passes within approximately 1.8km of Raeburn Flow SAC/SSSI and within approximately 1.5km of Bell's Flow SSSI. It also passes in close proximity to a number of areas of ancient woodland, including Cadgill Wood and Spout Craig Plantation, though these are not intersected by the route. Based on a review of OS mapping and aerial photography, Route Option B does not appear to pass through any raised bog habitat. It is located further from Raeburn Flow than Route Option A and further from Bell's Flow than Route Options C or D. Route Option B also follows in part an existing OHL route. For these reasons, Route Option B is considered the preferred route with regard to ecology and ornithology.	Similarly to Route Option B, Option C also passes in close proximity to several areas of ancient woodland, including Cadgill Wood and Spout Craig Plantation, though these are not intersected by the route. Route option C is the closest of the route options to Bell's Flow SSSI, passing within 50m of the designated site. For this reason, Option C is not considered to be the preferred route with regard to ecology and ornithology.	Route option D is the most easterly of the proposed routes, and therefore passes the closest to the Langholm-Newcastleton Hills SPA/SSSI. It is the furthest from Raeburn Flow SAC/SSSI, however it passes within 350m of Bell's Flow SSSI. For this reason Route Option D is not considered to be the preferred route with regard to ecology and ornithology.	**Route Option B**
Archaeology and Cultural Heritage	There are no Scheduled Monuments located within the route corridor. The closest are the Doe's Hill Prehistoric Settlement (SM12739) located 177m to the west of the route corridor, and the Kirtlehead, ring ditch house 150m north of; (SM12720) 277m to the west of the route corridor. There are no Listed Buildings located within the route corridor. However there are 7 Listed Buildings within	There are no Scheduled Monuments within the route corridor. The closest are the Doe's Hill Prehistoric Settlement (SM12739) located 430m to the west of the route corridor, and the Kirtlehead, ring ditch house 150m north of; (SM12720) 600m to the west of the route corridor. There are no Listed Buildings within the route corridor. However there are 2 within 100 m of the route corridor (both Category B).	There are no Scheduled Monuments within the route corridor. The closest scheduled monument is the Cursus 340 m west-north-west of Timpanheck Cottage (SM11964) approx. 350 m to the west of the route. There are no Listed Buildings within the route corridor, nor are any located within 100 m of the route. There are 9 NRHE (Canmore) records within the route corridor.	There are no Scheduled Monuments within the route corridor. The nearest scheduled monuments are the Scot's Dike Scheduled Monument (SM660) just 30 m to the south of the corridor route; and the Callisterhall Farmstead Scheduled Monument (SM4520) c. 80 m to the east of the route corridor. There are no Listed Buildings within the route corridor. The two closest are the Cat B Listed Sark Bridge	**Route Option C**

	100m of the route corridor (4 Category B; 3 Category C). There are 30 NRHE (Canmore) Records within the route corridor. A review of the 1st Edition Ordnance Survey Map from 1857 identified one additional gravel pit/ quarry at grid ref: 328547, 574895. The known heritage assets that are present within the route option are discrete and can be easily routed to avoid. The nature of the known heritage assets within the route option are not indicative of extensive archaeological potential for hitherto unknown archaeological remains that may be discovered during construction.	There are 21 NRHE (Canmore) Records within the route corridor. A review of the 1st Edition Ordnance Survey Map from 1857 did not reveal any previously unrecorded heritage assets within the route corridor. The known heritage assets that are present within the route option are discrete and can be easily routed to avoid. The nature of the known heritage assets within the route option are not indicative of extensive archaeological potential for hitherto unknown archaeological remains that may be discovered during construction.	A review of the 1st Edition Ordnance Survey Map from 1857 identified a sheepfold at grid ref: 329094, 578251.	(LB3534) approx. 195 m to the west of the route corridor; and the Cat B Listed Old Parish Church, Morton (LB 255) 250 m to the west of the route corridor. There are 15 NRHE (Canmore) records within the route corridor. A review of the 1st Edition Ordnance Survey Map from 1857 identified a farmstead named 'Over Bogie' at grid ref: 332679, 576763; and x2 rectangular enclosures at gid refs: 329766, 581337 and 329652, 581329. The known heritage assets that are present within the route option are discrete and can be easily routed to avoid. The nature of the known heritage assets within the route option are not indicative of extensive archaeological potential for hitherto unknown archaeological remains that may be discovered during construction.	
Landscape and Visual Amenity	This option intersects with Coastal Flats, Flow Plateau, Upland Fringe and Foothills LCTs. Existing infrastructure would reduce the sensitivity to the north of Gretna Substation. The route crosses several local roads and some small shelterbelt and woodland features. There are no designated recreational routes within the corridor, but there would be some intermittent views of the route from local roads and Core Path 276. There are several residential properties within the corridor option.	This option intersects with Coastal Flats, Flow Plateau, Upland Fringe and Foothills LCTs. This route is set between two existing transmission lines at the southern end which connect to Gretna Substation. The route crosses several local roads and some small shelterbelt and woodland features. There are no designated recreational routes within the corridor, but there would be some intermittent views of the route from local roads. There are several residential properties within this corridor.	This option intersects with Coastal Flats, Flow Plateau, Upland Fringe and Foothills LCTs. This route is aligned to existing infrastructure extending north from the Gretna Substation, passes through open fields and sections of forestry and to the west of Solwaybank Wind Farm. The route crosses several local roads and some small shelterbelt and woodland features. There are no designated recreational routes within the corridor but there would be some intermittent views of the route from local roads. There are few residential properties within this corridor with greater separation distances available.	This option intersects with Flow Plateau, Upland Fringe and Foothills LCTs. The route crosses several local roads and some small shelterbelt and woodland features. This route crosses Core Path 277 and is near to Core Path 288 with high potential of open views. There would be intermittent views of the route from local roads. There are few residential properties within this corridor with greater separation distances available. The southern most extent of this route may be briefly visible from local roads in the north of England	**Route Option C**
Geology Hydrogeology and Hydrology	Almost all peatland in Route A is mapped as Class 0 – described as mineral soil where peatland habitats are not typically found. Very small pockets of Classes 3 and 4 are present in the central area of Route A which are likely to contain peaty soils. Soils present in Route A are mostly brown forest soils, of the Canonbie Association, which typically contain mineral soils. Noncalcareous gleys and peaty gleys are present in the northern parts of Route A.	Peatland in Route B is mostly mapped as Class 0 – described as mineral soil where peatland habitats are not typically found. Pockets of Classes 3 and 4 are present in the central area of Route B which are likely to contain peaty soils. There are small pockets of Class 5 peatland described as carbon-rich peat soil which has the potential to be deep. The southern pocket tags onto an area of Class 1 peatland which is outwith the Route B corridor but is a further indication of presence of peat.	The northern and southern parts of Route C are mapped as Class 0 – described as mineral soil where peatland habitats are not typically found. A large section in the northern central part of Route C is mapped as Class 5 peatland – described as carbon-rich peat soil which has the potential to be deep. These are next to mapped areas of Class 1 and 3 peatland which indicate the presence of potentially deep peat and peatland habitat. Soils present in Route C are mostly brown forest soils, from the Canonbie Association. Gleys and peaty gleys of the Canonbie,	The northern part of Route D is predominantly mapped as Class 3 peatland described as carbon rich soils with some areas of deep peat. These areas generally coincide with smaller pockets of Classes 4, 5 and 0, indicating potential for variable peat depths and peat coverage. The southern part of Route D is mostly Class 0 (mineral soils). Soils present are brown forest soils and peaty gleys of the Canonbie Association. A large area of peaty	**Route Option A** **Soil and peat mapping indicate that Route A best avoids areas of peat, although this will need to be confirmed after completion of peat surveys.** **Aerial imagery indicates the route is mostly on agricultural land**

	Route A borders Winterhope Reservoir in the north. Route A encompasses several watercourses including the Kirtle Water to the west and Kirk Burn to the east. Further unnamed tributaries and drains (sikes) are mapped, particularly in the northern region around Winterhope Reservoir. The central and southern parts of the Study Area, including the southern part of Route A, fall within a Coal Mining Reporting Area and will require further investigation. Former coal mining areas may encounter complex ground conditions. Deep peat can usually be avoided and impact on peat is usually minimal from wood pole construction as there will be no foundations.	Soils present in Route B are mostly brown forest soils from the Canonbie Association. Gleys and peaty gleys of the Canonbie, Kirkwood and Ettrick Associations are also present. An area of organic soil is mapped in the south which corresponds with the mapped area of Class 5 peatland. Route B borders Winterhope Reservoir in the north. Route B option encompasses several watercourses including the Kirtle Water to the east and Broadbeck Burn and Cadgill Burn in the central areas. Further unnamed tributaries and sikes are mapped, particularly in the northern region around Winterhope Reservoir. The central and southern parts of the Study Area, including the southern part of Route B, falls within a Coal Mining Reporting Area which will require further investigation. Former coal mining areas may encounter complex ground conditions. Deep peat can usually be avoided and impact on peat is usually minimal from wood pole construction as there will be no foundations.	Kirkwood and Ettrick Associations are present. Pockets of organic soil are mapped in the central and southern areas, small sections of which intersect the Route C corridor. The central area of Route C looks to be heavily modified with the presence of commercial forestry plantation. Route C encompasses several small watercourses including the Woodside Burn and Ned's Beck. The River Sark is located in the southern part of the Study Area and is close to Route C border. Further unnamed tributaries and sikes are mapped, particularly in the northern region and in the area of commercial forestry. The central and southern parts of the Study Area, including the southern part of Route C, falls within a Coal Mining Reporting Area which will require further investigation. Former coal mining areas may encounter complex ground conditions. Deep peat can usually be avoided and impact on peat is usually minimal from wood pole construction as there will be no foundations.	gleys with blanket peat, from the Carter Association, is mapped in the central eastern region of Route D. Smaller pockets of organic soil are also present. Route D incorporates small patches of commercial forestry but is mostly agricultural land. Route D encompasses several watercourses and named sikes, particularly around the central region. The northern area of Route D has been heavily modified for forestry plantation. The southern part is mostly agricultural fields. The central and southern parts of the Study Area, including most of Route D, falls within a Coal Mining Reporting Area which will require further investigation. Former coal mining areas may encounter complex ground conditions.	**where disturbance of sensitive peat soils, wetland habitats and hydrology is likely to be minimal**.
Land Use and Infrastructure	The southern section of the corridor consists of grade 3.2 and 4.2 in the central and southern sections, with the northern section consisting of grade 5.2 and 5.3. Route encompasses ten 11kV OHL crossings, two 33kV OHL crossings, one 400Kv OHL crossing and one 132kV crossing. The route is also within proximity to a host of existing OHL transmissions and distribution infrastructure. The route is also within proximity to a host of existing OHL transmissions and distribution infrastructure. Two gas pipelines are located within the corridor, one of them near Gretna 132kV Substation.	Route B is mainly characterised by grade 3.2 in the south, 4.2 and 5.3 in the centre and 5.2 and 5.3 in the north. Route B is crossed by 1 132kV OHL, as well as a 11 x 11kV and 2 33kV OHL's. The route is also within proximity to a host of existing OHL transmissions and distribution infrastructure. One gas pipeline is located within the corridor, with a second one located near Gretna 132kV Substation.	Southern section of corridor consists of grade 3.2. The central and northern sections of the corridor mostly consist of grade 5.2 and 5.3 This route is crossed by a number of 11kV and 33kV OHL's. One gas pipeline is located within the corridor, with a second one located near Gretna 132kV Substation.	The corridor mainly consists of grade 3.2 and 5.3 land, with the rest consisting of grade 4.2, 5.3 and 6.3. This route is crossed by a number of 11kV and 33kV OHL's Four gas pipelines are located within the corridor, one of them being located near Gretna 132kV Substation and another one at the connection point site.	**Route Option C**
Forestry	Approximately 13.98 Ha of forestry presumed majority being commercial conifer crops are located within this route option	Approximately 24.73 Ha of forestry presumed majority being commercial conifer crops are located within this route option	Approximately 162.78 Ha of forestry presumed majority being commercial conifer crops are located within this route option. Site visit was undertaken on 26th August to assess the suitability of a proposed route in	Approximately 26.16Ha of forestry presumed majority being commercial conifer crops are located within this route option	**Route Option A – has the least amount of commercial forestry**

			this location. A felling license would likely be required, as would compensatory planting. Ground conditions are relatively flat across the forestry section, altitude ranges from 160m asl at Pokeskine Sike to 220m asl on the higher ground within the area surveyed.		
Traffic and Transport	Route Option A access may use existing field accesses and tracks. Where there are no existing tracks and/or no formal access junctions, new temporary tracks and/or access points will be required. Additional construction traffic will be generated. Those will result in additional HGVs on roads during construction phase.	Route Option B access may use existing field accesses and tracks. Where there are no existing tracks and/or no formal access junctions, new temporary tracks and/or access points will be required. Additional construction traffic will be generated. Those will result in additional HGVs on roads during construction phase.	Route Option C access may use existing field accesses and tracks. Route Option C can utilise the existing field access off the B7068 to its northern section as principal access. It also crosses B7068 in the vicinity of Solwaybank Wind Farm access therefore can potentially utilise it to access the areas south of B7068. Solwaybank Wind Farm access tracks together with existing forestry tracks can be utilised. Where no forestry tracks present, 'fire breaks' may potentially be used. New access tracks will result in additional HGVs on roads during construction.	Route Option D access may use existing field accesses and field/forestry tracks. Where there are no existing tracks and/or no formal access junctions, new temporary tracks and/or access points will be required. Forestry tracks located along the C70A eastern edge can be utilised. Where no forestry tracks present, 'fire breaks' may potentially be used. Additional construction traffic will be generated. Those will result in additional HGVs on roads during construction phase.	**Route Option C**
Recreation and Tourism	**N/A**	**N/A**	**N/A**	The southern section of the Mouldy Hill to Outer Hill core path within the west of the study area cuts across route option D	**No preference of Routes A, B and C.**
Additional/Technical Considerations	The majority of the corridor is within an altitude <200m AOD, however around the last 25% of the corridor section there is an altitude >200m AOD, with a maximum altitude of ~253m AOD. Corridor has gradients between 0-6 degrees with some sections having gradients up to 22 degrees.	The majority of the corridor is within an altitude <200m AOD, however around the last 5% of the corridor section has an altitude >200m AOD, with a maximum altitude of ~253m AOD. Corridor has gradients between 0-6 degrees with some sections having gradients up to 22 degrees.	The majority of the corridor is within an altitude <200m AOD, however around the last 20% of the corridor section there is an altitude >200m AOD, with a maximum altitude of ~254m AOD. Corridor has gradients between 0-6 degrees with some sections having gradients up to 22 degrees.	The majority of the corridor is within an altitude <200m AOD, however around the last 20% of the corridor section there is an altitude >200m AOD, with a maximum altitude of ~303m AOD. Corridor has gradients between 0-6 degrees with some sections having gradients up to 22 degrees.	**Route B**
Route Length	c.17.5 km in length	c. 16.7 km in length	c. 14.6 km in length	c. 19.1 km in length	**Route Option C**

Final Technical Review

6.1.10 Following the environmental appraisal of options, and prior to the final selection of a preferred route option, a technical assessment by SPEN Engineers in August 2025 was completed in relation to the feasibility of the proposed corridors. This review was undertaken to ensure that, based on the level of detail available, the preferred route was within the technical and engineering parameters required to construct OHLs. This included consideration of matters such as altitude, topography, slope gradients, crossing of existing OHL infrastructure and crossing other existing and proposed infrastructure e.g. Roads, wind farms etc.

6.1.11 Route B will require the deployment of H-Pole structures over the last 5% of that routes as the last 5% is above 200m AOD, which is the least of all options. All corridor options would require a further Public Utilities search to establish the existence of further services. Route D contains 4 gas pipelines, with Route A containing 2 and Routes B and C containing 1 each.

6.1.12 The technical review highlighted a number of areas that would require mitigation. All potential site options will require crossing within the 3x rotor diameter buffer zone of the proposed turbines at the Callisterhall Wind Farm. Whilst all routes are considered feasible from a length perspective, Route C is the shortest by a distance of 2km. This route also contains the shortest number of crossings of existing OHL transmission and distribution infrastructure.

Conclusion

6.1.13 On the balance of technical considerations, Route C is identified as the preferred route.

7 PREFERRED ROUTE OPTION

7.1 The Preferred Route Option

7.1.1 The Routeing Objective was, in summary, to identify a technically feasible and economically viable route while minimising the impact on people and the environment as far as possible. The preferred route option is technically feasible and economically viable and, relative to other route options, avoids or reduces impacts on the environment and people who live, work and undertake recreational activities in the area as far as possible.

7.1.2 As set out in the Routeing Strategy this includes identifying as direct a route as possible between Callisterhall Wind Farm and Gretna Substation while taking account of landscape character, residential and visual amenity, designated sites as well as other constraints such as areas of ancient and native woodland. The preferred route option has been developed and assessed taking account of the routeing strategy as summarised in the following sections.

7.1.3 Across the suite of environmental categories through which the route options were analysed, Route B was the preferred option for 2 disciplines – Ecology and Additional/Technical Considerations and Route C was the preferred option for 5 disciplines – Archaeology, Landscape, Land Use, Traffic and Transport and Route Length. From a landscape perspective, all options pass through the coastal flats, flow plateau, upland fringe and foothills LCT's, but given the alignment of Route C with existing transmission infrastructure and proximity to the existing Solwaybank Wind Farm, Route C is favoured. Route C is shorter than the next shortest route by a distance of circa 2km. An important consideration is also the number of crossings of existing transmission infrastructure, of which Route C has the fewest.

7.1.4 The alignment of Route C avoids sensitive ancient woodland, demonstrating a clear commitment to environmental stewardship. The commercial forestry plantations intersected by Route C consist of forestry at various stages of maturity, which presents a lower ecological sensitivity compared to ancient woodland. Additionally, the variation of age and height of woodland through Route C when considering routeing allows for less environmental and visual impact when tree clearance is considered for the positioning of the OHL.

7.1.5 Therefore, Route C is the chosen option going forward on the balance of all available constraints. The preferred route is shown on **Figure 7.1.**

8 NEXT STEPS

8.1 Public Consultation

8.1.1 SPEN is inviting comments on the development proposals described in this document. You may comment in person, at the forthcoming public exhibition (detailed in section 8.1.6), by post or by email.

8.1.2 When providing comments, SPEN would appreciate your consideration of the following questions:

- Do you have any comments regarding the rationale for the project, as set out within this route selection consultation document?
- Do you have any comments regarding the approach to the selection of the preferred route as set out in this route selection consultation document?
- Are there any factors you consider that may have been overlooked, or given either too much or insufficient consideration during the route selection process?
- Do you have any other comments about the preferred route of the overhead line?

8.1.3 The exhibition will be advertised in the local press and in the local community.

8.1.4 Comment forms will be available at the public exhibition. Comments can be posted or emailed to the SPEN Community Liaison Manager at the address below:

Callisterhall Wind Farm Connection, Land and Planning Team, SP Energy Networks, 55 Fullarton Drive, Glasgow, G32 8FA

8.1.5 Public consultation events detailing the proposals outlined in this document will be held on Tuesday 2nd December at the following location:

2-7pm Tuesday 2nd December 2025 at Chapelknowe Village Hall, Canonbie DG14 0YF

SPEN request that all consultation responses are received by 16th January.

8.1.6 All comments received will inform further consideration of the preferred route alignment and the selection of a proposed route alignment, which will be taken forward for more detailed environmental assessment prior to submission of an application for consent.

APPENDIX 1 ENVIRONMENTAL DATA SOURCES

Feature	Abb	Source
Ancient Woodland Inventory	AW	NatureScot
Conservation Areas	CA	Historic Environment Scotland
Core Paths	-	Open data
Cycle Routes	-	SUSTRANS
Existing Transmission Infrastructure	-	SPEN
Flood Risk Zones	FRZ	SEPA online flood mapping
Historic Environment Record	HER	Canmore (canmore.org.uk)
Hydrogeology	-	Bgs (ONLINE)
Landscape Character Types (Landscape Character Assessment)	LCT (LCA)	NatureScot
Listed Buildings	LB	Historic Environment Scotland
National Tourist Routes	-	VisitScotland
National Scenic Areas	NSA	Scottish Government
OS Maps 1-250k	-	OS Open Data
OS Maps 1-50k	-	Emapsite
Ramsar sites	-	NatureScot
Residential Settlements and housing allocation areas	-	OS_Address_Layer (downloaded from emapsite)
RSPB Reserves	-	RSPB
Scheduled Monuments	SM	Historic Environment Scotland
SEPA Assessed Watercourses	-	SEPA online river basin management plan mapping
Sites of Special Scientific Interest	SSSI	NatureScot
Special Area of Conservation	SAC	NatureScot
Special Protection Areas	SPA	NatureScot
Wild Land Areas	WLA	NatureScot
Wind Farms	-	NatureScot

APPENDIX 2 DETAILED ENVIRONMENTAL & TECHNICAL ANALYSIS

Topic	Study Area	
Ecology and Ornithology	The Study Area is located in south eastern Dumfries and Galloway, and spans between the Callisterhall Wind Farm in the north and the Gretna Substation in the south. The M74 motorway borders the study area to the south west, as does the A7 to the east of the site. The national border with England demarcates the border to the south. There are a number of statutory sites with biological designations both within and nearby the study area: • Raeburn Flow SAC and SSSI, located within the study area; • Langholm - Newcastleton Hills SPA and SSSI, located approximately 1.6km to the north east of the study area; • Upper Solway Flats and Marshes RAMSAR and SSSI, located approximately 1.1km to the south west of the study area; • Solway Firth SPA and SAC, located approximately 2.1km to the south west of the study area; and • Bell's Flow SSSI, located within the study area. In addition there are extensive areas of ancient woodland throughout the study area, consisting both ancient semi-natural woodland and long established plantation. Habitats in the study area are broadly defined by the geological conditions and elevation. The northern section of the study area includes more upland areas, with a mixture of upland grassland, heath and mire habitats used for rough grazing, interspersed with steep-sided burns and cleughs, and some enclosed areas of semi-improved pasture associated with farm structures. There are also some large commercial conifer plantations in various stages of cultivation from mature trees to fresh clear-cuts, as well as smaller areas of mixed and broadleaved woodland, including some ancient semi-natural woodlands. Towards the central and southern areas of the study area, the elevation decreases and semi-improved pastures become more common, along with broadleaved and mixed woodland, which is associated with farmsteads and river valleys. Raised bog habitats are also present in the central part of the study area, namely the Bell's Flow SSSI. This trend continues into the southern parts of the study area closest to the Solway Firth, where there are a number of named raised bogs, including the Raeburn Flow SAC and SSSI and several Local Wildlife Sites. The southern section of the study area is dominated by farmland, as well as lowland grassland and marshes. **Assumptions and limitations** Habitats likely to be present along the route have been assessed based on a review of OS mapping and aerial photography, as it was not possible to carry out a site survey prior to this routeing study. Surveys of the routes for habitats and protected species must be carried out and the survey findings may result in changes to the RAG ratings. Surveys of the preferred route must be carried out prior to the detailed design. **Route option A** Starting in the north of the study area at the proposed Callisterhall Wind Farm connection site, Route Option A passes to the west of the Winterhope reservoir, then follows the western bank of Kirtle Water for approximately 6km, crossing several smaller watercourses, before crossing the river close to the village of Waterbeck and heading south east along the southern edge of the route of an existing OHL until it meets the Gretna substation. As the route option approaches the substation, it is defined to the south west by patches of ancient woodland and the Logan Burn. It is generally advised in guidance for ecology to group OHL structures together, as this means that obstacles to wildlife are confined to one area and are more visible, so placing the new OHL along the route of an existing one is considered a positive in terms of ecology. Option A is the most westerly of the proposed route options, and therefore is located the furthest away from the Langholm – Newcastleton Hills SPA/SSSI and Bell's flow SSSI. However, of the four route options, option A is in closest proximity to the Raeburn Flow SAC/SSSI, passing within 1.3km of the protected site, and to the protected sites of the Solway Firth. Raeburn Flow is designated for its lowland raised bog habitat, for which it is considered to be one of the best areas in the United Kingdom. In the central and southern areas of the route option, Route Option A also passes close to several areas of unnamed ancient woodland, but these are not intersected by the route.	

Topic	Study Area	
	Route Option A passes through Cowgarth Flow, which is a raised bog that is listed as a Local Wildlife Site. Raised bog is a priority habitat, listed on Annex 1 of the European Habitats Directive, on the Scottish Biodiversity List, and on the citations for several of the local statutory sites. For this reason, along with the proximity of Route Option A to the Raeburn Flow SAC/SSSI, it is the least preferred route option with regard to ecology. **Route option B** From the Callisterhall Wind Farm connection site, Route Option B passes to the east of the Winterhope reservoir, continuing south along the eastern bank of Kirtle water for approximately 4km before skirting around the eastern edge of the plantation woodland at High Muir. From there, the route follows the north eastern side of the existing OHL followed by Route Option A before joining the Gretna substation. It is generally advised in guidance for ecology to group OHL structures together, as this means that obstacles to wildlife are confined to one area and are more visible, so placing the new OHL along the route of an existing one is considered a positive in terms of ecology. The route crosses several watercourses, including Cadgill Burn, which is connected to Cadgill Flow, a raised bog and Local Wildlife Site, which also borders the route option. Route option B passes within approximately 1.8km of Raeburn Flow SAC/SSSI and within approximately 1.5km of Bell's Flow SSSI. It also passes in close proximity to a number of areas of ancient woodland, including Cadgill Wood and Spout Craig Plantation, though these are not intersected by the route. Based on a review of OS mapping and aerial photography, Route Option B does not appear to pass through any raised bog habitat. It is located further from Raeburn Flow than Route Option A and further from Bell's Flow than Route options C or D. Route Option B also follows in part an existing OHL route. For these reasons, Route Option B is considered the preferred route with regard to ecology. **Route option C** Route Option C heads directly south from the Callisterhall Wind Farm connection point for approximately 4km, passing through plantation woodland to the south west of the Solwaybank Wind Farm before heading south east to join the Gretna Substation, passing between the southern edge of Bell's Flow SSSI and the northern edges of Cadgill Wood and Cadgill Flow. Before it joins the substation, the route passes to the west of another area of raised bog, Greenwrae Flow. As with the other routes options, Route Option C crosses a number of watercourses, including Cadgill Burn, which is connected to the raised bog at Cadgill Flow. Similarly to Route Option B, Option C also passes in close proximity to several areas of ancient woodland, including Cadgill Wood and Spout Craig Plantation, though these are not intersected by the route. Route option C is the closest of the route options to Bell's Flow SSSI, passing within 50m of the designated site. For this reason, Option C is not considered to be the preferred route with regard to ecology. **Route option D** From the Callisterhall Wind Farm connection point, Route Option D travels south east, skirting to the south of the ancient woodland at Greencleugh Plantation, crossing Bigholms Burn twice and following the course of a minor track south from the B7068 before turning west at Ryehills and south at Barnglies to pass between Bell's Flow SSSI and Bogrie Flow, following the eastern bank of the River Sark. At the Scottish-English border, Route option D joins Route Option C, continuing south to the Gretna substation. As with the other options, Route option D crosses several watercourses, including the River Sark. Route option D is the most easterly of the proposed routes, and therefore passes the closest to the Langholm-Newcastleton Hills SPA/SSSI. It is the furthest from Raeburn Flow SAC/SSSI, however it passes within 350m of Bell's Flow SSSI. For this reason Route Option D is not considered to be the preferred route with regard to ecology.	
Archaeology and Cultural Heritage	There are no Conservation Areas, Inventory Gardens and Designed Landscapes, Inventory Battlefields or World Heritage Sites within the Study Area. There are: • 20 Scheduled Monuments • 59 Listed Buildings (x2 Category A; x34 Category B; x23 Category C) • 268 National Record of the Historic Environment (NRHE) records • 642 Canmore Records	

Topic	Study Area	
	These comprise cairns, enclosures, farmsteads, mines, quarries, sheepfolds, prehistoric platform settlements. The Study Area in part follows the length of the Scot's Dike Scheduled Monument (SM660). There are no known heritage assets that represent a significant constraint to the OHL development. **Route Option A** • There are no Scheduled Monuments located within the route corridor. The closest are the Doe's Hill Prehistoric Settlement (SM12739) located 177m to the west of the route corridor, and the Kirtlehead, ring ditch house 150m north of; (SM12720) 277m to the west of the route corridor. • There are no Listed Buildings located within the route corridor. However there are 7 Listed Buildings within 100m of the route corridor (4 Category B; 3 Category C). o Cat B Listed Carruthers Old Churchyard (LB16980) o Cat B Listed Branteth Farm (LB9809) o Cat B Listed Gowkhall Bridge (Over Kirtle Water) (LB9790) o Cat B Listed Gowkhall Bridge (LB16948) o Cat C Listed Gate Lodge, Kirtleton House (LB16959) o Cat C Listed Middlebie Mission Church, Lauriesclose (LB16960) o Cat C Listed North Craigs Farmhouse and Steading (LB16965) • There are 30 NRHE (Canmore) Records within the route corridor. o Winterhope Burn Rigg and Furrow (97607) o Doe's Hill Enclosure (97590) o Doe's Hill Prehistoric Cord Rig (97627) o Kirtle Slack Field Boundaries, Enclosures (97604) o Winterhope Reservoir Ring Enclosures (67202) o Kirtlehead Farmstead (86812) o Kirtlehead Tower House (86811) o Crowdieknow Hill Enclosure (67204) o House at Dunraggit (104653) o Crowdieknowe Cottage (104645) o Linnbridgeford Cottage (96391) o Patrickholm Farmhouse (96364) o Hotts Farmhouse (96363) o Lavrock Hall Farmstead (262447) o Between the Waters Farmhouse (96355) o Gowkhall Bridge Farmstead (179425) o Gowkhall Farmstead (262448) o High Muir Limekiln? (262461) o Caldronlee Farmhouse (96362) o Limekiln at Caldronlee Farm (262538) and quarry area (67057) o High Muir Cottage (262462) o Gallhills Farmhouse (96385) o Branteth Flow field boundary (262465) o Branteth Stone Circle (96323) (No visible remains today, only noted in the National Statistical Account (NSA)). o Quarry at Knowehead (67563)	

Topic	Study Area	
	○ Logan Mains Farmhouse (94042) ○ Rig and Furrow at Loganburn (90970) ○ Stubbyknowe Farmhouse (94057) ○ Stubbyknowe Bar Cottage (94058) ○ Milliganbushfield Farmhouse (94064) A review of the 1st Edition Ordnance Survey Map from 1857 identified one additional gravel pit/ quarry at grid ref: 328547, 574895. **Route Option B** There are no Scheduled Monuments within the route corridor. The closest are the Doe's Hill Prehistoric Settlement (SM12739) located 430m to the west of the route corridor, and the Kirtlehead, ring ditch house 150m north of; (SM12720) 600m to the west of the route corridor. • There are no Listed Buildings within the route corridor. However there are 2 within 100 m of the route corridor. ○ Cat B Listed Kirtleton House and Outbuildings (LB16954) ○ Cat B Listed Dovecote, Kirtleton House (LB16954) • There are 21 NRHE (Canmore) Records within the route corridor. ○ Enclosure at Standingstone Edge (97591) ○ Circular Enclosure at Craig Sike (67201) ○ Field Boundaries at Winterhope Reservoir (78477) ○ Ring Enclosure at Peat Sike (97608) ○ Ring Enclosures at Ley Hill (91591) ○ Ring Enclosures at Ley Hill (91594) ○ Enclosures at Ley Hill (67205) ○ Farmhouse at Setthorns (67193) ○ Setthorns Cottage (104646) ○ Prehistoric Enclosure at Kirtle Water (67056) ○ Conhess Cottage (96373) ○ Conhess Farmhouse (96372) ○ Farmhouse at Chapelhill (96383) ○ Sheepfold at Snab Corner (265274) ○ Snab Farmhouse (96384) ○ Enclosure at Branteth (262467) ○ Former Tileworks at Branteth (96319) ○ Hillhead Farmhouse (265193) ○ Chapelknowe Village (94059) ○ Chapelknowe, Chapel of Logan Farmhouse (67572) ○ Chapel of Logan Chapel (67566) A review of the 1st Edition Ordnance Survey Map from 1857 did not reveal any previously unrecorded heritage assets within the route corridor. **Route Option C** • There are no Scheduled Monuments within the route corridor. The closest scheduled monument is the Cursus 340 m west-north-west of Timpanheck Cottage (SM11964) approx. 350 m to the west of the route. • There are no Listed Buildings within the route corridor, nor are any located within 100 m of the route. • There are 9 NRHE (Canmore) records within the route corridor. ○ Burnt Mound at Kirtlehead Moss (97606)	

Topic	Study Area	
	○ Farmstead at Ley Hill (97610) ○ Ring Enclosure at Megsfield (91592) ○ Farmhouse at Alfornought (96389) ○ Tower House (Auchinbetrig) at Solway Bank (67540) ○ Rig and Furrow at Cadgillhead (90399) ○ Farmhouse at Cadgillhead (67534) ○ Farmhouse at Cadgillfoot (94062) ○ Farmhouse at Greenwrae (94063) ○ Tower House (Grenewich) at Greenwrae (67569) ○ Farmhouse at Staffler (94070) A review of the 1st Edition Ordnance Survey Map from 1857 identified a sheepfold at grid ref: 329094, 578251. **Route Corridor D** • There are no Scheduled Monuments within the route corridor. The nearest scheduled monuments are the Scot's Dike Scheduled Monument (SM660) just 30 m to the south of the corridor route; and the Callisterhall Farmstead Scheduled Monument (SM4520) c. 80 m to the east of the route corridor. • There are no Listed Buildings within the route corridor. The two closest are the Cat B Listed Sark Bridge (LB3534) approx. 195 m to the west of the route corridor; and the Cat B Listed Old Parish Church, Morton (LB 255) 250 m to the west of the route corridor. • There are 15 NRHE (Canmore) records within the route corridor. ○ Burnt Mound at Birny Hill (97595) ○ Ring Enclosures at Collin Burn (91558) ○ Collon Cottage (95203) ○ Undated settlement at Broomholm (354459) ○ Undated field system at Cow Sike (179371) ○ Kerr Farmhouse (90477) ○ Rig and Furrow at Kerr (90394) ○ Ryehills Farmhouse (90492) ○ Rig and Furrow north of March Cottage (90357) ○ March Cottage (90479) ○ Rig and Furrow south of March Cottage (90356) ○ Barngleish Farmhouse (90478) ○ Tower House (Barnglishe) at Barngleish (67541) ○ Bogrie Farmhouse (67532) ○ Tower House at Croftsike (67564) ○ Croftsike Farmhouse (94077) A review of the 1st Edition Ordnance Survey Map from 1857 identified a farmstead named 'Over Bogie' at grid ref: 332679, 576763; and x2 rectangular enclosures at gid refs: 329766, 581337 and 329652, 581329. Overall, the upland nature of the landscape within the study area means that past human activity and use of the land is likely to have taken the form of stock-raising and animal husbandry (e.g. sheep), hunting and fishing rather than arable agriculture. Human occupation of the land is more likely to have been of low density and temporary or seasonal (such as the occupation of summer grazings, shielings and bothies) rather than permanent year-round settlement.	

Topic	Study Area	
Landscape and Visual Amenity	The study area is spread across upland areas and settled areas to the north of the Scotland-England border in Dumfries and Galloway, between the settlements of Gretna to the south, Ecclefechan to the west and Langholm to the east. Settlements and agricultural areas are predominantly located in the south and west of the study area. Larger settlements are located on major transport routes on the outer fringes and boundary of the study area including the M74 to the southwest and the A7 to the east, while dispersed settlement and agricultural steadings are located along local routes which dissect the study area, though are less common in upland areas in the centre and north. Recreational routes are dispersed throughout the study area, though are predominantly located within upland areas to the northeast are associated with woodland, forestry and higher ground between the B7068 and the northern edge of the study area. Designated recreational routes within the study area include: • Core Path 288 in the centre of the study area which connects the C63a to the B7068 via Leaheads Hill and Collin Hags, to the east of the Solwaybank Farm; • Core Paths 267 and 268 located in the southwest of the study area adjoining the C62a and C63a; • Core Path 277 located in the northeast of the study area extending from the C70a, through Langholm and then back into the study area to the north of the B7068; • Core Path 362 located on a local road extending north from Gretna Green; and, • National Cycle Network (NCN) Route 7 which extends northeast from Gretna Green aligned with the Scotland/England Border to the north of the River Sark. Landform is varied throughout the study area. Large, expansive coastal flats located in the southern extents rise into gently undulating plateau and foothills in the centre of the study area with larger upland landform located in the north, extending beyond into the southern uplands. Open views are common in the southern edge of the study area in close proximity to Gretna, though roadside vegetation tends to contain visibility to a degree. Vegetation increases in coverage toward the centre and north of the study area, with some larger tracts of forestry, both mature and juvenile, intermittently screening views from local roads and core paths. Open views are also occasionally available from hilltops and open sections of road and recreational routes in the centre and northeast of the study area. Existing infrastructure is apparent in views from elevated areas, including the Solwaybank Wind farm and transmission line branching northward form the Gretna Substation. The transmission line and other smaller OHL are also intermittently visible throughout the study area from local roads, Core Paths and settlements. Landscape character for the study area is detailed in section 4.4. **Route Option A** This corridor covers lowland agricultural landscapes within Coastal Flats and Flow Plateau LCTs to the south of the study area, extending through undulating farmland in the Upland Fringe LCT and into the Foothills LCT. This route is aligned to an existing transmission line which connects to Gretna Substation. The route crosses several local roads and some small shelterbelt and woodland features; consideration should be taken into minimising potential removal of existing features. There are no designated recreational routes within the corridor. There may be some views of the route from local roads and Core Path 276, though these would be intermittent, with views form local roads changing orientation frequently and sequentially screened by roadside and shelterbelt vegetation. There are several residential properties within this corridor, with potential encirclement of a small number of properties by transmission lines occurring due to the relationship of the proposed grid connection and existing transmission lines. **Route Option B** This corridor covers lowland agricultural landscapes within Coastal Flats and Flow Plateau LCTs to the south of the study area, extending through undulating farmland in the Upland Fringe LCT and into the Foothills LCT. This route is set between two existing transmission lines at the southern end which connect to Gretna Substation. There is potential for mitigation of the spread of effects by aligning to the existing infrastructure. The route crosses several local roads and some small shelterbelt and woodland features; consideration should be taken into minimising potential removal of existing features. There are no	

Topic	Study Area	
	designated recreational routes within the corridor. There may be some views of the route from local roads, though these would be intermittent, with views form local roads changing orientation frequently and sequentially screened by roadside and shelterbelt vegetation. There are several residential properties within this corridor, including the village of Chapelknowe. There is the potential that encirclement by transmission lines may occur due to the relationship of the proposed grid connection and existing transmission lines. **Route Option D** This corridor branches from corridor C, extending through undulating farmland in the Upland Fringe LCT and into the Foothills LCT. The route crosses several local roads and some small shelterbelt and woodland features; consideration should be taken into minimising potential removal of existing features. This route crosses Core Path 277 and is closely aligned to the northern section of Core Path 288, Open, close-range views of the proposed grid connection would be available form these routes. There may be some views of the route from local roads, though these would be intermittent, with views form local roads changing orientation frequently and sequentially screened by roadside and shelterbelt vegetation. There are few residential properties within this corridor, with the opportunity for the proposed grid connection to be located at a greater distance from sensitive visual receptors. The southern most extent of this route may be briefly visible from local roads in the north of England. **Summary** Route Option C is the preferred route from a landscape and visual perspective due to both it's alignment with existing infrastructure the absence of sensitive receptors within the proposed search corridor. Existing transmission lines branching north from Gretna substation, and the existing Solwaybank Wind Farm are located close by this Route Option C, which would potentially lower the sensitivity to the proposed grid connection. A lower concentration of residential properties and greater separation distanced available within Option C would aid in locating the proposed grid connection away from sensitive residential receptors.	
Hydrology, Geology and Soils	**Geology** <u>Bedrock Geology</u> Geology in the area is complex with formations of rocks from the Sherwood Sandstone Group, Yoredale Group, Inverclyde Group, Pennine Upper Coal Group, Riccarton Group and Cumbrian Coast Group. The central and southern parts of the Study Area are underlain by rocks from the St Bees Sandstone Member, a fine to medium grained sandstone formation of the Sherwood Sandstone Group of Triassic age. The central part of the Study Area has a band of Eden Shales Formation, composed of red shale and mudstones from the Cumbrian Coast Group, of Permian age. A band of Pennine Upper Coal stretches east from the central section of the Study Area, consisting of interbedded grey mudstone, siltstone and sandstone, commonly with coal seams of the Pennine Coal Measures Group from the Carboniferous period. The north-western part of the Study Area comprises mudstone, sandstone and limestone rocks from the Tyne Limestone Formation and broader Yoredale Group. These are Carboniferous in age. The northern part of the Study Area has several formations of sandstone, siltstone and limestone from the Ballagan Formation. These rocks are also Carboniferous in age and belong to the Inverclyde Group. The north-east of the Study Area consists of greywackes with interbedded mudstones from the Riccarton Group of Silurian age, and form the oldest bedrock within the Study Area. Several fault lines are mapped within the Study Area. **Superficial Geology** Superficial deposits within the Study Area are predominantly glacial till of Devensian age, comprising a mixture of clay, sand and boulders of variable size and shape. There are small deposits of glacial sand and gravel and alluvium within the Study Area. These are generally confined to valleys and watercourse channels, indicated by the elongated form. They are characterised by sediments of mud, sand and gravel with some peat in places. Areas of peat are mapped across the Study Area. These are generally associated with lower lying ground and natural hollows where peat has had a chance to accumulate. Parts of the Study Area are without mapped deposits – these usually indicate areas with steeper slopes.	

Topic	Study Area	
	Mining Several mines and quarries are mapped within the Study Area and in the wider search area. Most of these are mapped as quarries which are now ceased. The central and southern parts of the Study Area are located within a Coal Mining Reporting Area. Special Designations Special designations with relevance to Hydrology, Geology and Soils within the Study Area include: • Bell's Flow SSSI – Biological: lowland raised bog. • Raeburn Flow SSSI and SAC – Biological: lowland raised bog Special designations with relevance to Hydrology, Geology and Soils within 5 km of the Study Area are: • Langholm - Newcastleton Hills SPA and SSSI – Mixed: Geology, upland and breeding birds, upland habitats and woodland. • Solway Firth SAC, SSSI and SPA – Mixed: estuarine, intertidal and coastal habitats, fish species, bird species, coastal geomorphology, mineralogy and stratigraphy. **Soils** According to the 1:250,000 National Soil Map of Scotland, the soils within the Study Area are characterised by brown forest soils, peaty podzols, peaty gleys, blanket peat and organic soils. Brown forest soils form the dominant soil type across much of the Study Area, particularly in the south and west. Peaty gleys and podzols are mapped in the northern parts of the Study Area. Blanket and basin peats are concentrated within the eastern part of the Study Area plus mapped pockets of organic soil. Basin and blanket peats are the most environmentally sensitive soil types present. NatureScot's Carbon and Peatland Map indicates the presence of peatland Classes 1, 3, 4, 5 and 0. Class 1 peatland is described as 'nationally important carbon-rich soils, deep peat and priority peatland habitat and likely to be of high conservation value.' Several areas of Class 1 peatland are mapped within the central parts of the Study Area. Most of the Study Area is mapped as Class 0, described as 'mineral soils where peatland habitats are not typically found'. These coincide with soil mapping where brown forest soils are present. Parts of the central and eastern areas are mapped as Class 3 peatland, described as 'dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type. Occasional peatland habitats can be found. Most soils are carbon-rich soils, with some areas of deep peat'. Smaller sections within the Study Area are mapped as Classes 4 and 5 peatland. Class 4 is described as 'predominantly mineral soil with some peat soil'. Class 5 is described as 'no peatland habitat recorded. May also include areas of bare soil. Soils are carbon-rich and deep peat'. **Hydrogeology** The central part of the Study Area is predominantly underlain by moderately productive aquifers. A section in the north of the Study Area is underlain by low productivity aquifers. The southern part of the Study Area is underlain by a highly productive aquifer. These include: • Yoredale Group – Moderately productive multi-layered aquifer with local supplies from sandstones and limestones. • Borders Group – Moderately productive aquifer. Multi-layered aquifer with variable yields up to 6 l/s. • Inverclyde Group – Moderately productive aquifer. Multi-layered aquifer with fracture flow yielding up to 10 l/s. • Pennine Upper Coal Measures Formation – Moderately productive regional, cyclic multi-layered aquifer with moderate yields from sandstones and many springs. Mine water quality poor but elsewhere reasonable. • Riccarton Group – low productivity aquifer. Highly indurated greywackes with limited groundwater in near surface weathered zone and secondary fractures.	

Topic	Study Area	
	• Unnamed Extrusive Dinantian Rocks – Low productivity aquifer. Flow is through fractures and discontinuities with small amounts of groundwater in near surface weathered zone and secondary fractures. • Permian rocks (undifferentiated) – band of rocks with essentially no groundwater separating Permian and Triassic sandstones. • Triassic rocks (undifferentiated) – Highly productive aquifer. Principal sandstone aquifer up to 600 m thick and yielding up to 125 l/s. Quality good but hard and becomes saline beneath confining Mercia Mudstone. The largest aquifer in the region is the Yoredale Group, although the Triassic rocks (Sherwood Sandstone) is the most productive. **Hydrology** <u>Watercourses</u> The main watercourses in the area are the River Esk, the River Sark, the Kirtle Water and the River Annan. The River Esk catchment serves the eastern parts of the Study Area. Three main tributaries drain the north-east and east of the Study Area: the Wauchope Water, Irvine Burn and Boughlin Burn. The River Esk joins the inland, eastern end of the Solway Firth south-east of Gretna. The River Sark catchment serves the central eastern part of the Study Area. Several tributaries including the Woodside Burn, Palling Burn and Hall Burn combine in the central region of the Study Area and form the headwaters to the River Sark. The River Sark joins the Solway Firth immediately south of Gretna. The Kirtle Water catchment serves the central, western and northern parts of the Study Area. Several named and unnamed tributaries drain south of Winterhope Reservoir before combining to form the Kirtle Water. The Kirtle Water flows south-west then south-east before joining the Solway Firth immediately south-west of Gretna. The River Annan serves the western boundary of the Study Area. The Mein Water is the main tributary draining this part of the Study Area, flowing south-west before joining the River Annan. The River Annan drains into the Solway Firth south of Annan. **Flood Risk** SEPA's Flood Map (2025) indicates that there are some areas of flood risk within the Study Area. Flood risk is mostly restricted to small watercourse and river channels, notably around the discharge points to the Solway Firth, which in turn has a high likelihood of coastal flooding. Surface water flooding is largely confined to the small watercourse channels within the Study Area.	
Land Use and Infrastructure	Using the LCA capability for Agriculture 250k map, the study area is comprised mainly of the following land grades: • 3.2 • 4.1 • 4.2 • 6.3 • 5.2 • 5.3 • 5.1 They key for the map is shown below:	

Topic	Study Area	

	Class 1 - Land capable of producing a very wide range of crops
	Class 2 - Land capable of producing a wide range of crops
	Class 3.1 - Land capable of producing consistently high yields of a narrow range of crops and/ or moderate yields of a wider range. Short grass leys are common
	Class 3.2 - Land capable of average production though high yields of barley, oats and grass can be obtained. Grass leys are common
	Class 4.1 - Land capable of producing a narrow range of crops, primarily grassland with short arable breaks of forage crops and cereal
	Class 4.2 - Land capable of producing a narrow range of crops, primarily on grassland with short arable breaks of forage crops
	Class 5.1 - Land capable of use as improved grassland. Few problems with pasture establishment and maintenance and potential high yields
	Class 5.2 - Land capable of use as improved grassland. Few problems with pasture establishment but may be difficult to maintain
	Class 5.3 - Land capable of use as improved grassland. Pasture deteriorates quickly
	Class 6.1 - Land capable of use as rough grazings with a high proportion of palatable plants
	Class 6.2 - Land capable of use as rough grazings with moderate quality plants
	Class 6.3 - Land capable of use as rough grazings with low quality plants
	Class 7 - Land of very limited agricultural value
	Urban

Figure 7.2 shows the land capability classification for agriculture (published by the Scottish Government) across the study area.

Wind farms

The boundaries of the following wind farms in the study area which are either in planning, consented or built are shown on **Figure 4.3.**

Built

Minsca Wind Farm

Solwaybank Wind Farm

In Planning

Bloch Wind Farm

Callisterhall Wind Farm

Loganhead Wind Farm

Cables and Overhead Lines

Electricity infrastructure within the Study Area include. These include:

- HV Overhead Line (132kV)
- Transmission Overhead Line (400kV)

Topic	Study Area	
	• 33kV Overhead Lines • 11kV Overhead Lines **Roads** The route options are intersected by regional and local roads. The main roads in the study area are the B6357, which is adjoined by the B720 and B706B, which in turn is adjoined by the B722 and B725. There are a number of local roads intersecting each route option.. **Housing Allocations, Planning Designations and Settlement Distribution** The study area is dotted with residential properties and there are a number of small settlements present. There are no urban settlements within the study area. All routeing options contain scattered residential properties.	
Forestry	The study area contains commercial forestry, primarily in the central corridor classed as Option C Native woodland lies to the southern borders of Options A, B & C Within the forested area commercial harvesting operations appear to have been undertaken with restocking of these areas now beginning to establish New woodland creation also appears to have been undertaken recently in Option B & D	
Recreation, Amenity and Tourism	There are a number of core paths within the study area: • Separate sections of the Mouldy Hill to Outer Hill core path are present in the east • Barnglieshead to Callisterhall in the centre of the study area, adjoins the B7068 • Errolston to Springfield core path crosses slightly into the study areas southern boundary • Springkell to The Forest and Eaglefield to Kirkconnel Church in the west • Almanside to Tinnishall in the south west The study area is relatively sparse in terms of recreation and leisure facilities and activities. National Cycle network route number 7 is located south of Gretna substation close to the border, not affecting any of the routes.	
Traffic and Transport	All route options under consideration start and end at the same two points, namely the Gretna Substation collector point and the Callisterhall Wind Farm POC. There are number of existing minor roads and tracks that cross the proposed route options and the Solwaybank Wind Farm and existing forestry tracks that crosses Route Option C. General topography and land use have been considered for routes to gain access to construct the OHL.	

APPENDIX 3 HOLFORD RULES[3]

Appendix 1 : The Holford Rules

The Holford Rules for the Routeing of New High Voltage Overhead Transmission Lines

It is generally accepted across the electricity industry that the guidelines developed by the late Lord Holford in 1959 for routeing overhead transmission lines, 'The Holford Rules', should continue to be employed as the basis for routeing high voltage overhead transmission lines. The Holford Rules were reviewed circa 1992 by the National Grid Company (NGC) Plc. (now National Grid Transmission (NGT)) as owner and operator of the electricity transmission network in England and Wales, with notes of clarification added to update the Rules.

A subsequent review of the Holford Rules (and NGC clarification notes) was undertaken by Scottish Hydro Electric Transmission Limited (SHETL) in 2003 to reflect Scottish circumstances. The principles of these guidelines for the routeing of new high voltage overhead transmission lines, with the NGC 1992 and SHETL 2003 notes have been considered within this Strategic Environmental Review. The Holford Rules are detailed below.

Rule 1

Avoid altogether, if possible, the major areas of highest amenity value, by so planning the general route of the line in the first place, even if the total mileage is somewhat increased in consequence.

Note on Rule 1

(a) Investigate the possibility of alternative routes, avoiding altogether, if possible major areas of highest amenity value. The consideration of alternative routes must be an integral feature of environmental statements. If there is an existing transmission line through a major area of highest amenity value and the surrounding land use has to some extent adjusted to its presence, particularly in the case of commercial forestry, then effect of remaining on this route must be considered in terms of the effect of a new route avoiding the area.

(b) Areas of highest amenity value require to be established on a project-by-project basis considering Schedule 9 to The Electricity Act 1989, Scottish Planning Policies, National Planning Policy Guidelines, Circulars and Planning Advice Notes and the spatial extent of areas identified.

Examples of areas of highest amenity value which should be considered are:

- Special Area of Conservation (NPPG 14)
- Special Protection Area (NPPG 14)
- Ramsar Site (NPPG 14)
- National Scenic Areas (NPPG 14)
- National Parks (NPPG 14)
- National Nature Reserves (NPPG 14)
- Protected Coastal Zone Designations (NPPG 13)
- Sites of Special Scientific Interest (SSSI) (NPPG 14)
- Schedule of Ancient Monuments (NPPG 5)
- Listed Buildings (NPPG 18)
- Conservation Areas (NPPG 18)
- World Heritage Sites (a non-statutory designation) (NPPG 18)
- Historic Gardens and Designed Landscapes (a non-statutory designation) (NPPG 18)

Rule 2

Avoid smaller areas of high amenity value, or scientific interest by deviation; provided that this can be done without using too many angle towers, i.e. the more massive structures which are used when lines change direction.

Note on Rule 2

(c) Small areas of highest amenity value not included in Rule 1 as a result of their spatialextent should be identified along with other areas of regional or local high amenity value identified from development plans.

(d) Impacts on the setting of historic buildings and other cultural heritage features should be minimised.

(e) If there is an existing transmission line through an area of high amenity value and the surrounding landuses

have to some extent adjusted to its presence, particularly in the case of commercial forestry, then the effect of remaining on this line must be considered in terms of the effect of a new route deviating around the area.

Rule 3

Other things being equal, choose the most direct line, with no sharp changes of direction and thus with few angle towers.

Note on Rule 3

(a) Where possible choose inconspicuous locations for angle towers, terminal towers and sealing end compounds.

(b) Too few angles on flat landscape can also lead to visual intrusion through very long straight lines of towers, particularly when seen nearly along the line.

Rule 4

Choose tree and hill backgrounds in preference to sky backgrounds, wherever possible; and when the line has to cross a ridge, secure this opaque background as long as possible and cross obliquely when a dip in the ridge provides an opportunity. Where it does not, cross directly, preferably between belts of trees.

Rule 5

Prefer moderately open valleys with woods where the apparent height of towers will be reduced, and views of the line will be broken by trees.

Notes on Rules 4 and 5

(a) Utilise background and foreground features to reduce the apparent height and domination of towers from main viewpoints.

(b) Minimise the exposure of numbers of towers on prominent ridges and skylines.

(c) Where possible follow open space and run alongside, not through woodland or commercial forestry, and consider opportunities for skirting edges of copses and woods. Where there is no reasonable alternative to cutting through woodland or commercial forestry, the Forestry Commission Guidelines should be followed (Forest Landscape Design Guidelines, second edition, The Forestry Commission 1994 and Forest Design Planning – A Guide to Good Practice, Simon Bell/The Forest Authority 1998).

(d) Protect existing vegetation, including woodland and hedgerows, and safeguard visual and ecological links with the surrounding landscape.

Rule 6

In country which is flat and sparsely planted, keep the high voltage lines as far as possible independent of smaller lines, converging routes, distribution poles and other masts, wires and cables, so as to avoid a concatenation or 'wirescape'.

Note on Rule 6

(a) In all locations minimise confusing appearance.

(b) Arrange wherever practicable that parallel or closely related routes are planned with tower types, spans and conductors forming a coherent appearance. Where routes need to diverge allow, where practicable, sufficient separation to limit the impacts on properties and features between lines.

Rule 7

Approach urban areas through industrial zones, where they exist; and when pleasant residential and recreational land intervenes between the approach line and the substation, go carefully into the comparative costs of undergrounding, for lines other than those of the highest voltage.

Note on Rule 7

(a) When a line needs to pass through a development area, route it so as to minimise as far as possible the effect on development.

(b) Alignments should be chosen after consideration of impacts on the amenity of existing development and on proposals for new development.

(c) When siting substations take account of the impacts of the terminal towers and line connections that will need to be made and take advantage of screening features such as ground form and vegetation.

[3] Taken from Appendix 1 of: SP Energy Networks. 2015. *Major Electrical Infrastructure Projects: Approach to Routeing and Environmental Impact Assessment*.

Explanatory Note on Rule 7

The assumption made in Rule 7 is that the highest voltage line is overhead.

Supplementary Notes

(a) Residential Areas Avoid routeing close to residential areas as far as possible on grounds of general amenity.

(b) Designations of Regional and Local Importance Where possible choose routes which cause the least disturbance to Areas of Great Landscape Value and other similar designations of Regional or Local Importance.

(c) Alternative Lattice Steel Tower Designs

In addition to adopting appropriate routeing, evaluate where appropriate the use of alternative lattice steel tower designs available where these would be advantageous visually, and where the extra cost can be justified. [Note: SHETL have reviewed the visual and landscape arguments for the use of lattice steel towers in Scotland and summarised these in a document entitled Overhead Transmission Line Tower Study 2004].

Further Notes on Clarification to The Holford Rules

Line Routeing and People

The Holford Rules focused on landscape amenity issues for the most part. However, line routeing practice has given greater importance to people, residential areas etc.

The following notes are intended to reflect this.

(a) Avoid routeing close to residential areas as far as possible on grounds of general amenity.

(b) In rural areas avoid as far as possible dominating isolated house, farms or other small-scale settlements.

(c) Minimise the visual effect perceived by users of roads, and public rights of way, paying particular attention to the effects of recreational, tourist and other well used routes.

Supplementary Notes on the Siting of Substations

(a) Respect areas of high amenity value (see Rule 1) and take advantage of the containment of natural features such as woodland, fitting in with the landscape character of the area.

(b) Take advantage of ground form with the appropriate use of site layout and levels to avoid intrusion into surrounding areas.

(c) Use space effectively to limit the area required for development, minimizing the impacts on existing land use and rights of way.

(d) Alternative designs of substation may also be considered, e.g. 'enclosed', rather than 'open', where additional cost can be justified.

(e) Consider the relationship of tower and substation structures with background and foreground features, to reduce the prominence of structures from main viewpoints.

(f) When siting substations take account of the impacts of line connections that will need to be made.

APPENDIX 4: FIGURES