Scottish & Southern Electricity Networks

TRANSMISSION

Consultation Document – Substation Site Selection and Alignment Selection

Project: Foyers Substation Upgrade

REF: LT243

Scottish & Southern Electricity Networks

TRANSMISSION

CONTENTS

GLOSSARY

Term	Definition
Alignment	A centre line of an overhead line OHL, along with location of key angle structures.
Amenity	The natural environment, cultural heritage, landscape and visual quality. Also includes the impact of SSEN Transmission's works on communities, such as the effects of noise and disturbance from construction activities.
Ancient Woodland	In Scotland, Ancient Woodland are areas of woodland that have existed since 1750 and are relatively undisturbed by human development. They are considered irreplaceable and have complex biodiversity that have accumulated over hundreds of years.
Birds of Conservation Concern	Birds of Conservation Concern (BoCC) provides the status of all regularly occurring birds in the UK, Channel Islands and Isle of Man. The current version is BoCC 5. Birds of highest conservation concern will appear on the Red List.
Class 1 and Class 2 Peatland	Class 1 – Nationally important carbon-rich soils, deep peat and priority peatland habitat. Areas likely to be of high conservation value. Class 2 – Nationally important carbon-rich soils, deep peat and priority peatland habitat. Areas of potentially high conservation value and restoration potential.
Consultation	The dynamic process of dialogue between individuals or groups, based on a genuine exchange of views and, normally, with the objective of influencing decisions, policies or programmes of action.
Corridor	A linear area which allows a continuous connection between the defined connection points. The corridor may vary in width along its length; in unconstrained areas it may be many kilometres wide.
Drinking Water Protected Areas	The water in ditches, streams, lochs and possibly groundwater in these areas is protected and likely to be taken to Water Treatment works, where it is treated and provided to the public as drinking water.
Effect	The direct or indirect physical consequence(s) of the proposed option on receptors, under each of the various topic headings.
Electricity System Operator (ESO)	The Electricity System Operator (ESO) performs several important functions; from second-by-second balancing of electricity supply and demand, to developing markets and advising on network investments.
Environmental Impact Assessment (EIA)	Environmental Impact Assessment. A formal process codified by EU directive 2011/92/EU, and subsequently amended by Directive 2014/52/EU. The national regulations are set out in The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. The EIA process is set out in Regulation 4(1) of the regulations and includes the preparation of an EIA Report by the developer to systematically identify, predict, assess and report on the likely significant environmental impacts of a proposed project or development.
Gardens and Designed Landscapes (GDLs)	The Inventory of Gardens and Designed Landscapes lists those gardens or designed landscapes which are considered by a panel of experts to be of national importance.
Gigawatt (GW)	One billion watts.
Ground Water Dependent Terrestrial Ecosystem (GWDTE)	Wetlands which critically depend on groundwater flows. They are safeguarded by the Water Framework Directive (WFD) and are sensitive to hydrological and ecological changes.
Habitat	Term most accurately meaning the place in which a species lives, but also used to describe plant communities or agglomerations of plant communities.
High Voltage Direct Current (HVDC)	A high voltage, direct current (HVDC) electric power transmission system uses direct current for electric power transmission, in contrast to the more common alternating current systems. Most HVDC links use voltages between 100 kV and 800 kV.
Kilovolt (kV)	One thousand volts.

Term	Definition
Landscape Character Type (LCT)	A distinct, recognisable and consistent pattern of elements in a landscape that differentiate the area from another.
Level of Impact	The outcome of a comparative appraisal of the combination of effects within a specific topic for a specific option after a consideration of the potential for mitigation, using professional judgement based on experience.
Listed Building	Building included on the list of buildings of special architectural or historic interest and afforded statutory protection under the 'Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997' and other planning legislation. Classified categories A – C.
Local Nature Reserve	Areas of natural heritage that are locally important.
Micrositing	The process of positioning individual structures to avoid localised environmental or technical constraints.
Mitigation	Term used to indicate avoidance, remediation or alleviation of adverse impacts.
National Nature Reserve	Areas of natural heritage that are nationally important.
National Scenic Area (NSA)	A national level designation applied to those landscapes considered to be of exceptional scenic value.
Network Options Assessment (NOA)	The National Grid's Network Options Assessment (NOA) provides their recommendation for which network reinforcement projects should receive investment, and when.
Outage	A period when a power supply is unavailable.
Overhead line (OHL)	An electric line installed above ground, usually supported by lattice steel towers or poles.
Plantation Woodland	Woodland of any age that obviously originated from planting.
RAG Rating	A Red, Amber, Green rating provided to assess the potential impact of the proposed options.
Route	A linear area of approximately 1 km width (although this may be narrower/wider in specific locations in response to identified pinch points / constraints), which provides a continuous connection between defined connection points.
Routeing	The work undertaken which leads to the selection of a Proposed Alignment, capable of being taken forward into the consenting process under Section 37 of the Electricity Act 1989.
Schedule 1 Species	Birds listed on the Schedule 1 of the Wildlife & Countryside Act 1981, of which it is an offence to intentionally or recklessly disturb at, on or near an 'active' nest.
Scheduled Monument	A monument which has been scheduled by the Scottish Ministers as being of national importance under the terms of the 'Ancient Monuments and Archaeological Areas Act 1979'.
Semi-natural Woodland	Woodland that does not obviously originate from planting. The distribution of species will generally reflect the variations in the site and the soil. Planted trees must account for less than 30% of the canopy composition.
Sites of Special Scientific Interest (SSSI)	Areas of national importance. The aim of the SSSI network is to maintain an adequate representation of all natural and semi-natural habitats and native species across Britain.
Special Area of Conservation (SAC)	An area designated under the EC Habitats Directive to ensure that rare, endangered or vulnerable habitats or species of community interest are either maintained at or restored to a favourable conservation status.
Special Landscape Area (SLA)	Landscapes designated by councils, which are considered to be of regional/local importance for their scenic qualities.
Special Protection Area (SPA)	An area designated under the Wild Birds Directive (Directive74/409/EEC) to protect important bird habitats. Implemented under the Wildlife and Countryside Act 1981.
Stakeholders	Organisations and individuals who can affect or are affected by SSEN Transmission works.

Term	Definition
Study Area	The area within which the corridor, route, alignment and / or site study takes place.
The National Grid	The electricity transmission network in the Great Britain.
Volts	The international unit of electric potential and electromotive force.
Wild Land Area (WLA)	Those areas comprising the greatest and most extensive areas of wild characteristics within Scotland.

PREFACE

This Consultation Document has been prepared by WSP UK Ltd. on behalf of Scottish and Southern Electricity Networks Transmission (SSEN Transmission), operating under licence held by Scottish Hydro Electric Transmission plc to seek comments from all interested parties on the preferred Site Option for the creation of a new transformer compound, switching station extension, and preferred alignment for the 275kV underground cable connection in between Foyers Power Station and Switching Station. The Consultation Document is available online at the project website: https://www.ssen-transmission.co.uk/projects/foyers-substation-extension/

Over the coming months SSEN Transmission will be actively engaging with Statutory Consultees and stakeholders to further understand constraints and identify potential opportunities. A public consultation event detailing the proposals described in this document will be held at the following time:

Wednesday 19th October from 2-7pm in Stratherrick Public Hall, Gorthleck, Inverness, IV2 6YS.

Comments on this Consultation Document should be sent to:

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All comments are requested by **Friday 18th November 2022.**

EXECUTIVE SUMMARY

This project involves the replacement of degrading transformers at the existing Foyers Pumped Storage Hydro Power Station, an extension of the existing Switching Station to the north of the Foyers Power Station, and replacement of approximately 600 m of 275 kV Underground Cable to connect the two.

The Proposed Development is in line with SSEN Transmission's commitment and licence obligation to facilitate the connection of renewables generators to the grid through an economical, efficient and coordinated approach to transmission reinforcement.

Substation, Switching Station, and Cable Alignment options were identified, which provided feasible areas for the options to be developed. From this, Preferred Options and a Preferred Alignment have been selected that provide an optimum balance of environmental, technical and economic factors. This Consultation Document invites comments from all interested parties on the Preferred Options and Alignment.

Moving forward, confirmation of the Preferred Site Options and Alignment will be informed by this consultation exercise and through detailed surveys, which are ongoing, that may identify any as yet unknown engineering, environmental or land use constraints. Subject to the outcome of the consultation, the Preferred Options will be referred to as the Proposed Options. On identification of the Proposed Substation and Switching Station Options, a planning application will be submitted under the Town and Country Planning (Scotland) Act 1997 (as amended).

When providing comments and feedback on this Consultation Document, SSEN Transmission would be grateful for your consideration of the questions below:

- Have we explained the need for this Project adequately?
- Have we explained the approach taken to select the Preferred Sites and Alignment adequately?
- Are there any factors, or environmental features, that you consider may have been overlooked during the Preferred Sites and Alignment selection process?
- Do you feel, on balance, that the Preferred Sites and Alignment selected is the most appropriate for further consideration at the environmental assessment stage?

1. INTRODUCTION

1.1 Purpose of the Document

This Site Option and alignment Consultation Document has been prepared by WSP UK Ltd on behalf of Scottish and Southern Electricity Networks Transmission (SSEN Transmission). SSEN Transmission, operating under licence held by Scottish Hydro Electric Transmission plc, owns, operates and develops the high voltage electricity transmission system in the north of Scotland and remote islands. SSEN Transmission is a wholly owned subsidiary of the SSE plc group of companies. This Consultation Document invites comments from all interested parties on the preferred Site Option for the creation of a new transformer compound, switching station extension, and preferred alignment option for the 275kV underground cable connection in between Foyers Power Station and Switching Station.

This Consultation Document describes the Underground Cable (UGC) alignment options identified, the options appraisal undertaken, the alternatives considered during the selection of Site Options for the new transformer compound and switching station extension and the preferred alignment for the 275kV UGC. Comments are now sought from statutory authorities, key stakeholders, elected representatives and the public on the Site Option and Alignment Option process and the Preferred Site Option and Alignment identified.

All comments received will inform further consideration of the Preferred Site Option and Preferred Alignment Option.

1.2 Document Structure

This report is comprised of seven sections as follows:

1: Introduction – setting out the purpose of the Consultation Document and document structure.

2: The Proposals – describes the need for the proposals, the strategic alternatives considered, the proposed technology solution, a description of the proposals and the typical construction methods.

3: Site selection and alignment selection process – sets out the Site Option and alignment selection process and methodology that has been applied to date to derive the preferred Option and Alignment.

4: Potential Site Options and Alignment Option – summarises the potential options.

5: Comparative Analysis of Potential Site Options and Alignment Option – summarises the key considerations of each Site Option and alignment option from an environmental, engineering and economic perspective, and provides a comparative appraisal of each option in order to select a Preferred Site Option and Alignment.

6: Preferred Site Option and Alignment – summarises the overall Preferred Site Option and Alignment.

7: Consultation on the Proposals – invites comments on the Site Option and Alignment Option assessment process and identification of the Preferred Site Option and Alignment.

1.3 Next Steps

As part of the consultation exercise, comments are sought from members of the public, statutory consultees and other key stakeholders on the Preferred Site Alignment option put forward in this report.

A Report on Consultation will be produced which will document the consultations received, and the decisions made in light of these responses.

Once preferred options have been confirmed, these will become the proposed options taken forward to EIA Screening and Scoping.

2. THE PROPOSALS

2.1 The Need for the Project

Foyers 275/18kV substation (built in 1975) facilitates the connection of the SSE Generation Foyers Pumped Storage Hydro scheme to the transmission network. This scheme has a capacity of 300MW and connects two 150MVA pumped storage units to Foyers 275kV Switching Station via a single 275kV oil filled cable circuit. Foyers Switching Station is connected to Knocknagael 275kV Substation via a double circuit 275kV overhead line.

The Foyers Pumped Hydro Scheme provides generation and demand services to the National Grid Electricity System Operator (NGESO) and no increase in capacity is anticipated. The substation is currently the only pumped storage connection on SSEN Transmission's network and therefore plays a pivotal role in NGESO's Great Britain wide 'Restoration Services'[1].

Located within Foyers Power Station, are two 18/275kV Generation Transformers (GTs), which are banked together and directly connected to the sealing end of the single 275kV oil filled cable. The banked connection is an unusual arrangement and is used to interconnect the two systems, which in itself introduces risk to not only the Restoration Services, but also to the routine provision of power to the UK grid.

Due to the layout of the substation, the GTs are very confined and do not meet current standards in terms of adequate fire damage zones, oil containment, operability and maintenance access. The condition of GT2 (manufactured in 1982) is advanced in its degradation both internally and externally. In addition, as the transformers are installed at the Power Station and not within the Foyers 275kV switching substation compound, ownership boundaries and the continued use of shared facilities with SSE Generation, is also a consideration of this project.

The oil filled 275kV cable connection between Foyers Power Station and Foyers 275kV Switching Station is the last 275kV oil filled cable circuit in operation in the network, following a long-term strategy of replacement over the years. The Power Station was originally connected via a single transformer, however when one of the windings failed this was replaced with a separate unit, which was installed over the 275kV cable route. This leads to the arrangement we have today with the two GTs providing the necessary total capacity for the Power Station, and GT2 located over the top of the cable as it enters the site.

Due to the unusual arrangement of GT2, and the existing cable arrangement, any works on either GT or the circuit connecting the Power Station necessitates a whole station outage. Therefore there is an opportunity to minimise longer term disruption and provide a net benefit to the NGESO Restoration Services, via the replacement of both GTs and the installation of two new cable circuits.

2.2 Project Overview

The following elements are included as a part of the Proposed Development:

- Two new GTs, within a transformer compound. This is likely to accommodate all temporary construction areas and tracks, as well as the permanent (operational) site.
- A Switching Station Extension (including provision for a future 275kV connection).
- A new UGC connection between the new transformer compound, and Switching Station extension.

[1] The process used to restore power in the event of total or partial shutdown of the national electricity transmission system. https://www.nationalgrideso.com/balancing-services/system-security-services/restoration-services

- A new UGC connection between the new transformer compound and existing Foyers Power Station.
- Landscaping and biodiversity requirements.
- Permanent access to the site dependent on the Site Option chosen.

2.3 Construction Activities

To facilitate the Proposed Development, the main construction elements associated with the development are anticipated to include:

- establishment of a temporary construction compound and any temporary access track construction;
- establishment of suitable laydown areas for materials;
- ground works to achieve a level area at the site;
- delivery of components and materials to site;
- construction of retaining walls around the proposed transformer compound;
- construction of the substation, switching station extension, and new underground cables connecting to the transformers to the switching station (275kV UGC) and transformers to power station (18kV UGC);
- construction of a control building;
- decommissioning and removal of existing Foyers Power Station 275kV apparatus (transformers, plant, cables etc);
- remedial works to reinstate the immediate vicinity, and any ground disturbed to pre-existing condition;
- landscaping; and
- inspections and commissioning.

2.4 Programme

The current programme for the Proposed Development is for submission of a planning application in May 2023, with construction commencing May 2024 and construction complete in April 2026.

3. SITE SELECTION AND ALIGNMENT SELECTION PROCESS

3.1 Introduction

The approach to site selection was informed by SSEN Transmission's guidance on 'Substation Site Selection Procedures for Voltages at or above 132kV' (November 2020[2]). The guidance sets out the approach to identification and selection of new substation sites. The guidelines are developed based on Holford Rules principles, industry best practice, and lessons learned.

The approach to alignment selection was primarily informed by SSEN Transmission's guidance on 'Procedures for Routeing Overhead Lines and Underground Cables of 132 kV or above, SSEN Transmission, 2020 (PR-NET-ENV-501)'[3].

Both these documents help SSEN Transmission to meet its obligations under Schedule 9 of the Electricity Act 1989, which requires transmission license holders:

- to have a 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 interests; and
- to do what they reasonably can to mitigate any effect that the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects.

The guidance for both site selection and alignment selection aim to balance environmental considerations with technical and economic considerations throughout both processes.

The Site Selection guidance splits a project into the following stages:

- Stage 0: Pre-Site Selection Activities – Strategic Connections Options Appraisal
- Stage 1: Initial Site Screening
- Stage 2: Detailed Site Selection
- Post Site Selection Activities – Consenting Process

The Routeing Selection guidance splits a project into the following stages:

- Pre-Routeing Activities: Selection of proposed connection option;
- Stage 1: Corridor Selection;
- Stage 2: Route Selection;
- Stage 3: Alignment Selection; and
- Stage 4: EIA and consenting

The Proposed Development is currently at Stage 2: Detailed Site Selection, and Stage 3: Alignment Selection. A condensed Stage 1: Initial Site Screening was carried out for the Substation element of Foyers Substation Upgrade (further detail provided in Section 3.2.). The Switching Station element of the project was not applicable for Stage 1: Initial Site Screening as options to extend surrounding the existing Switching Station were very limited technically and topographically. Additionally, the UGC element of the project has started with Stage 3: Alignment Selection, due to its short length and limited space to lay the cable.

In consideration of the principles outlined in both guidance documents, the method of identifying a preferred Substation and Switching Station extension site, and UGC alignment has involved the following four key tasks:

[2] SSEN Transmissions (2020) Substation Site Selection Procedures for Voltages at or above 132kV.

[3] Scottish & Southern Electricity Networks, 2020. PR-NET-ENV-501: Procedures for Routeing Overhead Lines and Underground Cables of 132 kV and above

- identification of the baseline situation;
- identification of Site Options/Alignment Options;
- analysis of Site Options/Alignment Options; and
- identification of Preferred Site Options/Alignment Options.

3.2 Methodology

3.2.1 Area of Search

Due to the nature of the project, the Area of Search was limited. The Area of Search was developed to encompass a range of feasible Site Options within close proximity to the existing Foyers Power Station, and existing Foyers Switching Station, as well as taking into account existing topographical, settlement and engineering constraints.

All initial option areas, apart from between the existing Foyers Power Station and Foyers Switching Station, were ruled out of consideration at an early stage. This is due to the unique nature of the Foyers Power Station electrical network connection which requires an extremely high generation capacity at 18kV. To achieve this type of connection the existing substation is connected to the Power Station generator via short, overhead connected, suitably rated IPB (Isolated Phase Busbars). To enable alternative site options to be considered in the vicinity of the Power Station, options to provide an extended 18kV connection have been considered as part of the Project remit. Due to topographical and engineering constraints, an overhead busbar option would not provide a practical solution, therefore an 18 kV UGC connection is required. To provide the required rating, the connection will require a large quantity of 18kV cables, to be routed from the Power Station to any potential site option. This will therefore require a robust pre-cast concrete trench (i.e. 1.5 m x 2.5 m concrete trough with lids that will require access). It is necessary to position the substation as close to the Power Station as possible to ensure this 18 kV cable length is as short as possible to keep electrical losses from the cable system as low as possible and to reduce environmental and economic impacts.

3.2.2 Baseline Conditions

A baseline desktop study has been carried out to identify a broad range of potential constraints and opportunities within the Area of Search, and its adjacent context. This has involved the following activities:

- Identification of environmental designated sites and other constraints, utilising GIS datasets available via the NatureScot Site Link[4] and Scotland's Environment webmap[5].
- Identification of archaeological designations and other recorded sites, utilising GIS datasets available via Historic Environment Scotland and the Historic Environment Record[6,7].
- Review of the Inner Moray Firth Local Development Plan (LDP) 2015 [8] and the Highland-wide Local Development Plan 2012[9], to identify further environmental constraints and opportunities, such as regional level designations or other locations important to the public.

[4] NatureScot. Site Link. [online] Available at: https://sitelink.nature.scot/home

[5] https://map.environment.gov.scot/sewebmap/. Accessed 24.06.22.

[6] Historic Environment Scotland Data Services. *Portal*. [online] Available at: http://portal.historicenvironment.scot/

[7] Royal Commission on Ancient and Historical Monuments of Scotland. *Canmore*. [online] Available at: http://canmore.rcahms.gov.uk/

[8] Inner Moray Firth Local Development Plan. Available at: https://www.highland.gov.uk/downloads/file/15008/adopted_inner_moray_firth_local_development_plan

[9] Highland-wide Local Development Plan. Available at: https://www.highland.gov.uk/info/178/local_and_statutory_development_plans/199/highland-wide_local_development_plan

- Review of landscape character assessments of relevance to the Area of Search[10].
- Review of Native Woodland Survey of Scotland and Ancient Woodland Inventory data sets[11].
- Review the Scotland's Soils National Scale Land Capability for Agriculture maps[12]
- Review of Ordnance Survey (OS) mapping (1:50,000 and 1:25,000 and online GIS data sources from OS OpenData) and aerial photography (where available) to identify other potential constraints such as settlement, properties, walking routes, cycling routes etc.
- Identification of core paths in The Highland Council area, utilising The Highland Council Interactive Map of Core Paths[13].
- Extrapolation of OS Vectormap GIS data to identify further environmental constraints including locations of watercourses and waterbodies, and roads classifications.
- Review of other local information through online and published media such as tourism sites i.e. Outdoor Highlands[14].

Site visits

Site Visits for all three elements of the project have been undertaken since April 2022, and are ongoing. These site visits have helped inform an opinion on how the potential environmental effects identified during the baseline studies, could influence potential substation site and UGC options.

3.2.3 *Site and Alignment Identification and Selection Methods*

In accordance with the steps outlined in SSEN Transmission's approach to Substation Site Selection and Procedures for Routeing Overhead Lines and Underground Cables of 132 kV or above (November 2020), and having regard to the Holford Rules principles, the following considerations have been taken into account as far as is practicable at this stage:

- respect areas of high amenity value and take advantage of the containment of natural features such as woodland, fitting in with the landscape character of the area;
- take advantage of ground form with the appropriate use of site layout and levels to avoid intrusion into surrounding areas;
- use space effectively to limit the area required for development, minimising the effects on existing land use and rights of way;
- alternative designs of Substations may also be considered, e.g. 'enclosed', rather than 'open', where additional cost can be justified;
- consider the relationship Substation structures with background and foreground features, to reduce the prominence of structures from main viewpoints; and
- when siting Substations take account of the effects of line connections that will need to be made.

In addition, principles of Biodiversity Net Gain (BNG) and the mitigation hierarchy have been considered to inform detailed site design decisions as the project progresses.

Stage 1 Initial Site Screening

[10] Scottish Natural Heritage. (2019). *Scottish Landscape Character Types Map and Descriptions* [online] Available at: https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions

[11] Available at data.gov.uk

[12] Scotland's Soils National Scale Land Capability for Agriculture map. Available at: https://soils.environment.gov.scot/maps/capability-maps/national-scale-land-capability-for-agriculture/

[13] The Highland Council, Core Paths Online Map Viewer. Available at: https://www.highland.gov.uk/info/1225/countryside_farming_and_wildlife/161/outdoor_access/4

[14] The Highland Council, Outdoor Highlands. Available at: https://www.highland.gov.uk/outdoorhighlands/

An Initial Site Screening desk-based exercise took place in April 2022, to consider possible positioning of an intermediate transformer compound between Foyers Power Station and Foyers Switching Station. Four positions were considered see **Figure 3.1** and an environmental appraisal was carried out for each option. As discussed, a Stage 1 Initial Site Screening was not considered to be necessary for the Switching Station extension as the options for site selection are limited to two, both of which are assessed in this Consultation Report.

Option 1 was considered the preferred option to take forward to Stage 2: Detailed Site Selection. This option proposes the offline construction of a new intermediate compound, 150 m north of Foyers Power Station, to house the 2 x 18/275 kV transformers. The new compound would also include a small control building to house the associated new transformer protection and control panels. A diesel generator and increased autonomy DC system would also be installed at the new intermediate compound. With this option it would be feasible to install two 18kV generator circuit breakers and a relatively short section of 18 kV cable circuit. This cable circuit would be implemented to connect the existing Foyers Power Station to the new intermediate compound, with 275 kV cable required to connect the new intermediate compound to Foyers 275 kV Switching Station.

Whilst the majority of RAG Ratings for each option rated similarly across the environmental topics, Option 1 was preferred over the other options due to slightly favourable Landscape impacts. All options were rated Red for Landscape Designations and Landscape Character, however the placement of Option 1 directly adjacent to the Power Station would contain development within one area. Furthermore, Option 1 sits lower on the slopes, whereas Options 3 and 4 have a more elevated position due to the steep nature of the landscape, and therefore would be more visible

3.2.4 Appraisal Method

A series of high-level appraisals of the Substation Site options and UGC Alignment options were carried out by experienced professionally qualified individuals in the various specialist fields to enable an informed combined opinion on how the potential environmental effects identified during the baseline studies could influence potential Substation Site options and UGC Alignment options.

Environmental Criteria for the Substation

Appraisal of the Substation Site options has involved systematic consideration against the following environmental topic areas:

- Natural Heritage[15] – designations, protected species, habitats (including BNG), ornithology, hydrology and geology.
- Cultural Heritage – designations and cultural heritage assets.
- Landscape and Visual – designations, landscape character and visual.
- Land Use – agriculture, forestry and woodland, and recreation.
- Planning – policy and proposals.

Appraisal of the UGC Alignment options has involved systematic consideration against the following environmental topic areas:

- Natural Heritage[16] – designations, protected species, habitats (including BNG), ornithology, hydrology and geology.
- Cultural Heritage – designations and cultural heritage assets.
- Landscape and Visual – designations, landscape character and visual.
- Land Use – agriculture, commercial forestry and recreation.
- Planning – policy and proposals.

[15] Ancient Woodland is assessed under Natural Heritage Designations and not within the Forestry and Woodland section.
[16] Ancient Woodland is assessed under Natural Heritage Designations and not within the Forestry section.

Engineering Criteria

Appraisal of the Substation Site Selection has involved systematic consideration against the following engineering topic areas:

- Connectivity – existing circuits / network, future development possibilities, interface with SSE Distribution and Generation and DNO Connection.
- Footprint Requirements – technology, adjacent land use and space availability.
- Hazards – unique hazards, railway interface and existing utilities.
- Ground Conditions – topography, geology – superficial deposits (peat) and geology – site testing to verify properties.
- Environmental conditions – elevation, salt pollution, flooding, carbon footprint, SF6, contaminated land and noise (proximity to dwellings/ residential properties).
- Construction access – access road and transformer delivery road.
- Construction Safety – customer access disruption during construction
- Operation and Maintenance – access.

Appraisal of the UGC Alignment Selection has involved systematic consideration against the following engineering topic areas:

- Infrastructure crossings – major crossings and road crossings.
- Environmental design – elevation, atmospheric pollution, contaminated land and flooding.
- Ground conditions – terrain, rock and peat.
- Construction / maintenance – access, angles of deviation and cable haul road.
- Proximity – clearance distance, windfarms, communication masts, urban environment and metallic pipelines.
- Design – reactive compensation and joint bays and link box chambers.

Economic Criteria

Appraisal of the Substation Site Selection has involved systematic consideration against the following economic topic areas:

- Capital – construction, diversions, public road improvements, felling, land assembly and consent mitigation.
- Operational – inspections and maintenance.

Appraisal of the UGC Alignment Selection has involved systematic consideration against the following economic topic areas:

- Capital – construction, diversions, public road improvements, felling, land assembly and consent mitigations.
- Operational – inspections and maintenance.

3.2.5 *Comparative Appraisal*

A Red-Amber-Green (RAG) rating has been applied to each topic area within each section, indicating potential impacts. This rating is based on a four-point scale as follows:

Table 3-1: RAG Ratings

Performance	Comparative Appraisal	
Most Preferred  **Least Preferred**	**Lower Impact**	Potentially minor effects, with little or no requirement for mitigation
	Moderate Impact	Potentially moderate effects subsequent to appropriate mitigation
	Higher Impact	Potentially major effects which may be difficult to mitigate

Using the terminology of SSEN Transmission's Routeing Guidance and the SSEN Substation Site Selection Guidance, the following definitions have been used:

Effect - the direct or indirect physical consequence(s) of the proposed alignment option on receptors, under each of the various topic headings.

Level of Impact - the outcome of a comparative appraisal of the combination of effects within a specific topic of Site Option or UGC Alignment option after a consideration of the potential for mitigation, using professional judgement based on experience.

4. POTENTIAL OPTIONS

This section of the report describes the options that have been appraised for each element of the project. **Figures 4.1 -4.3** show the Substation Site Options, with associated UGC options. **Figure 4.4** shows the Switching Station Extension site options.

4.1 Transformer Compound (Substation)

The Site Options (**Figures 4.1**) assessed are listed below (in order from north to south) and described in the following section:

- Site Option 1 – This option proposes the offline construction of a new intermediate compound, 150 m north of Foyers Power Station, to house the 2 x 18/275 kV transformers. The new compound would also include a small control building to house the associated new transformer protection and control panels. A diesel generator and increased autonomy DC system would also be installed at the new intermediate compound. With this option it would be feasible to install two 18kV generator circuit breakers and a relatively short section of 18 kV cable circuit. This cable circuit would be implemented to connect the existing Foyers Power Station to the new intermediate compound, with 275 kV cable required to connect the new intermediate compound to Foyers 275 kV Switching Station.
- Site Option 2 – This option assumes a 'like-for-like' replacement of current assets within the existing space, at Foyers Power Station two 18/275 kV transformers would be installed within the existing transformer compound location. The existing 275 kV cable circuit, which provides supply to the existing banked transformers, would be replaced with two separate 275kV circuits, connecting to Foyers Switching Station.
- Site Option 3 – This option proposes a hybrid solution of options 1 and 2. The option would involve offline construction of a new intermediate compound to house one 18/275 kV transformer, in an area 150 m north of Foyers Power Station. The new compound would also include a small Control building to house the associated new transformer protection and control panels. A diesel generator and increased autonomy DC system would also be installed at the new intermediate compound. Following removal of the existing GTs, a new 18/275 kV transformer would also be installed within the existing Power Station transformer compound. A single 18 kV cable circuit would be required to connect the existing Foyers Power Station to the new intermediate compound. 275 kV cable circuits will be required from Foyers 275 kV switching station to the new intermediate compound and the new GT within the existing Power Station transformer compound. A purpose built cable trough would be required for the 18 kV cable circuit, to house the quantity of cables per phase. The area of platform required to accommodate a single transformer is approximately 60% of the size of the Option 1 platform required to locate two transformers.

4.2 Switching Station Extension

The Site Options (**Figure 4.4**) assessed are listed below (in order from north to south) and described in the following section:

- Switching Station Option A – This option extends to the west, east and south of the existing switching station. Option A lies to the west of the B852, and borders a Core path to the east (Foyers Pier to Inverfarigaig by Loch-ness side).
- Switching Station Option B – This option extends to the west, east and north of the existing switching station. Option B lies to the west of the B852, and borders a Core path to the east (Foyers Pier to Inverfarigaig by Loch-ness side).

4.3 Cable Alignment

For each substation option, there are two possible cable alignment options (**Figures 4.2 and 4.3**) for the 275kV cable. For each substation option, the cable alignment has an option running to the north of the access road between the Switching Station and the Power Station, and one following the access road directly.

UGC alignment Options 1A and 1B run for approximately 600m connecting Site Options 1 and 3 to the existing Switching Station (due to the different size of the Site Options, the UGC Alignment Options would be slightly longer for Site Option 3 and slightly shorter for Site Option 1). UGC options 2A and 2B run for approximately 800m connecting Site Option 2 to the existing switching station. Both UGC Options 1A and 2A run across woodland parallel to the west of the Power Station access road, and both UGC Options 1B and 2B run under the existing access road.

5. COMPARATIVE ANALYSIS

5.1 Introduction

The following is a summary of the key considerations of each of the Substation site option, Switching station site option and UGC alignment options from an environmental, engineering and economic perspective. Additionally, the following section provides a comparative appraisal of each Substation Site option, Switching Station Site option and UGC Alignment options in order to select an overall Preferred Option. The following figures accompany the text in this section and illustrate potential environmental baseline constraints identified under each topic.

Figure 5.1 – Substation Option 1 with UGC Options 1A and 1B with Environmental Constraints

Figure 5.2 - Substation Option 2 with UGC Options 2A and 2B with Environmental Constraints

Figure 5.3 - Substation Option 3 with UGC Options 1A and 1B with Environmental Constraints

Figure 5.4 – Switching Station Options with Environmental Constraints

5.2 Substation Site Selection

Table 5-1 below shows a comparative analysis of Substation Options 1, 2 and 3. The table splits each option into the topics discussed in SSEN Transmission's 'SSEN Substation Site Selection Guidance'.

Table 5-1 – Comparative Analysis of Section 1 Substations

Topic	Substation Option 1	Substation Option 2	Substation Option 3
Environmental			
Natural Heritage	Option 1 is unlikely to affect the Ness Woods SAC qualifying interests, or the integrity of the Inverfarigaig SSSI. Option 1 would require removal of habitat listed as AWI ancient semi-natural woodland and NWSS woodland, and would have a direct impact on the integrity of these habitats.	Option 2 is unlikely to affect the Ness Woods SAC qualifying interests, or the integrity of the Inverfarigaig SSSI. Option 2 does not require the removal of ancient semi-natural woodland habitat. Option 2 is located within a Buglife B-Line and Butterfly Conservation Priority Landscape Great Glen and the Beauly	Option 3 is unlikely to affect the Ness Woods SAC qualifying interests, or the integrity of the Inverfarigaig SSSI. Option 3 would require removal of habitat listed as AWI ancient semi-natural woodland and NWSS woodland, and would have a direct impact on the integrity of these habitats.

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	Option 1 is located within a Buglife B-Line and Butterfly Conservation Priority Landscape Great Glen and the Beauly Catchment. It has the potential to directly and indirectly impact protected species due to the presence of suitable habitat to support a range of such species within the footprint or within close proximity to this option. Option 1 is distinct in habitats, containing a combination of Highland BAP priority habitats, SBL priority habitats and Annex I habitats. Option 1 is located within Middle Old Red Sandstone (moderately productivity aquifer). This site is also located within a DWPA for Surface Water and Groundwater. In terms of proximity to PWS the site is located downgradient and more than 150 m from PWS Easter Boleskine and therefore is unlikely to compromise the quality or quantity of PWS. Additionally, the site is less than 50 m from the east shore of Loch Ness and may compromise the quality of surface water.	Catchment. It has the potential to directly and indirectly impact protected species due to the presence of suitable habitat to support a range of such species within the footprint or within close proximity to this option. Option 2 is distinct in habitats, containing a combination of Highland BAP priority habitats, SBL priority habitats and Annex I habitats. Option 2 is located within Middle Old Red Sandstone (moderately productivity aquifer). This site is also located within a DWPA for Surface Water and Groundwater. In terms of proximity to PWS the site is located downgradient and more than 150 m from PWS Easter Boleskine and therefore is unlikely to compromise the quality or quantity of PWS. Additionally, the site is less than 50 m from the east shore of Loch Ness and may compromise the quality of surface water.	Option 3 is located within a Buglife B-Line and Butterfly Conservation Priority Landscape Great Glen and the Beauly Catchment. It has the potential to directly and indirectly impact protected species due to the presence of suitable habitat to support a range of such species within the footprint or within close proximity to this option. Option 3 is distinct in habitats, containing a combination of Highland BAP priority habitats, SBL priority habitats and Annex I habitats. Option 3 is located within Middle Old Red Sandstone (moderately productivity aquifer). This site is also located within a DWPA for Surface Water and Groundwater. In terms of proximity to PWS the option is located downgradient and more than 150 m from PWS Easter Boleskine and therefore is unlikely to compromise the quality or quantity of PWS. Additionally the site is less than 50 m from the east shore of Loch Ness and may compromise the quality of surface water.
Cultural Heritage	For Option 1 there is the potential for indirect impacts on the Scheduled	For Option 2 there is the potential for indirect impacts on the Scheduled	For Option 3 there is the potential for indirect impacts on the Scheduled

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	Monument of Dun Scriben, Fort (SM6220) from distant views to the south east, it is unlikely that these impacts would be significant in nature. No adverse impacts on undesignated archaeology are expected. Option 1 has the potential for indirect impacts on a number of Listed Buildings through views to the south west.	Monument of Dun Scriben, Fort (SM6220) from distant views to the south east, it is unlikely that these impacts would be significant in nature. No adverse impacts on undesignated archaeology are expected. For Option 2, due to the distances involved and the retention of current screening, any indirect impacts on Listed Buildings to the north east are unlikely to be significant.	Monument of Dun Scriben, Fort (SM6220) from distant views to the south east, it is unlikely that these impacts would be significant in nature. No adverse impacts on undesignated archaeology are expected. Option 3 has the potential for indirect impacts on a number of Listed Buildings with the introduction and expansion of infrastructure in views to the south west.
Landscape and Visual	Option 1 is connected to the Power Station by a 18kV underground cable, which is not anticipated to have any effects on the special qualities of the Loch Ness and Duntechaig Special Landscape Area (SLA). However, it would require the removal of woodland and considerable earthworks, affecting one of the SLA special qualities which are the steep wooded slopes flanking the landform trench of the Loch. This option would extend the visible presence of energy infrastructure within the SLA. Option 1 would require the removal of woodland and considerable earthworks, which would affect key characteristics of the Landscape Character Type (LCT) such	The in-situ replacement of the transformers at the Power Station for Option 2 would have negligible effects on the special qualities of the SLA. As Option 2 does not involve removal of woodland and considerable earthworks, the key characteristics of the LCT would not be greatly affected. Key visual receptors with potential visibility would be largely located along the Loch and lower banks. Visual amenity of sensitive visual receptors will not be greatly impacted due to the in-situ replacement.	Similarly to Option 1, Option 3 is connected to the Power Station by a 18kV underground cable, which is not anticipated to have any effects on the special qualities of the SLA. However, it would require the removal of woodland and considerable earthworks, affecting one of the SLA special qualities which are the steep wooded slopes flanking the landform trench of the Loch. Although is option extends over an area 60% smaller than Option 1, this option would still notably extend the visible presence of energy infrastructure within the SLA. Option 3 would require the removal of woodland and considerable earthworks, which would affect key characteristics of

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	as the steep slopes of the Loch, with broadleaf woodland and forestry plantations covering most of the glen sides. Option 1 is located nearby the existing Power Station, and on the lower banks of the Loch, therefore it would benefit from landform, topography and woodland cover to limit the options visual influence inland to the east for receptors. Other receptors on the western shore of Loch Ness, including residential receptors in settlements, people travelling along the Great Glen Way and other hillwalkers, as well as people travelling along the A82, would have distant glances of the option where landform and intervening vegetation allow, limiting the visual influence of the Site Option in these receptors. Key visual receptors with potential visibility would be largely located along the Loch and lower banks.		the LCT such as the steep slopes of the Loch, with broadleaf woodland and forestry plantations covering most of the glen sides. Option 3 is located nearby the existing Power Station, and on the lower banks of the Loch, therefore it would benefit from landform, topography and woodland cover to limit the options visual influence inland to the east for receptors. Other receptors on the western shore of Loch Ness, including residential receptors in settlements, people travelling along the Great Glen Way and other hillwalkers, as well as people travelling along the A82, would have distant glances of the options where landform and intervening vegetation allow, limiting the visual influence of the Site Option in these receptors. Key visual receptors with potential visibility would be largely located along the Loch and lower banks.
Land Use and Recreation	For Option 1 the Land Capability for Agriculture is 6.3. Only areas with a Land Capability for Agriculture of 3.1 and above are considered to be good quality arable	For Option 2, the Land Capability for Agriculture is 6.3. There is no commercial Forestry or woodland within the option area.	Option 3 shares a similar appraisal as Option 1.

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	land, therefore agriculture is not considered a constraint. There is no commercial Forestry within the option area, however the option is entirely covered by woodland. Due to the Core Path Foyers Pier to Inverfarigaig by Loch Ness-side, and the Caledonia Way, running in between Foyers Power Station and the Switching Station all options are likely to interact with these features.	Due to the Core Path Foyers Pier to Inverfarigaig by Loch Ness-side, and the Caledonia Way, running in between Foyers Power Station and the Switching Station all options are likely to interact with these features.	
Planning	Whilst there is the potential for conflict with planning policies due to the Natural Heritage and Landscape constraints, there is a clear drive within Scottish Planning Policy to increase green energy transmission. With careful siting and design, environmental constraints would be minimised as far as practicable.	Option 2 shares a similar appraisal as Option 1, however due to the reduced impact on Natural Heritage and Landscape, there is likely to be less conflict with planning policies for these options.	Option 3 shares a similar appraisal as Option 1.
Engineering			
Connectivity	Option 1 provides an opportunity for a complete offline build for the new substation and the outage requirements are minimised with this solution. It would be feasible to energise and commission the new substation without impacting the existing Foyers generation, with only	Option 2 utilises the existing transformer compound, for a full in-situ installation, therefore there is no opportunity for an offline build. This option would therefore place the greatest risk on the network as it would require a significant outage on the power station as the installation is	Option 3 also provides an opportunity for an offline build for the new substation, therefore reducing outage requirements on the project. However this option does not provide the full benefits of Option 1 due to the hybrid nature of the solution. Significant station outages would still be

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	shorter outages needed for the installation of the new 18kV connection equipment and final connection/ commissioning. The area in close proximity to the existing Foyers Power Station has existing topographical, settlement and engineering constraints. As such, there would be no feasible option to extend the sites to accommodate future development. Option 1 provides opportunity for increased business separation from SSE Renewables, by removing the existing GTs from the Power Station, reducing operation and maintenance requirements at the site. In addition, the installation of new SSEN Transmission owned 18kV circuit breakers will provide network demarcation, in accordance with current specifications. The new diesel standby generator, Protection and Control and Direct Current systems would provide improved autonomy from Foyers Generation systems. Due to the unique nature of the Foyers site, the existing LVAC supplies to the transformer compound are derived from the Power Station, with an interconnection to Foyers 275kV switching station. The proposed design for the site will require	carried out. With this option, there would be no opportunity to restore Foyers Power Station until all works were fully complete, putting the site at risk for any project complications/delays. As such, this places a significant limitation on the output of Foyers and an increased risk on the network given the Power Station's importance as a black-start site as part of network security and resilience. Option 2 shares the same topographical constraints as Option 1. As Option 2 is an in-situ replacement, significant business separation issues would continue at the Power Station. This solution does not provide an opportunity to improve business separation, as SSEN Transmission equipment would remain within the Power Station. In addition, there would be no opportunity to install SSEN Transmission owned equipment, therefore relying on Foyers Generation for network operations. As Option 2 utilises the existing transformer compound, there is insufficient space to install a new standby diesel generator. This does not meet the requirements of the SSET LVAC auxiliary supplies specification.	required to enable installation of the 2nd GT and installation of the new 18kV connection equipment. This would present a limitation on the output of Foyers for an extended period and an increased risk to the network. Option 3 shares the same topographical constraints as Option 1. Similarly to Option 1, Option 3 provides an improvement in business separation. The removal of one of the GTs to the intermediate transformer compound also improves operation and maintenance requirements at the Power Station. However, as a major transmission asset would still remain within the power station with this option, business separation issues would continue, similarly to option 2. Regarding the LVAC supplies Option 3 shares the same concerns as Option 1.

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	diversion of the existing LVAC supplies into the new site, together with the inclusion of a new standby diesel generator, to meet with the requirements of the SSET LVAC auxiliary supplies specification.		
Footprint Requirements	Option 1 provides opportunity to accommodate new SSEN Transmission apparatus within a new substation location. Due to the unique nature of the connection, the new SSEN Transmission owned 18kV Circuit breakers would be located within the existing Power Station site. As the overall site is largely constrained, the layout of the new substation site is challenging and therefore the specification and procurement of all new equipment must take account of these layout restrictions. Owing to the sloping topography of the proposed intermediated site, a significant volume of earth fill material will be required to be imported to site. Large retaining wall structures will likely be required to provide platform stability at the intermediate compound. Ground Investigation works at the site will be	There is limited opportunity within the available site envelope of the Power Station to achieve modern technology standards. As such, Option 2 would require a number of key deviations from specification, to be agreed with the SSEN Transmission technical authority, to enable this option to be progressed. In addition, significant business separation issues would continue at the Power Station as there would be no opportunity to install SSEN Transmission owned 18kV circuit breakers. This would be a failure of a key driver on the project, and effectively require SSEN Transmission to remain reliant on a 3rd party for protection of a critical asset. There is a large volume of below ground services, utilities and infrastructure beneath the existing substation compound which has been verified by GPR utility surveys at the site. There would be a significant amount of design	Option 3 shares a similar justification to Option 1. For Option 3 the footprint of the proposed sub-station site is largely constrained due to its location directly adjacent to Loch Ness, which comprises steep sloping hillside. A significant volume of earth fill material would be required to be imported to site for this option, due to the sloping topography. Regarding adjacent land use, Option 3 shares a similar justification to Option 1. The area of platform required to accommodate a single transformer is approximately 60% of the size of the Option 1 platform required to locate two transformers.

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	necessary to inform the depth at which the retaining walls can be suitably founded.	and work on site required to divert below ground services to make way for the new civils infrastructure necessary to accommodate the transformer units. There is also a level of risk during the construction phase as a number of the below ground services are SSE Generation assets, thus disruption to these services could have a direct impact to the Power Station. Due to the amount of time required to divert the below ground services, the power station outage period could be extensive. The new transformers are likely to be heavier units than the existing models, therefore any below ground infrastructure will need to be assessed for increased load effects Regarding adjacent land use, Option 2 shares a similar justification to Option 1. .	
Hazards	The gradient of the slope at the proposed intermediate site will present challenges for clearance works and platform construction. A number of considerations such as an assessment of the slope's stability, consideration of the soil conditions / moisture content is required to ensure any removal of vegetation,	The works involved with Option 2 are of significantly less risk in comparison to Options 1 and 3. There is however a significant element of construction required within the existing power station compound, which is an extremely restrictive area that will require careful planning and isolation of services.	Option 3 shares similar unique hazard constraints to Option 1. There would also be a significant element of construction required within the existing power station compound, which is an extremely restrictive area that will require careful planning and isolation of services. This will add a large amount of complexity

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	excavation / undercutting, and introduction of construction loading does not compromise the bearing capacity of the slope. The majority of existing services are located in and around the existing transformer compound. . It is critical that the design of the 18kV cable trench acknowledges the location of all existing below ground infrastructure and existing services are suitably re-routed where necessary to accommodate the design.	This will add a large amount of complexity to the construction activities within this area and will likely restrict how activities are planned/undertaken. To accommodate the installation of the new GTs the demolishment of the existing back-up diesel generator building will be required. The building was erected pre-1990 and therefore may have asbestos within it's construction make-up which would need to be assessed and mitiigated in both design and demolition.	to the construction activities within this area and will likely restrict how activities are planned/undertaken.
Ground Conditions	The gradient of the slope at the proposed site will present construction challenges. The sloping topography adjacent to the proposed intermediate platform should also be assessed to ensure any vibration induced by the construction works does not initiate potential landslide events. No previous ground investigation data is available, however preliminary outcrop field mapping along the Switching Station Access Road indicates the Foyers Sandstones Formation would typically be described as moderately strong to strong, massive, crystalline, light grey to grey, medium to coarse grained, metasandstone with visible mica content as a result of	The majority of the works take place within the existing transformer compound where the terrain is level and the potential slope stability issues associated with Site Options 1 and 3 are not as prominent. With Option 2, there is no requirement to design and construct a new earthworks platform at the intermediate greenfield site considered in Options 1 and 3. There is a large volume of below ground services, utilities and infrastructure beneath the existing substation compound which has been verified by GPR utility surveys at the site. There would be a significant amount of design	Option 3 shares a similar appraisal to Option 1.

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	likely low grade metamorphism. Large retaining wall structures will likely be required to provide platform stability at the intermediate area compound. Ground Investigation works at the site will be necessary to inform the depth at which the retaining walls can be suitably founded.	and work on site required to divert below ground services to make way for the new civils infrastructure necessary to accommodate the transformer units. There is also a level of risk during the construction phase as a number of the below ground services are SSE Generation assets, thus disruption to these services could have a direct impact to the Power Station. Due to the amount of time required to divert the below ground services, the power station outage period could be extensive.	
Environmental Conditions	All options are at an elevation of less than 100m AOD. This option is partially located within the fluvial flood zone of Loch Ness. The level of the proposed new platform for the intermediate compound must take Loch Ness's tide into consideration which, according to the National Oceanography Centre, can result in water levels rising and falling by 1.5m. The carbon footprint of Option 1 and Option 3 is considered likely to be much higher than Option 2 due to tree felling and significantly higher building materials required.	All options are at an elevation of less than 100m AOD. Option 2 falls outside the flood zone of Loch Ness. Options 2 requires significantly less in way of building material and tree felling compared to Options 1 and 3 and therefore the carbon footprint will be lower. As Option 2 does not enable the installation of new 18kV circuit breakers, there would be no additional CBs or the potential for SF6 added. New GTs will have a lower noise output in comparison to the existing ageing	All options are at an elevation of less than 100m AOD. This option is partially located within the fluvial flood zone of Loch Ness. The level of the proposed new platform for the intermediate compound must take Loch Ness's tide into consideration which, according to the National Oceanography Centre, can result in water levels rising and falling by 1.5m. The carbon footprint of Option 1 and Option 3 is considered likely to be much higher than Option 2 due to tree felling and significantly higher building materials required.

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	The installation of new 18kV circuit breakers may employ SF6 as an interrupting medium, however there are alternatives on the market that may meet the requirements of the project. This would be assessed during the detailed design phase of the project. New GTs will have a lower noise output in comparison to the existing ageing units. In addition, all substation options are in close proximity to the existing Power Station, with no 3rd party properties in close vicinity, so are unlikely to contribute to an overall noise output.	units. In addition, all substation options are in close proximity to the existing Power Station, with no 3rd party properties in close vicinity, so are unlikely to contribute to an overall noise output.	The installation of new 18kV circuit breakers may employ SF6 as an interrupting medium, however there are alternatives on the market that may meet the requirements of the project. This would be assessed during the detailed design phase of the project. New GTs will have a lower noise output in comparison to the existing ageing units. In addition, all substation options are in close proximity to the existing Power Station, with no 3rd party properties in close vicinity, so are unlikely to contribute to an overall noise output.
Construction Access	Option 1 could be accessed via a single track access road off the B852. However, the access road may prove unfeasible for transporting large volumes of earth fill material to the site. The import of earthfill material to the site to construct a new intermediate platform will generate significant volumes of construction traffic. Based on the initial transport assessments undertaken, this will require new passing places to be constructed and widening of 200m of the B852. It is anticipated that there would be the need for road widening over a 200m	Option 2 shares a similar appraisal to Option 1, however significant volumes of earthworks would not be required to the same extent as Option 1 and Option 3, therefore construction traffic would not be as high. It is anticipated that there would be the need for road widening over a 200m stretch with the need for multiple passing places to be introduced.	Option 3 shares a similar appraisal to Option 1.

Topic	Substation Option 1	Substation Option 2	Substation Option 3
	stretch with the need for multiple passing places to be introduced.		
Operation and Maintenance	This option's layout would be in accordance with SSEN Transmission specifications to ensure the required operation and maintenance access is achieved.	There is limited opportunity within the available site envelope to achieve modern standards and provide the required levels of physical separation and access. As such, additional task specific access equipment may be required to enable safe access during O&M activities.	Option 3 shares a similar appraisal to Option 1.
Economic			
Capital	Construction cost for Option 1 would be greater than Option 2. Diversions are not likely to be high. Significant tree felling, in comparison to Option 2 would be required for Option 1. Mitigation costs for Option 1 are expected to be high.	Construction cost for Option 2 would be the least. As Option 2 is an in-situ replacement, it is more likely to require significant diversions. Tree felling cost would be minimal for Option 2. Due to Option 2 being an in-situ replacement, mitigation costs are anticipated to be low.	Construction cost for Option 3 would be greater than Option 2. As Option 3 is a hybrid option, it is likely to require some diversion. Significant tree felling, in comparison to Option 2 would be required for Option 1. Mitigation costs for Option 3 are expected to be high.
Operational	Option 1 would result in a design that meets modern standards and specification including health and safety. It is considered the more straightforward it is to visit the asset and complete inspections and maintenance, the lower the cost becomes.	Option 2 would not result in a design that meets modern specification standards.	Option 3 would result in a design that meets modern standards and specification on one transformer. However challenges would still be present for the transformer within the Power Station.

5.3 Underground Cable Alignment Selection

Table 5--2 below shows a comparative analysis of UGC Options 1A, 1B, 2A and 2B. UGC Options 1A and 1B are associated with Substation Options 1 and 3, as they are designed to connect into an intermediate compound at the southern end. UGC Options 2A and 2B are associated with Substation Option 2 as they connect into the existing Foyers Power Station at the southern end. As UGC Option 1A and 2A follow a similar alignment, they have been appraised together in **Table 5-2**. The same applies to Options 1B and 2B as well.

Table 5-2 – Comparative Analysis of UGC options

Topic	'A' Options	'B' Options
Environmental		
Natural Heritage	Options 1A and 2A are located between 1.8 km and 2.6 km north east of the Ness Woods SAC which is the closest European designation to the options. It is unlikely that any of the options would affect the habitat qualifying interests. Both options would require removal of habitat listed as AWI ancient semi-natural woodland and NWSS woodland, and would have a direct impact on the integrity of these designations. Both options are located within a Buglife B-Line and Butterfly Conservation Priority Landscape Great Glen and the Beauly Catchment. Both options have the potential to directly and indirectly impact protected species such as Badger, Bats, Pine Marten, Red Squirrel, due to the presence of suitable habitat to support a range of such species within the footprint or within close proximity to each option. Both options are distinct in habitats, containing a combination of Highland BAP priority habitats, SBL priority habitats and Annex I habitats.	Options 1B and 2B has the same natural heritage constraints as the 'A' options, however due to their positioning along the existing road, the impact of habitat removal would be reduced.

Topic	'A' Options	'B' Options
	Both options are located within Middle Old Red Sandstone (moderately productivity aquifer). This site is also located within a DWPA for Surface Water and Groundwater. In terms of proximity to PWS the options are located downgradient and more than 150 m from PWS Easter Boleskine and therefore are unlikely to compromise the quality or quantity of PWS. Additionally, the site is less than 50 m from the east shore of Loch Ness and may compromise the quality of surface water.	
Cultural Heritage	There is unlikely to be impacts on designated or undesignated heritage assets as the cable will be underground. Due to the steep topography and previous disturbance from existing tracks, subsurface archaeology is unlikely to be impacted.	Option 1B and 2B share the same Cultural Heritage appraisal as Option 1A and 2A.
Landscape and Visual	Option 1A and 2A run alongside the road, entirely within woodland, which would require a large strip of woodland removal on the steep wooded slopes of the Loch, as well as potential earthworks, which would affect the special qualities of the Loch Ness and Duntechaig SLA and the key characteristics of Landscape Character Type at the site. Although located underground, both options would be visually intrusive for a limited stretch for the users of Core path 8573 - Foyers Pier to Inverfarigaig by Loch Ness-side.	Options 1B and 2B run under the tarmac of the existing road. They would potentially require minor earthworks and the removal of a limited number of trees. Retained woodland along this option would provide screening from the wider context. Option 1B and 2B will require some woodland removal but is less likely to compromise the special qualities of the SLA and key characteristics of the site's Landscape Character Type. The poles indicating the underground cable would be the only change to the visual amenity for users of Core path 8573 and no other receptors would be affected by this UGC option during operation.
Land Use and recreation	Agriculture is not considered a constraint for this site. Option 1A and 2A are aligned through the woodland, however there is no commercial forestry within either option.	Agriculture is not considered a constraint. Options 1B and 2B are aligned over the existing tarmac road and therefore minimising the requirement for forestry removal. There is no commercial forestry within either option.

Topic	'A' Options	'B' Options
	Due to the Core Path Foyers Pier to Inverfarigaig by Loch Ness-side, and the Caledonia Way, running in between Foyers Power Station and the Switching Station all options are likely to interact with these features.	Due to the Core Path Foyers Pier to Inverfarigaig by Loch Ness-side, and the Caledonia Way, running in between Foyers Power Station and the Switching Station all options are likely to interact with these features.
Planning	Whilst there is the potential for conflict with planning policies due to the Natural Heritage and Landscape constraints, there is a clear drive within Scottish Planning Policy to increase green energy transmission. With careful siting and design, environmental constraints would be minimised as far as practicable.	Option 1B and 2B share a similar appraisal as Option 1A and 2A with regards to planning policy, however due to their reduced impacts on Landscape Designations and Character, as well as reduction in woodland removal and visual impacts, there is likely to be less conflict with planning policies for these options.
Engineering		
Infrastructure Crossings	There are no major infrastructure crossings. No public roads are anticipated to be intersected.	Option 1B and 2B share the same appraisal as Option 1A and 2A.
Environmental Design	Both options are located at an elevation of less than 100 m AOD, and outside of any high pollution areas. It is expected that the risk of significant concentrations of potential contaminants being present in the ground is low. Buried possible contaminants hazards could be present in what are expected to be tunnel spoil reused for the Switching Station Access Road. Fragments of masonry and loose metals and rock cores have been observed in the waste materials consistent with anticipated tunnelling wastes of this era. There is no visual evidence of asbestos; however, there remains a possibility that ancillary structures and temporary working building of this era could contain asbestos. Surface water was previously observed along the Switching Station Access Road. The surface water is thought to be ephemeral and may increase from seepages to flows with the season. However, based on a review of the SEPA maps, the length of cable route is not shown to be	Options 1B and 2B share the same appraisal as Option 1A and 2A.

Topic	'A' Options	'B' Options
	impacted by a 200 year return period flood event, therefore the flood impact is considered to be low.	
Ground Conditions	The gradient of the proposed site will present challenges for site clearance works. A number of considerations such as an assessment of the slope's stability, consideration of the soil conditions / moisture content etc. is required to ensure any removal of vegetation, excavation / undercutting and introduction of construction loading does not compromise the bearing capacity of the slope. Site walkovers have previously identified extensive fills below the existing access road particularly on the downslope side and in the vicinity of naturally incised steep sided streams culverted below the Switch Station access road. These fills are anticipated to be largely rockfill of cobble and boulder size and most likely deposited as part of the Station construction and are tunnelling spoils although this is not recorded. As such, tunnel spoils or "tunnelling muck" can often have a wide range of variability in gradation and can contain other mixed waste. According to the BGS there are no historical wells or boreholes records available in the vicinity of the Site.	Options 1B and 2B share the same appraisal as Option 1A and 2A.
Construction and Maintenance	Both options are within 500 m to 1 km of well maintained public roads. The road between the Switching Station and Power Station is a single track road and the works to excavate the cable trench may impede the maintenance/delivery access to the Power Station.	Options 1B and 2B share the same appraisal as Option 1A and 2A.
Proximity	There is an existing 275kV electrical cable which runs directly between the Foyers Power Station and the Switching Station. The utility records indicate the existing electrical cable is located on the west side of the access road (i.e. closest to the shore line).	Options 1B and 2B share the same appraisal as Option 1A and 2A.

Topic	'A' Options	'B' Options
	There are no windfarms, communication masts, urban environments or metallic pipelines within close proximity to Option 1A.	
Design	Option 1A UGC length is 600 m, therefore reactive compensation and joint bays are required. Link boxes would be installed within the new intermediate compound and the Foyers Switching Station, therefore there is no restrictions on Link box location and no foreseeable risk of asset damage.	Options 1B and 2B share the same appraisal as Option 1A and 2A.
Economic		
Capital	Option 1A and 2A are assumed to cost more as they are located on the side of a steep forested slope, therefore the civil engineering costs to construct are considered to be substantially higher. More diversions (electrical, drainage and arrangements for working in close proximity to existing substation equipment including outages) are considered to be required near to the power station hence options 1A and 1B are considered least cost in comparison to 2A and 2B. Options 1A and 2A would result in the greatest tree felling to accommodate the alignments. Option 2A would be more costly than Option 1A when it comes to land assembly as 2A would require the power station to stop generating electricity and result in an outage for a significantly longer period than required for options 1A. Any outage of the power station to facilitate the construction may incur the need for compensation for lost revenue, hence the cost of land assembly. All cable options are considered to benefit from permitted development therefore consenting is not applicable however appropriate mitigation	Option 1B and 2B are considered to cost less than Options 1A and 2A, as they are largely aligned under the existing tarmac road. Option 2B would be the least costly as it aligns with the tarmac access road for the longest length. More diversions (electrical, drainage and arrangements for working in close proximity to existing susbattion equipment including outages) are considered to be required near to the power station hence options 1A and 1B are considered least cost in comparison to 2A and 2B. Option 1B would require some felling as it deviates from the existing tarmac road to tie into the Substation platform. Option 2B follows the existing tarmac road for its entire length and will result in the least amount of felling. Option 2B would be more costly than Option 1B when it comes to land assembly as 2B would require the power station to stop generating electricity and result in an outage for a significantly longer period than required for options 1B. Any outage of the power station to facilitate the construction may incur the need for compensation for lost revenue, hence the cost of land assembly. All cable options are considered to benefit from permitted development therefore consenting is not applicable however appropriate mitigation would still be expected

Topic	'A' Options	'B' Options
	would still be expected by SSEN Transmission. Options 1A and 2A align along existing forestry and hence would require felling and loss of habitat, which is expected to be more costly in mitigation.	by SSEN Transmission. Mitigation for Options 1B and 2B is expected to be less costly than Options 1A and 2A.
Operational	Options 1A and 2A align along the edge and top of an existing steep slope, which makes inspections and maintenance more difficult and costly.	Option 1B deviates away from the existing tarmac road for a short length to connect into the proposed Substation platform. Option 2B aligns underneath the existing tarmac road until it reaches the existing Substation compound. Given a short length of the Option 2B alignment is within the existing Substation compound, inspections and maintenance are considered less straightforward and potentially more costly.

5.3.1 **Tables 5-3 to 5-6** below show the RAG Ratings for the Substation Options and their corresponding UGC options. For Environment and Cost, these have been combined into one table as the criteria for rating both Substation options and UGC options are the same. The RAG Rating for Engineering criteria have been separated for Substation and UGC elements as they are appraised differently.

Substation Options

Environmentally, Option 2 is the preferred Substation option. Option 2 would not require removal of ancient semi-natural woodland habitat and therefore have the lesser impact to designations. The Landscape and Visual impacts are reduced for Option 2 due to the in-situ replacement of the transformers, and therefore minimal introduction of new electrical infrastructure to the landscape.

There are however fundamental issues with Option 2 including the inability to comply with modern standards. The design solution does not address the overlapping of fire damage zones between the two transformers, nor does it address a key requirement of the project to provide clear business separation between SHE-T and SSE Generation. In addition, the works to overhaul the existing Power Station transformer compound requires extensive diversion works on the existing below ground services and utilities (some of which are SSE Generation assets). The period of time required for a Power Station outage cannot be quantified, however it is anticipated that any outage associated with this option is likely to be extensive. There would of-course be no generation output from Foyers during this period and there would also be an increased risk to the network given this stations importance in network security and resilience. Option 2 is clearly more favourable in the sense of the impact to the local landscape and visualisation. However, owing to the technical constraints associated with this option, the adverse impact to the wider SSE business and the significant safety issues expected during operation, Option 2 is deemed unviable.

From an engineering perspective, Substation Option 1 is preferred. This is because Option 1 provides the opportunity for a complete offline build for the new Substation and the outage requirements are minimised with this solution. It would also bring increased business separation from SSE Renewables and provide

network demarcation in accordance with current specifications. For Option 2 there would be no opportunity to install SSEN Transmission owned equipment, therefore there would be a reliance on Foyers Generation for network operations, which Option 1 could provide. Whilst Option 1 is considered more of a constraint from topography, flooding, carbon footprint and contaminated land, from an engineering perspective these potential constraints are outweighed by the benefits Option 1 could bring.
From a cost perspective, Option 1 is preferred. Whilst Option 1 would have higher construction, tree felling and consents mitigation costs, it is preferred in terms of costs for Diversions and Land Assembly and would be cheaper through its operational timescale in regards to inspections and maintenance.

Overall, Substation Option 1 is preferred.

Underground Cable Options

Environmentally, the 'B' option cables are preferred. This is because they allow for minimised removal of ancient woodland and a reduction in Landscape and Visual impacts. If Substation Option 1 is the overall preferred Substation Option, then from an environmental perspective, UGC Option 1B is preferred.
From an engineering perspective, the 'B' option cables are preferred. This is because they allow for easier construction and operational access, and the terrain is level due to the existing tarmac road, whereas the 'A' options are located on steep topography. If Substation Option 1 is the overall preferred Substation Option, then from an engineering perspective, UGC Option 1B is preferred.
From a cost perspective, the 'B' options are preferred. They provide a cheaper option in terms of construction cost, tree felling and consents mitigation, in addition to a reduced operational cost.

Overall, UGC Option 1B is preferred.

Table 5-3 – Environmental RAG Ratings for Substation Options 1, 2 and 3 and UGC 1A, 1B, 2A and 2B

Category	Sub-Topic	Infrastructure Type	Substation Option 1		Substation Option 2		Substation Option 3	
			UGC Option 1A	UGC Option 1B	UGC Option 2A	UGC Option 2B	UGC Option 1A	UGC Option 1B
Natural Heritage	Designations	Substation	H		M		H	
		Underground Cable	H	H	H	H	H	H
	Protected Species	Substation	M		M		M	
		Underground Cable	M	M	M	M	M	M
	Habitats	Substation	M		M		M	
		Underground Cable	M	M	M	M	M	M
	Ornithology	Substation	L		L		L	
		Underground Cable	L	L	L	L	L	L

Category	Sub-Topic	Infrastructure Type	Substation Option 1		Substation Option 2		Substation Option 3	
			UGC Option 1A	UGC Option 1B	UGC Option 2A	UGC Option 2B	UGC Option 1A	UGC Option 1B
	Geology, Hydrology and Hydrogeology	Substation	M		M		M	
		Underground Cable	M	M	M	M	M	M
Cultural Heritage	Designations	Substation	L		L		L	
		Underground Cable	L	L	L	L	L	L
	Cultural Heritage Assets	Substation	M		L		M	
		Underground Cable	L	L	L	L	L	L
Landscape and Visual	Designations	Substation	H		L		H	
		Underground Cable	H	M	H	M	H	M
	Character	Substation	H		L		H	
		Underground Cable	H	M	H	M	H	M
	Visual	Substation	M		L		M	
		Underground Cable	M	L	M	L	M	L
Land Use	Agriculture	Substation	L		L		L	
		Underground Cable	L	L	L	L	L	L
	Forestry and Woodland[17]	Substation	H		L		H	
		Underground Cable	L	L	L	L	L	L
	Recreation	Substation	M		M		M	
		Underground Cable	M	M	M	M	M	M
Planning	Policy	Substation	M		M		M	
		Underground Cable	M	M	M	M	M	M
	Proposals	Substation	M		M		M	
		Underground Cable	M	M	M	M	M	M

[17] SSEN Transmission's 'Substation Site Selection Guidelines for Voltages at or Above 132kV' includes percentage loss of woodland within the RAG Assessment for Forestry and Woodland. Based on these guidelines, Substation Option 1 and 3 have been assigned a RAG Rating of Red due to being greater than 120% of the least 'woodland impacted on' option. SSEN Transmission's 'Procedures for Routeing Overhead Lines and Underground Cables of 132kV and above' do not include percentage loss of woodland within the RAG Assessment for Forestry, and therefore the UGC RAG Ratings remain green due to having no Commercial Forestry within the UGC options.

Table 5-4: Substation Site Options Engineering RAG Appraisal

Category	Sub-Topic	Substation Option 1	Substation Option 2	Substation Option 3
Connectivity	Existing Circuits / Network	L	H	M
	Future Development Possibilities	H	H	H
	Interface with SSE Distribution and Generation	L	H	H
	DNO Connection	L	M	L
Footprint Requirements	Technology	M	H	M
	Adjacent Land Use	M	M	M
	Space Availability	M	H	M
Hazards	Unique Hazards	M	L	M
	Existing Utilities	M	M	M
Ground Conditions	Topography	H	L	H
	Geology	M	M	M
Environmental Conditions	Elevation	L	L	L

Category	Sub-Topic	Substation Option 1	Substation Option 2	Substation Option 3
	Salt Pollution	L	L	L
	Flooding	M	L	M
	Carbon Footprint	M	L	M
	SF6	M	L	M
	Contaminated Land	M	M	M
	Noise (proximity to dwellings / residential properties)	L	L	L
Construction Access	Substation Access Road (from public road)	H	M	H
	Transformer Delivery Route	H	H	H
Operation and Maintenance	Access	L	M	L

Table 5-5: UGC Alignment Engineering RAG Appraisal

Category	Sub-Topic	UGC Option 1A	UGC Option 1B	UGC Option 2A	UGC Option 2B
Infrastructure Crossings	Major Crossings	L	L	L	L
	Road Crossings	L	L	L	L
Environmental Design	Elevation	L	L	L	L

Category	Sub-Topic	UGC Option 1A	UGC Option 1B	UGC Option 2A	UGC Option 2B
	Atmospheric Pollution	L	L	L	L
	Contaminated Land	M	M	M	M
	Flooding	M	M	M	M
Ground Conditions	Terrain	M	L	M	L
	Rock	M	M	M	M
	Peat	L	L	L	
Construction / Maintenance	Access	H	L	H	L
	Angles of Deviation	L	L	L	
	Cable Haul Road	M	M	M	M
Proximity	Clearance Distance	M	M	M	M
	Windfarms	L	L	L	L
	Communication Masts	L	L	L	L
	Urban Environments	L	L	L	L
	Metallic Pipelines	L	L	L	L

Category	Sub-Topic	UGC Option 1A	UGC Option 1B	UGC Option 2A	UGC Option 2B
Design	Reactive Compensation (HVAC circuits only)	L	L	L	L
	Joint Bays and Link Box Chambers	L	L	L	L

Table 5-6 – Cost RAG Ratings for Substation Options 1, 2 and 3 and UGC 1A, 1B, 2A and 2B

Category	Sub-Topic	Infrastructure Type	Substation Option 1		Substation Option 2		Substation Option 3	
			UGC Option 1A	UGC Option 1B	UGC Option 2A	UGC Option 2B	UGC Option 1A	UGC Option 1B
Capital	Construction	Substation	H		L		H	
		Underground Cable	H	M	H	L	H	M
	Diversions	Substation	L		H		M	
		Underground Cable	L	L	M	M	L	L
	Public Road Improvements	Substation	L		L		L	
		Underground Cable	L	L	L	L	L	L
	Tree Felling	Substation	H		L		H	
		Underground Cable	H	M	H	L	H	M
	Land Assembly	Substation	L		H		M	
		Underground Cable	L	L	H	H	L	L
	Consent Mitigations	Substation	H		L		H	
		Underground Cable	H	M	H	L	H	M
Operational	Inspections	Substation	L		M		L	

Category	Sub-Topic	Infrastructure Type	Substation Option 1		Substation Option 2		Substation Option 3	
			UGC Option 1A	UGC Option 1B	UGC Option 2A	UGC Option 2B	UGC Option 1A	UGC Option 1B
		Underground Cable	M	L	M	M	M	L
	Maintenance	Substation	L		H		L	
		Underground Cable	M	L	M	M	M	L

5.4 Switching Station Site Selection

Table 5-7below shows a comparative analysis Switching Station Options A and B.

Table 5-7– Comparative Analysis of Switching Station Option A and B

Topic	Switching Station Option A	Switching Station Option B
Environment		
Natural Heritage	Option A is located 1.7 km north east of Ness Woods SAC which is the closest European designation to the options. It is unlikely that the option would affect the habitat related qualifying interests of this designation. Option A is also located within 2 km of Inverfarigaig SSSI, and it is also unlikely that it would affect the habitat related qualifying interests of this designation. The option would require removal of habitat listed as AWI ancient semi-natural woodland and NWSS woodland and would have a direct impact on the integrity of these designations. Option Ais located within a Buglife B-Line and Butterfly Conservation Priority Landscape Great Glen and the Beauly Catchment. Option A has the potential to directly and indirectly impact protected species such as Bats, Badgers, Pine Marten and Red Squirrel. Option A contains distinctive habitats including a Highland BAP priority habitat, SBL priority habitat and Annex I habitat. Option A is situated within the Middle Old Red Sandstone (moderately productivity aquifer) and is located within a DWPA for Surface Water and Groundwater. In terms of proximity to PWS, it is located downgradient and more than 150 m from PWS Easter Boleskine and therefore unlikely to compromise the quality or quantity of PWS.	Option B shares a similar appraisal to Option A. However, Option B would have a slightly lesser impact on the Annex I habitat.

Topic	Switching Station Option A	Switching Station Option B
Cultural Heritage	Option A, has the potential for indirect impacts on the Scheduled Monument of Dun Scriben, fort (SM6220) with the introduction and expansion of infrastructure in distant views to the south east. It is unlikely that these impacts would be significant in nature due to the distances involved. There is potential for indirect impacts on a number of Listed Buildings with the introduction and expansion of infrastructure in views to the north east.	Option B shares a similar appraisal to Option A.
Landscape and Visual	Option A would require the removal of woodland and considerable earthworks, which may affect one of the Loch Ness and Duntechaig SLA special qualities. The presence of pylons is also mentioned in the special qualities of the SLA, as notable features in contrast to the horizontal skyline and grand proportions of the Loch. Option A would be perceived in the context of existing energy infrastructure. Whilst woodland would need to be removed, a woodland buffer would be retained around the Option providing enclosure and screening from the wider landscape. Option A would extend the presence of infrastructure in the area in the context of the existing switching station, and they would require the removal of woodland and considerable earthworks, which may affect key characteristics of the LCT such as the steep slopes of the Loch, broadleaf woodland, forestry plantations and small areas of open moorland on the glen sides. Existing woodland that would be retained around the Option would provide enclosure and screening from the wider landscape. Residential receptors along the B852 in the vicinity of the switching station could have potential views of both options through intervening vegetation. Users of Core Path 8573 - Foyers Pier to Inverfarigaig by	Option B shares a similar appraisal to Option A. However, Option B is located on higher grounds and on a wider area of the embankment where earthworks are likely to be slightly less intrusive than those to the south west of the switching station.

Topic	Switching Station Option A	Switching Station Option B
	Loch Ness-side would have a direct view of the Option for a limited stretch, and users of Core Path 14518 - Foyers to Inverfarigaig could have potential views of the options through intervening vegetation and topography. People traveling along the B852 and cycling along The Caledonia Way would have direct views of the Option for a limited stretch. Visitors to Clan Fraser Cemetery and Boleskine House could potentially have views of the Option through screening vegetation. Option Awould require the removal of woodland to the west, which could open views for receptors to the west of the Option, especially for users of the consented boat house nearby the switching station, and people undertaking outdoor recreational pursuits on Loch Ness. For residential and recreational receptors on the western shore of Loch Ness, landform, distance and intervening vegetation would limit the visual influence of the option.	
Land Use and Recreation	Agriculture is not considered a constraint for this site. Option A passes close to an area of commercial coniferous plantation. Due to the Core Path Foyers Pier to Inverfarigaig by Loch Ness-side, and the Caledonia Way, running in between Foyers Power Station and the Switching Station, Option A is likely to interact with the feature.	Agriculture is not considered a constraint for this site. Option B intersects a commercial coniferous plantation identified as ancient woodland and contains pockets of windthrow which are likely to be exaggerated should they be exposed by this proposed switching station extension. Due to the Core Path Foyers Pier to Inverfarigaig by Loch Ness-side, and the Caledonia Way, running in between Foyers Power Station and the Switching Station, Option B is likely to interact with the feature.
Planning	Whilst there is the potential for conflict with planning policies due to the Natural Heritage constraints, there is a clear drive within Scottish Planning Policy to increase green energy transmission. With careful	Option B shares a similar appraisal to Option A.

Topic	Switching Station Option A	Switching Station Option B
	siting and design, environmental constraints would be minimised as far as practicable.	
Engineering		
Connectivity	Option A would include the space provision for a future bay. There is no additional interface anticipated with Distribution or Generation with Option A. The existing LVAC supplies are provided from a local DNO supply with an additional interconnected supply from the Power Station.	Option B shares a similar appraisal to Option A.
Footprint Requirements	To accommodate the works at the Switching Station, the existing Switching Station earthworks platform will need to be extended with new retaining wall structures constructed around the perimeter of the extension to provide stability. Extending to the east and south of the existing Switching Station is feasible and has been proven via topographical survey and ground based laser scanning.	To accommodate the works at the Switching Station, the existing Switching Station earthworks platform will need to be extended with new retaining wall structures constructed around the perimeter of the extension to provide stability. The proposed extension of the Switching Station to the north extends into another landownership. Additional land will likely need to be purchased to accommodate the extension before any construction works at the site can progress. The footprint extends onto a public access road which would need to be re-routed to accommodate the extension. Currently there is no available space at the west and north west portions of the Switching Station to allow for a platform extension due to being located next to a rock out-crop and due to the cliff falling away to the west of the Switching Station. This option would require a significant amount rock removal to the north of the existing Switching Station.
Hazards	The proposed platform extension is next to a steep slope which falls towards Loch Ness.	The proposed platform extension is next to a steep slope which falls towards Loch Ness.

Topic	Switching Station Option A	Switching Station Option B
	The existing 275 kV cable is routed from the existing access road towards the south of the Switching Station. Development to extend the south of the Switching Station will require special measures, detailed risk assessments and method statements to ensure that live electrical services are not disrupted and contractor personnel are not placed at risk during the construction works.	The majority of development to extend the Switching Station is to the north, east and west. Utility Surveys have not identified existing utilities in this area.
Ground Conditions	The area to the east of the Switching Station comprises steep topography (in the region of around 15% gradient). Similar to the intermediate sub-station options, retaining wall structures are required to stabilise the platform and retain the earthfill material upon which the existing access road is routed. No previous ground investigation data is available for the Site, however preliminary outcrop field mapping along the Switching Station Access Road indicates the Foyers Sandstones Formation would typically be described as moderately strong to strong, massive, crystalline, light grey to grey, medium to coarse grained, metasandstone with visible mica content as a result of likely low grade metamorphism.	The area to the east of the Switching Station comprises steep topography. The area to the west of the Switching Station is located close to a cliff face. Works in this area are not feasible and would put construction personnel at risk. No previous ground investigation data is available for the Site, however preliminary outcrop field mapping along the Switching Station Access Road indicates the Foyers Sandstones Formation would typically be described as moderately strong to strong, massive, crystalline, light grey to grey, medium to coarse grained, metasandstone with visible mica content as a result of likely low grade metamorphism. Retaining wall structures will likely be required to provide platform stability. Ground Investigation works at the site will be necessary to inform the depth at which the retaining walls can be suitably founded.
Environmental Conditions	Site is less than 100m AOD. The Switching Station site is located out with the fluvial flood zone of Loch Ness for a 1,000 year return period. It is however noted that there are localised pluvial flood risk zones located at the centre of the Switching Station with flood depths ranging between 0.1m - 0.3m for a 200 year return period.	Option B shares a similar appraisal to Option A. The Carbon Footprint of Option B is greater than Option A.

Topic	Switching Station Option A	Switching Station Option B
	The Carbon Footprint of Option A is smaller than Option B as the extent of construction and volume of materials to be brought to site are significantly less. Option A would require the installation of new 275kV CBs which may employ SF6 as an interrupting medium, however there are alternatives on the market that may meet the requirements of the project. This would be assessed during the detailed design phase of the project. It is expected that the risk of significant concentrations of potential contaminants being present in the ground is low. Buried possible contaminants hazards could be present in what are expected to be tunnel spoil reused for the Switching Station Access Road. Fragments of masonry and loose metals and rock cores have been observed in the waste materials consistent with anticipated tunnelling wastes of this era. There is no visual evidence of asbestos; however, there remains a possibility that ancillary structures and temporary working building of this era could contain asbestos. No formal asbestos survey has been undertaken. Based on the available information, the site should be classified as 'Yellow' in terms of the BDA contaminated site classification. No proposed equipment would have a detrimental impact to the existing noise levels.	
Construction Access	The import of earthfill material to the site will generate significant volumes of construction traffic along the B852. Based on the initial transport assessments undertaken, this will require new passing places to be constructed and widening of 200 m of the B852	Option B shares a similar appraisal to Option A.

Topic	Switching Station Option A	Switching Station Option B
Operation and Maintenance	The roads to the site are between 500 m to 1 km of well-maintained public roads.	Option B shares a similar appraisal to Option A.
Cost		
Capital	Both switching station options A and B would require a similar platform to be constructed. The civil engineering costs to complete would be similar. A similar amount of diversion work would be required to accommodate the options. Public road improvements and tree felling are considered to be similar for both options. Option A has two third party land holdings.	Both switching station options A and B would require a similar platform to be constructed. The civil engineering costs to complete would be similar. However, given the orientation of existing electrical infrastructure within the existing switching station a greater amount of electrical work and reconfiguration of existing assets would be required to accommodate the connection utilising option B. A similar amount of diversion work would be required to accommodate the options however given the connection for Option B would require to come from the north and the cable connection routes from the south it is considered likely some additional reconfiguration or diversion works would be required. Public road improvements and tree felling are considered to be similar for both options. Option B has three third party land holdings.
Operational	Both options are considered to result in a similar design, setup, access and configuration and as such inspections and maintenance are similar for both options.	Option B shares a similar appraisal to Option A.

5.4.1 **Table 5-8** below shows the RAG Ratings for the Switching Station Options.

Environmentally, Switching Station Option A is preferred as it removes impact on commercial forestry.

From an engineering perspective, Switching Station Option A is preferred. Option A provides advantages over Option B in regard to space availability, topography and carbon footprint. Although Option B is preferable over Option A in regard to existing utilities due to the positioning of the existing 275 kV cable at the south of the Switching Station, the benefits outlined above outweigh this.

Switching Station Option A has been rated the least costly for construction, diversions and land assembly.

Overall Switching Station Option A is preferred.

Table 5-8 – RAG Ratings for Switching station option A and B

	Category	Sub-Topic	Switching Station Option A	Switching Station Option B
Environmental	**Natural Heritage**	Designations	H	H
		Protected Species	M	M
		Habitats	H	H
		Ornithology	L	L
		Geology, Hydrology and Hydrogeology	M	M
	Cultural Heritage	Designations	L	L
		Cultural Heritage Assets	M	M
	Landscape and Visual	Designations	M	M
		Character	M	M

	Category	Sub-Topic	Switching Station Option A	Switching Station Option B
		Visual	M	M
	Land Use	Agriculture	L	L
		Forestry and Woodland	M	H
		Recreation	M	M
	Planning	Policy	M	M
		Proposals	M	M
Engineering	**Connectivity**	Existing circuits/ networks	L	L
		Future development	M	M
		Interface with SSE distribution and generation	L	L
		DNO connection	L	L
	Footprint requirements	Technology	M	M
		Adjacent land use	M	M
		Space availability	L	H
	Hazards	Unique hazards	M	M

	Category	Sub-Topic	Switching Station Option A	Switching Station Option B
		Existing utilities	M	L
	Ground conditions	Topography	M	H
		Geology	M	M
	Environmental conditions	Elevation	L	L
		Salt pollution	L	L
		Flooding	M	M
		Carbon footprint	L	M
		SE6	M	M
		Contaminated land	M	M
		Noise (proximity to dwellings)	L	L
	Construction area	Substation access road (from public road)	H	H
		Transformer delivery road	N/A	N/A
	Operation and maintenance	Access	L	L
Cost	**Capital**	Construction	L	M

	Category	Sub-Topic	Switching Station Option A	Switching Station Option B
		Diversion	L	M
		Public road improvements	L	L
		Tree felling	L	L
		Land assembly	L	M
		Consent mitigations	L	L
	Operation	Inspection	L	L
		Maintenance	L	L

6. PREFERRED OPTIONS

Following on from the comparative analysis carried out in Section 5, the Preferred Options can be seen on **Figure 6.1** and comprises Substation Option 1, UGC Option 1B, and Switching Station Option A. The RAG Ratings for each of the Preferred Options can be seen in **Table 6-1**.

It is important to note that the Preferred Options are preferred based on the outcome of the environmental, engineering and cost analysis, and does not take consultation into account. Once consultation with the public and stakeholders has taken place, consultee comments will be considered, which may alter the Preferred Options in **Table 6-1** to **6-4** before they are taken forward as the Proposed Options.

Table 6-1 Environmental RAG Ratings of the Preferred Options.

	Category	Sub-Topic	Substation Option 1	UGC Cable Option 1B	Switching Station Option A
Environmental	**Natural Heritage**	Designations	H	H	H
		Protected Species	M	M	M
		Habitats	M	M	H
		Ornithology	L	L	L
		Geology, Hydrology and Hydrogeology	M	M	M
	Cultural Heritage	Designations	L	L	L
		Cultural Heritage Assets	M	L	M
	Landscape and Visual	Designations	H	M	M
		Character	H	M	M
		Visual	M	L	M
	Land Use	Agriculture	L	L	L
		Forestry and Woodland	H	L	M
		Recreation	M	M	M
	Planning	Policy	M	M	M
		Proposals	M	M	M

Table 6-2 Engineering RAG Ratings of the Preferred Options for the Substation and Switch Station

	Category	Sub-Topic	Substation Option 1	Switching Station Option A
Engineering	**Connectivity**	Existing circuits/ networks	L	L
		Future development	H	M
		Interface with SSE distribution and generation	L	L
		DNO connection	L	L
	Footprint requirements	Technology	M	M
		Adjacent land use	M	M
		Space availability	M	L
	Hazards	Unique hazards	M	M
		Existing utilities	M	M
	Ground conditions	Topography	H	M
		Geology	M	M
	Environmental conditions	Elevation	L	L
		Salt pollution	L	L
		Flooding	M	M
		Carbon footprint	M	L
		SE6	M	M
		Contaminated land	M	M
		Noise (proximity to dwellings)	L	L
	Construction area	Substation access road (from public road)	H	H
		Transformer delivery road	H	N/A
	Operation and maintenance	Access	L	L

Table 6-3 Engineering RAG Ratings of the Preferred Option for the UGC cable

	Category	Sub-Topic	Option 1B
Engineering	**Infrastructure Crossings**	Major Crossings	L
		Road Crossings	L
	Environmental Design	Elevation	L
		Atmospheric Pollution	L
		Contaminated Land	M
		Flooding	M
	Ground Conditions	Terrain	L
		Rock	M
		Peat	L
	Construction / Maintenance	Access	L
		Angles of Deviation	L
		Cable Haul Road	M
	Proximity	Clearance Distance	M
		Windfarms	L
		Communication Masts	L
		Urban Environments	L
		Metallic Pipelines	L
	Design	Reactive Compensation (HVAC circuits only)	L
		Joint Bays and Link Box Chambers	L

Table 6-4 Cost RAG Ratings of the Preferred Options

	Category	Sub-Topic	Substation Option 1	UGC Cable Option 1B	Switching Station Option A
Cost	**Capital**	Construction	H	M	L
		Diversion	L	L	L
		Public road improvements	L	L	L
		Tree felling	H	M	L
		Land assembly	L	L	L
		Consent mitigations	H	M	L
	Operation	Inspection	L	L	L
		Maintenance	L	L	L

7. CONSULTATION ON THE PROPOSALS

SSEN Transmission places great importance on, and is committed to, consultation and engagement with all parties, and stakeholders, likely to have an interest in proposals for new projects such as this. Stakeholder consultation and engagement is an essential part of an effective development process.

7.1 Questions for Consideration by Consultees

When providing your comments and feedback, SSEN Transmission would be grateful for your consideration of the questions below:

- Have we explained the need for this project adequately?
- Have we explained the approach taken to select the Preferred Options adequately?
- Are there any factors, or environmental features, that you consider may have been overlooked during the Preferred Options selection process?
- Do you feel, on balance, that the Preferred Options selected are the most appropriate for further consideration at the environmental assessment stage?

7.2 Next Steps

Consultation will be held as detailed in the preface of this document. The responses received from the consultation s, and those sought from statutory consultees and other key stakeholders, will inform further consideration of the options put forward, and the confirmation of the Proposed Options to take forward to the environmental assessment stage.

All comments are requested by Friday 18th November 2022. A Report on Consultation will be published after the consultation period has ended, which will document the consultation responses received, and the decisions made in light of these responses