

Volume 1: Chapter 4 - Alternatives and the Routeing Process

VOLUME 1, CHAPTER 4: ALTERNATIVES AND THE ROUTING PROCESS

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4. ALTERNATIVES AND THE ROUTEING PROCESS

4.1 Introduction

- 4.1.1 The need for the Proposed Development and the work undertaken by the Applicant to assess the strategic electricity transmission infrastructure requirements to identify a viable and enduring technical design solution is explained in **Volume 1, Chapter 2: Established Need for the Proposed Development**.
- 4.1.2 In accordance with Regulation 5(2)(d) and Schedule 4, paragraph 2 of the EIA Regulations, this Chapter describes the reasonable alternatives studied by the Applicant which are relevant to the Proposed Development and sets out the main reasons for the options which have been selected, taking account of their potential effects on the environment of the alternatives considered. The Chapter describes the consideration of alternatives that has been undertaken for the Proposed Development following the need identification, including both: (i) the alternative types of technology considered to address that need; and (ii) the routeing process for the selected technology type being an overhead line (OHL), comprising of the corridor, route and alignment selection stages.
- 4.1.3 The selection of the technology type for the proposed strategic connection option was undertaken by the Applicant following identification of the project need. This is explained further in **Section 4.2** and **4.3** taking account of the legislative framework and duties of the Applicant as a transmission licence holder particularly in relation to efficiency, economics and environmental considerations.
- 4.1.4 Following selection of the OHL technology, an iterative approach was undertaken for the identification, appraisal and selection of OHL alternatives through the corridor, route and alignment stages of the process. The routeing process¹ and the final configuration of the Proposed Development has been informed at each stage through the consideration of environmental, technical (engineering feasibility) and economic (cost) criteria; the environmental appraisal was undertaken by professional EIA practitioners at LUC and the technical and cost appraisals were undertaken by the Applicant's in-house specialist teams. It has also been informed by an ongoing process of consultation with statutory and non-statutory consultees, local communities and landowners. The approach has followed SSEN Transmission's *Routeing Guidance* which provides a systematic framework for the identification and appraisal of alternatives for OHL projects. The *Routeing Guidance* is explained further in **Section 4.4**.
- 4.1.5 The following diagram (**Plate 4.1: Summary of Design Evolution (2022 to 2025)**) provides a summary of the main project development stages following the technology choice and its introduction in December 2022 through to the Environmental Impact Assessment Report (EIAR) preparation and Section 37 application submission in August 2025. The diagram identifies the key activities undertaken and the timeframes in which the corridor, route and alignment options were prepared, reported and consulted on by the Applicant. The reasons for selection of alternatives at each stage were documented by the Applicant in the respective Reports on Consultation (RoCs) prepared following each consultation activity (see **paragraph 4.4.17** for document details). Information from these reports has been used to inform the summary of findings of the alternatives selection process in this Chapter.
- 4.1.6 The following terminology is referred to throughout this Chapter:
- Preferred Option: the Preferred Option at the corridor and routeing stages represents the corridor and route options which the Applicant identified as the best balance of environmental and technical constraints based on an initial appraisal.
 - Proposed Option: following the identification of a Preferred Option (corridor and route), the appraisal findings were then subject to consultation with stakeholders, where local and previously unknown considerations either confirmed or altered the Preferred Option. Following consultation, and once confirmed, the Proposed Option was taken forward to the next stage of project development.
 - Potential Alignment: the Potential Alignment refers to the alignment which the Applicant identified (following appraisal) as having the best balance of environmental and technical constraints.
 - Proposed Alignment: the Potential Alignment was taken to consultation (in autumn 2024), and the Applicant subsequently selected the Proposed Alignment for the OHL, taking account of the findings of the appraisals and the consultation

¹ The term 'routeing process' has been used generically to refer to the identification, appraisal and selection of preferred alternatives at the corridor, route and alignment stages of OHL project development.

feedback received. Following further minor adjustments to minimise environmental and technical constraints, this was then taken forward as part of the Proposed Development which was subject to EIA and to support the Section 37 application.

Plate 4.1: Summary of Design Evolution (2022 to 2025)

December 2022	Late 2022 to Early 2023	May to July 2023	July to October 2023	July to October 2023
Project Introduction Publicity	OHL Corridor and Route Selection	Corridor and Route Options Consultation	Revised Substation Site Selection (Fiddes to Hurlie)	Review of OHL Route Options
The Kintore to Tealing 400 kV OHL is introduced to the public and stakeholders with information uploaded to SSEN Transmission's website including advanced notification of upcoming public events in early 2023.	Identification and appraisal of OHL corridor and route options following SSEN Transmission's <i>Routeing Guidance</i> . In parallel, site options are identified and appraised for substations near Tealing (Emmock) in Angus and at Fiddes in Aberdeenshire.	A Preferred Corridor (in two sections, 1 and 2) and a Preferred Route (in six sections, A to F) for the new OHL is shared with stakeholders together with the two preferred substation sites (near Tealing (Emmock) and Fiddes). Within each Section, multiple corridor and route options were identified for appraisal. Community feedback is received regarding the proposed siting of the Fiddes substation and overall need for the project.	Drawing on stakeholder consultation, alternative locations for the Fiddes substation site (including potential OHL route connections) are appraised. A new preferred substation site is selected in Fetteresso Forest (Hurlie) west of Stonehaven.	Reflecting on stakeholder consultation and the change in substation from Fiddes to Hurlie, the Preferred Route in all sections of the OHL is reviewed. New routes are identified in Sections D and the southern part of E to provide connections to Hurlie substation. A new route in Section F (Option F1.3) is also identified.
November 2023	November 2023 to March 2024	March to April 2024	August 2024	May to September 2024
Report on Consultation (RoC)	New OHL Route Selection	New Route Options Consultation	Report on Consultation	OHL Alignment Selection
RoC confirms the Proposed Corridor (1b and 2b) for the OHL. It also explains the new route options to be appraised in Sections D and the southern part of E to connect with Hurlie substation, and confirms the Proposed Routes in Sections A, B, C, the northern part of E and the new Preferred Route F1.3 in Section F.	New route options in Sections D and the southern part of E are appraised in regard to the Hurlie substation to identify preferred route options. Appraisal of Route F1.3 is also prepared.	A Preferred Route for the OHL in Section D and the southern part of Section E is presented to stakeholders. At the same time a new alternative Route F1.3 appraisal is provided at consultation. Information is also provided on refinements to the boundaries of some parts of the Proposed Routes in Sections A, B, C and the northern part of F ('Refined Routes').	RoC confirms the Proposed Route in Section D following the new routes consultation. Recognising the feedback, an additional option in Section E to F is identified to provide an alternative to Route F1.3 to avoid Drumoak village. RoC also confirms the Proposed Route in Sections A-C and the additional options to be taken forward within which alignment designs will be developed and appraised.	Identification and initial design of a Potential Alignment and identification, design and appraisal of Alternative Alignments at eight locations for the OHL in the Proposed Route.
September to October 2024	October 2024 to January 2025	January 2025	January to February 2025	February to August 2025
Alignment Consultation	Review of Potential Alignment	Report on Consultation	Detailed Design of Proposed Alignment	Pre-Application Consultation (PAC)
The Potential Alignment is presented to stakeholders with the appraisal of Alternative Alignments in eight locations. This includes selecting alternatives which avoid the settlements of Drumoak and Echt. Feedback is sought on the alternatives identified as part of the Potential Alignment to inform the final design and EIA.	Following field surveys and the review of consultation feedback on the Alternative Alignments, further design refinement is undertaken of the Potential Alignment and includes confirmation of the Proposed Alignment for all OHL sections. This includes one change to the alignment at Schoolhill (Location 7 in Section F) from the Potential Alignment selected prior to the Alignment Consultations.	RoC confirms the Proposed Alignment for the OHL. It provides detailed responses to feedback received during consultation on the Alternative Alignments as well as general project themes including reconfirming the need for the project and technology choice. Information includes minor adjustments made to the Potential Alignment from the design presented at consultation to avoid localised constraints.	OHL alignment and access designs are developed to a level of detail to support the EIA and Section 37 application. Mitigation is incorporated into the design wherever feasible to avoid environmental effects at source. Pre-application consultations continued with local authorities and other statutory consultees.	A final public consultation is held to present updated details of the Proposed Alignment for the OHL including indicative tower and access track locations. Public events are held in various locations in the vicinity of the Proposed Alignment. A PAC Report is prepared and submitted with the EIAR and Section 37 application to Scottish Government. This report summarises project consultation activity, the feedback provided and how this has been considered in the design development by SSEN Transmission.

4.1.7 The initial sections of this Chapter (**Sections 4.2 to 4.3**) outline the relevant statutory framework, and the strategic alternatives considered by the Applicant in defining the nature of the project and its technology in response to the needs case identified and established by the relevant UK Government agencies and as set out in **Volume 1, Chapter 2: Established Need for the Proposed Development**. The principal stages which were subsequently followed in the development of the new OHL transmission infrastructure are then described in subsequent sections of this Chapter, along with their respective outcomes:

- the approach to the corridor, routeing and alignment selection stages for the Proposed Development (**Section 4.4**);
- the corridor selection stage process including corridor options identification and findings of the corridor options appraisal (**Section 0**);
- the route selection stage process including route options identification and findings of the route options appraisal which was undertaken over two key stages (**Section 0**);
- the alignment selection stage process including alignment options identification and findings of the alignment options appraisal (**Section 0**);
- further consideration of alternatives during development of the design of the Proposed Alignment and the EIA process (**Section 0**); and
- a summary of the selection of alternatives (**Section 4.9**).

4.2 Alternatives Considered

Statutory and Licence Framework

- 4.2.1 It is important to set out the statutory and licence framework that informs the practice of the Applicant when determining: (i) the type of infrastructure technology; and (ii) the route for that infrastructure.
- 4.2.2 Firstly, SSEN Transmission as a transmission licence holder, has a statutory duty under Section 9(2)(a) of the *Electricity Act 1989* to “develop and maintain an efficient, co-ordinated and economical system of electricity transmission”.
- 4.2.3 Secondly, SSEN Transmission has a statutory duty under Schedule 9 (para. 3) of the *Electricity Act 1989*, “when formulating proposals to generate, transmit, distribute or supply electricity” to:
- “have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest”; and
 - “do what [it] reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects.”
- 4.2.4 Thirdly, under the terms of the transmission licence, SSEN Transmission is obliged to comply with the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS)², which provides the criteria for the planning and design of the transmission system. The NETS SQSS requires SSEN Transmission to provide a transmission connection capable of withstanding single circuit faults without loss of supply and without disconnection of generation stations.
- 4.2.5 Fourthly, the requirements of the *Construction (Design and Management) Regulations 2015 (CDM Regulations)*³ require that the design aims to minimise hazards and reduce risks during construction, operation and maintenance of assets.
- 4.2.6 Taking account of these obligations, SSEN Transmission has considered environmental, technical and cost factors in identifying and evaluating the reasonable alternatives for the Proposed Development.

Scope of Alternatives Study

- 4.2.7 The *EIA Regulations* require the Applicant to report upon the reasonable alternatives that were studied and the main reasons for the choice of the development, taking into account the environmental effects. **Section 4.3** describes the strategic and technological alternatives that have been considered by SSEN Transmission in taking forward the Proposed Development in

² National Energy System Operator (NESO), 2024. *National Electricity Transmission System Security and Quality of Supply Standard, Version 2.8*. [Online] Available at: <https://www.neso.energy/industry-information/codes/security-and-quality-supply-standard-sqss/sqss-code-documents>.

³ UK Government, 2015. *The Construction (Design and Management) Regulations 2015*, UK Statutory Instrument 2015 No. 51 Health and Safety. [Online] Available at: <https://www.legislation.gov.uk/uksi/2015/51/contents>.

response to the needs case which has been set out in **Volume 2, Chapter 2: Established Need for the Proposed Development**. In summary, those alternatives were:

- **Do nothing:** the “do-nothing” scenario; and
- **Alternative technology types:** subsea cable and underground cable (UGC) options.

4.2.8 **Section 4.4** summarises the routeing process then undertaken by the Applicant for the selected technology type, describing the approach to the corridor, routeing and alignment selection stages of the project.

4.2.9 **Sections 0 to 0** describe in more detail the alternatives considered for the selected technology with the objective of identifying a Proposed Alignment and associated Limit of Deviation (LOD) for the OHL which is technically feasible, economically viable and, wherever possible, minimises disturbance to the environment and to the people who live, work, visit and enjoy recreation within it.

4.3 Strategic Alternatives: Do Nothing Scenario and Technology Types

“Do Nothing” Scenario

4.3.1 As established in **Volume 1, Chapter 2: Established Need for the Proposed Development**, the Proposed Development is of national importance, contributing significantly towards the delivery of UK and Scottish Government’s Net Zero Targets and helping reduce the UK’s dependence on imported oil and gas. In a “do-nothing” scenario, the current electricity network would not have capacity to support the transfer of power from both onshore and offshore renewable generation in the north of Scotland to key centres of demand across the country, and therefore the UK Government’s targets of 50 gigawatts (GW) of offshore wind generation by 2030 and delivery of Net Zero targets could not be met. This Strategic Option would not meet the requirements of the network and was discounted from further consideration given it did not represent a reasonable alternative. Accordingly, it was necessary to consider the available options for new infrastructure, during the holistic network design (‘HND’) and network options assessment (‘NOA’) processes.

Alternative technology types: HND and NOA process

Primary solution: OHL or UGC

4.3.2 When undertaking the initial assessment of the technology options to reinforce the transmission network (as set out in **Volume 2, Chapter 2: Established Need for the Proposed Development**) SSEN Transmission’s System Planning and Network Investment team assessed the potential technical options against its statutory and licence framework described at **Section 4.2**. As noted in **Chapter 2**, this consisted of both onshore and offshore options. In this case, an onshore option was selected, which meant that there was an initial strategic choice to make between UGC or OHL technology for the entire length of the route. At that time, the key factor distinguishing these two technology types was their relative cost. In summary:

- **IET endorsed Costing Study:** at the time the technology options were being considered, the Applicant was mindful of the study titled ‘*Electricity Transmission Costing Study: An Independent Report Endorsed by the Institution of Engineering & Technology*’, authored by Parsons Brinckerhoff in April 2012 (“the Parsons Brinckerhoff Report”). The report concluded that an underground cable had a build cost rate of 6.9-17.2 times greater than OHL, with a lifetime cost of 4.9-10.5 times greater (please see the cost comparison charts and tables in Section 8 of the Parsons Brinckerhoff Report⁴). The Parsons Brinckerhoff Report was a general (rather than project-specific) study and does not seek to establish a cost ratio that can be applied to all projects (see page vii). Nonetheless, the purpose of the report was to assist in determining the acceptability of a project in planning terms, ‘*based on an accredited view of the relative costs*’ (Foreword). The report sets out the key reasons why UGC is significantly more expensive than an OHL over an equivalent distance.
- **Draft UK Government Policy:** The Draft Overarching National Policy Statement of Energy dated 2021 (EN-1)⁵ and its supporting Draft National Policy Statement for Electricity Networks Infrastructure dated 2021 (EN-5)⁶, had also been

⁴ Institute of Engineering and Technology (IET) Electricity Transmission Costing Study - An Independent Report (2012) report by Parsons Brinckerhoff.

⁵ Department of Energy Security and Net Zero (2021) Draft Overarching National Policy Statement EN-1 Overarching National Policy Statement for Energy.

⁶ Department of Energy Security and Net Zero (2021) Draft Overarching National Policy Statement of Energy: EN-5 Electricity Networks National Policy Statement - final word version.

published at the time the options were being considered. EN-5, in particular, introduced the UK Government’s ‘strong starting presumption’ in favour of an overhead line (para. 2.9.21) on the basis of, among other factors, the ‘*additional cost of the proposed underground... alternatives, including their significantly higher lifetime cost of repair and later uprating*’ (para. 2.9.26).

- 4.3.3 With consideration of these factors, the applicant’s submission to the National Energy System Operator (NESO) (previously National Grid ESO) to inform the onshore options was based upon costs for OHL as the use of UGC did not meet the requirements for an economical network when a suitable alternative comprising OHL was available to perform the required network function.
- 4.3.4 After the NESO recommendations to proceed with the reinforcements, the development of the Kintore to Tealing 400 kV OHL Connection project commenced based on using OHL technology for its entire length.
- 4.3.5 During project development, the final published versions of the Overarching National Policy Statement for Energy (EN-1)⁷ and its supporting National Policy Statement for Electricity Networks Infrastructure (EN-5) reinforced that decision. In particular, section 2.9.20 of EN-5 affirmed the UK government’s “strong starting presumption”⁸ for OHL. In addition to the cost of undergrounding, there are further technological challenges that were explained to consultees during the project development phase (as noted below).

Combined Solutions: Partial Underground Cable Options

- 4.3.6 Through the development stages (refer to **Section 4.4**), where challenges to the consenting, construction or operation of an OHL are identified, the potential use of shorter sections of UGC were borne in mind by the project team. However, in the present case, there were no challenges that could not be overcome through re-routings the OHL to minimise impacts on sensitive areas such as those of national significance. This meant that, in turn, it was possible to avoid through other means both: (i) the technical engineering challenges; and (ii) system limitations that would be inherent in partial use of UGC on a 400 kV line.

Technical Challenges of Undergrounding

- 4.3.7 As part of the consultation phase (during project development), the Applicant explained the technical challenges involved in undergrounding to consultees. These challenges were presented within “*The challenges with undergrounding at 400 kV*” document⁹, which explains in general terms the rationale behind the Applicant’s decision to adopt a continuous OHL route. These challenges are explained in more detail in **Section 0**.

System Limitations of Short Sections of Underground Cable

- 4.3.8 A key technical consideration when assessing UGC sections is the impact to the wider transmission network. High voltage UGC causes the network to operate less efficiently and generates constraint issues. UGC does not transport electricity as efficiently as OHL and requires new or upgraded substation sites to house reactive compensation equipment. This equipment is essential to manage the flow of electricity through the network when using UGC. It would increase the size of existing substation footprints or require new sites to be constructed. Reactive compensation equipment is not relied upon to the same extent when using OHL and is part of the reason UGC are more expensive than OHL technology. Fundamental to the use of short sections of UGC is the availability of suitable sites to extend or build new substations whilst minimising technical challenges and environmental impacts.
- 4.3.9 During 2023, studies were conducted by SSEN Transmission on the impact of introducing UGC onto the 400 kV network. It was determined that the estimated length at which reactive compensation infrastructure would be required would be between 1-2 km of 400 kV UGC installed across the entirety of the over 500 km of new 400 kV OHL infrastructure. Notwithstanding the environmental, technical and cost considerations, introducing UGC sections presents challenges to achieve a functionally operable and compliant circuit on a comparable basis with 400 kV OHL.

⁷ Department of Energy Security and Net Zero (2023) Overarching National Policy Statement for Energy (EN-1).

⁸ Department for Energy Security and Net Zero (2023) National Policy Statement for Electricity Networks Infrastructure (EN-5).

⁹ SSEN Transmission, n.d. *The challenges with undergrounding at 400 kV*. [Online] Available at: <https://www.ssen-transmission.co.uk/globalassets/projects/2030-projects/2030-project-documents/the-challenges-with-undergrounding-at-400kv.pdf>

4.3.10 In line with the above, and in consideration with the system limitations, environmental, technical and cost challenges described, the practical application of 400 kV underground cabling was not considered to be a reasonable alternative technology at any stage of the development of the Proposed Development. Therefore, the Proposed Development has been progressed as a high voltage OHL in accordance with the process described in the sections below. Moreover, as noted below, the Applicant's decision during the project development/consultation phases to adopt a continuous OHL is further supported by factors that have been considered in further detail (or which have emerged) during the EIA study, as noted below at **Section 0**.

4.4 Alternative OHL Corridors, Routes and Alignments

Introduction

4.4.1 Following establishment of the need for the project, and selection of the preferred strategic option to deliver it (as previously detailed), the consideration of alternatives by the Applicant focused on the identification and selection of the new OHL alignment. This process is referred to as 'routeing' and encompasses the consideration, in a sequential approach, of a reasonable range of suitable corridors, routes and alignments for the OHL. This section of the Chapter provides an overview of the approach taken to routeing in accordance with SSEN Transmission's bespoke routeing process guidance.

4.4.2 Following the overview of the approach taken to routeing for the Proposed Development, which is set out in this section, the remainder of this Chapter presents information about the OHL corridor, route and alignment alternatives that were identified, appraised and selected as part of the routeing process. The findings of the work undertaken on the selection of alternatives at each stage of the routeing process is presented for OHL corridor options (**Sections 0**), route options (**Sections 0**) and alignment options (**Sections 0**).

The Routeing Process and Guidance

4.4.3 Routeing of new high voltage OHLs has traditionally been informed by guidelines known as the *Holford Rules*¹⁰ which have been widely used throughout the UK electricity supply industry since the 1960s. The *Holford Rules* set out a hierarchical approach to routeing which advocates the avoidance of areas of high amenity value, minimising changes in direction, taking advantage of topography, and minimising visual interaction with other transmission infrastructure.

4.4.4 In accordance with the steps outlined in the *Holford Rules* and SSEN Transmission's *Routeing Guidance*, the following principles have been followed during the corridor, route and alignment stages (where applicable) for the Proposed Development:

- avoid, if possible, the major areas of highest amenity value (including those classified as international and national designations and other sensitive landscapes);
- by deviation, avoid smaller areas of high amenity value;
- try to avoid sharp changes of direction which would reduce the number of larger angle towers required;
- in key views, avoid skylining the route and where necessary, obliquely cross ridges where a dip provides an opportunity;
- the OHL should be directed towards open valleys and woods where the scale of towers will be reduced, and views of the OHL would be broken by trees (try to avoid slicing through landscape types and keep to edges and landscape transitions wherever possible);
- to avoid a high concentration or dominating 'wirescape' effects, consider the appearance of other lines in the landscape; and
- approach urban areas through industrial zones, where they exist; and when pleasant residential and recreational land intervenes between the approach line and the substation, go carefully into the comparative costs of the undergrounding, for lines other than those of the highest voltage.

4.4.5 Based on the principles set out in the *Holford Rules*, SSEN Transmission has developed its own guidance, '*Procedures for Routeing Overhead Lines and Underground Cables of 132 kV and above*'¹¹ (hereafter referred to as SSEN Transmission's

¹⁰ National Grid, n.d. *The Holford Rules*. [Online] Available at: <https://www.nationalgrid.com/sites/default/files/documents/13795-The%20Holford%20Rules.pdf>.

¹¹ SSEN Transmission, 2018. *Procedures for Routeing Overhead Lines of 132kV and above* (updated in September 2020 to include underground cables of 132 kV and above). PR-NET-ENV-501.

Routeing Guidance)¹². Within this, the Applicant has broadened the basis for routeing decisions to reflect contemporary practice, and to provide a framework to ensure environmental, technical and cost considerations are identified and appraised at each stage of the consideration of alternatives in the routeing process. The application of this guidance also helps to ensure that SSEN Transmission fulfils its statutory obligations under the *Electricity Act* which require the Applicant to have regard to preservation of a range of features and sites of natural and cultural heritage importance and to reasonably mitigate the effects of the proposals on them (see **Section 4.2**).

- 4.4.6 The approach to corridor, route and alignment identification, appraisal and selection for the Proposed Development has therefore been informed by SSEN Transmission's *Routeing Guidance*. It supports the options selection and appraisal process through a number of stages for OHL routeing:
- Stage 1: Corridor Selection – to identify corridors which are as short as practicable, which are not constrained by altitude or topography and which would avoid where possible interaction with infrastructure and features of environmental sensitivity.
 - Stage 2: Route Selection – to find routes within the selected corridor(s) which avoid physical, environmental and amenity constraints as far as possible, which are likely to be acceptable to stakeholders, and are economically viable.
 - Stage 3: Alignment Selection – which seeks to identify an alignment for the OHL within the selected route(s) and the means of access to it, taking account of local constraints including properties and their amenity, ground suitability, habitats, cultural heritage and ecological sensitivities.
- 4.4.7 Each stage involves an iterative process, increasing in detail and resolution, bringing environmental, technical and cost considerations together in a way which seeks to achieve the best balance taking account of all key identified constraints. The stages that are carried out can vary depending on the type, nature and size of a project.
- 4.4.8 For the Proposed Development, the strategy for routeing determined that a comprehensive approach to consultation would be carried out throughout the routeing process. The principal consultation stages which were followed, and the methods of engagement with stakeholders, are set out further in **Volume 1, Chapter 6: Scope and Consultation**. The key feedback from each consultation is referred to in later sections of this chapter where this informed the key reasons for selection of alternatives by the Applicant at each stage of the routeing process.

Approach to Routeing for the Proposed Development

- 4.4.9 The approach to selection of alternatives followed a process based on the identification of options, the appraisal of the options following the *Routeing Guidance* and the selection of preferred options taking account of the findings of the appraisals and feedback from stakeholders, including that provided through formal public consultation stages and events. This sequential approach was followed through Stages 1 to 3 of OHL corridor, route and alignment selection.
- 4.4.10 A digital routeing toolkit was used to help identify alternatives to connect the Proposed Development from the existing Kintore Substation to the proposed new substations. Initial constraints data sets were gathered, reviewed and assessed using a Geographical Information System (GIS) platform. The constraints were layered onto a map so they could be viewed as a composite 'heat map' and potential alternatives were developed based on a 'Least Impact Pathway' analysis which identified areas within which an OHL could be routed which had the least interaction with physical, environmental and technical constraints. Further data sets including those derived from field surveys later in the process were added to the GIS platform to support the identification of lesser constrained alternatives and to inform spatial analyses used as part of the appraisals.
- 4.4.11 Appraisal of the level of environmental, technical and cost constraints at Stages 1 to 3 followed SSEN Transmission's *Routeing Guidance* which provides a standardised methodology for multicriteria options appraisal for OHL corridors, routes and alignments. The key appraisal criteria are as follows:
- Environmental:
 - Natural Heritage – designations; protected species; habitats; ornithology; hydrology, geology and hydrogeology; and consideration of Biodiversity Net Gain (BNG);

¹² A summary of SSEN Transmission's approach to the routeing process is set out in 'Routeing Overhead Lines' guidance note. SSEN Transmission, n.d. Routeing Overhead Lines guidance note. [Online] Available at: <https://www.ssen-transmission.co.uk/globalassets/projects/2030-projects/2030-project-documents/routeing-overhead-lines.pdf>.

- Cultural Heritage – designations; and cultural heritage assets (including their setting);
- People – proximity to dwellings;
- Landscape and Visual – designations; landscape character; and visual amenity;
- Land Use – agriculture; forestry and woodlands (including ancient woodland); and recreation; and
- Planning – policy; and proposals;
- Technical:
 - Infrastructure crossings – major crossings; and road crossings;
 - Environmental design – elevation; atmospheric pollution; contaminated land; and flooding;
 - Ground conditions – terrain; and peat;
 - Construction/maintenance – access; and angle towers; and
 - Proximity – clearance distance; wind farms; communication masts; urban environments; and metallic pipelines;
- Cost:
 - Capital; and
 - Operational.

4.4.12 The SSEN Transmission *Routeing Guidance* sets out the key factors (sub-criteria) to be considered and appraised in relation to the constraints for each of the listed criteria. Each alternative was appraised drawing on this guidance and supported by a comprehensive GIS analytical tool and with reference to:

- other available published constraints data;
- input from statutory consultees and organisations having an interest in the project;
- information gathered by the project team from preliminary site visits; and
- at Stage 3 (Alignment) from specific field surveys within the Proposed Route.

4.4.13 The appraisal findings for each alternative were captured within appraisal tables which allowed for consistent appraisal of topics and criteria and for presentation of the findings of the analysis of constraints. A Red/Amber/Green (RAG) rating was then applied to each criteria for each alternative, indicating the potential level of constraint to development identified from the appraisal process and informing identification of the preferred alternative. For each criterion appraised, assignment of a Red rating indicates a high potential for the development to be constrained; Amber indicates an intermediate potential for the development to be constrained; and Green indicates a low potential for the development to be constrained as per **Plate 4.2: RAG Rating Categories**.

Plate 4.2: RAG Rating Categories

Performance	Comparative Appraisal
Most preferred	Low potential for the development to be constrained
	Intermediate potential for the development to be constrained
Least preferred	High potential for the development to be constrained

4.4.14 The RAG ratings for each topic were used to examine the differences between the options being considered based on the analysis of the level of constraint present for each option considered. The appraisal compared the wider implications of each option on those topics (both individually and combined) and reached a reasoned conclusion, on balance across all the topics, regarding the least constrained alternative.

4.4.15 For the Proposed Development, reports were prepared detailing the appraisal of alternatives at each stage and the Applicant consulted on the findings of the appraisals on three separate occasions (see **Section 4.1, Plate 4.1: Summary of Design Evolution (2022-2025)** and **paragraph 4.4.17** for details of these reports). These appraisal reports, known as 'Consultation Documents', set out the approach to identification and proposed selection of alternatives and captured the detailed findings of

the appraisals undertaken to help identify a Preferred¹³ Corridor, Route and Alignment for the OHL. The Consultation Documents were made available at the start of each consultation period together with supporting maps and booklets. Following the close of each consultation period, all the feedback received from communities, landowners and other stakeholders was reviewed, together with updated information including relevant survey findings. The available information was considered by the Applicant to determine whether any changes to the findings of the appraisals was required or to inform refinement of the option or alignment design. Following this review, confirmation of the alternatives selected to be taken forward at each stage was publicised. The feedback received from these consultations was documented in a series of Reports on Consultation (RoC) which were published by SSEN Transmission following each consultation setting out their responses to the comments raised and the reasons for selection of the Proposed Corridor, Route and Alignment (see below).

- 4.4.16 Further information on the overall approach to consultation undertaken through the project's pre-application stages, including a more detailed coverage of issues raised in relation to the scope of the EIA, is presented in **Volume 1, Chapter 6: Scope and Consultation**.

Routeing Documents

- 4.4.17 The following documents have been prepared throughout the consideration of alternatives in design development for the proposals and were issued as part of the series of consultation events at the corridor, route and alignment selection stages. These documents are referenced throughout the remainder of this Chapter¹⁴ and provide further detail of appraisal findings, consultation feedback and selection of alternatives for the summaries presented in **Sections 0 to 0**.
- Consultation Document – Corridor Selection. Project: Kintore-Fiddes-Tealing 400 kV Overhead Line Connection (May 2023, REF: LT455): <https://www.ssen-transmission.co.uk/globalassets/projects/east-coast-phase-2-may-2023-docs/ohl-consultation-doc/consultation-document-corridor-selection---kintore-fiddes-tealing-400kv-ohl-connection-090523.pdf>
 - Consultation Document – Route Selection. Project: Kintore-Fiddes-Tealing 400 kV Overhead Line Connection (May 2023, REF: LT455): <https://www.ssen-transmission.co.uk/globalassets/projects/east-coast-phase-2-may-2023-docs/ohl-consultation-doc/consultation-document---route-selection-may-2023.pdf>
 - Kintore to Tealing 400 kV Overhead Line: Report on Consultation (November 2023): <https://www.ssen-transmission.co.uk/globalassets/projects/rocs/tkup-ohl/report-on-consultation---kintore-to-tealing-400kv-ohl.pdf>
 - Consultation Document – Kintore to Tealing 400 kV Overhead Line. New Overhead Line Routes (REF: LT455, February 2024): <https://www.ssen-transmission.co.uk/globalassets/projects/kintore---tealing-400kv-ohl-downloads/march-2024-consultation-docs/kintore-to-tealing-consultation-document-new-route-selection-february-2024.pdf>
 - Kintore to Tealing 400 kV Overhead Line: Report on Consultation (August 2024): <https://www.ssen-transmission.co.uk/globalassets/projects/rocs/tkup-ohl-august-24/report-on-consultation-august-2024.pdf>
 - Consultation Document – Alignment Selection. Kintore to Tealing 400 kV Overhead Line (REF: LT455, September 2024): <https://www.ssen-transmission.co.uk/globalassets/projects/kintore---tealing-400kv-ohl-downloads/september-2024-consultation-docs/september-october-2024-alignment-consultation-document.pdf>
 - Kintore to Tealing 400 kV Overhead Line: Report on Consultation – Alignment Selection (January 2025): <https://www.ssen-transmission.co.uk/globalassets/projects/kintore---tealing-400kv-ohl-downloads/alignment-report-on-consultation/kintore-tealing-report-on-consultation-january-2025.pdf>
- 4.4.18 The specific approach to, and findings of, the identification, appraisal and selection of alternatives for each stage of the project's design development are summarised in the remainder of this Chapter.

¹³ The Preferred Option at each of these stages represents the option which the Applicant identified as the best balance of environmental and technical constraint from initial appraisal. The appraisal findings were then subject to consultation with stakeholders, where local and previously unknown considerations may confirm or alter the initial option preference. Following consultation, and once confirmed, the Proposed Option was taken forward to the next stage of project development.

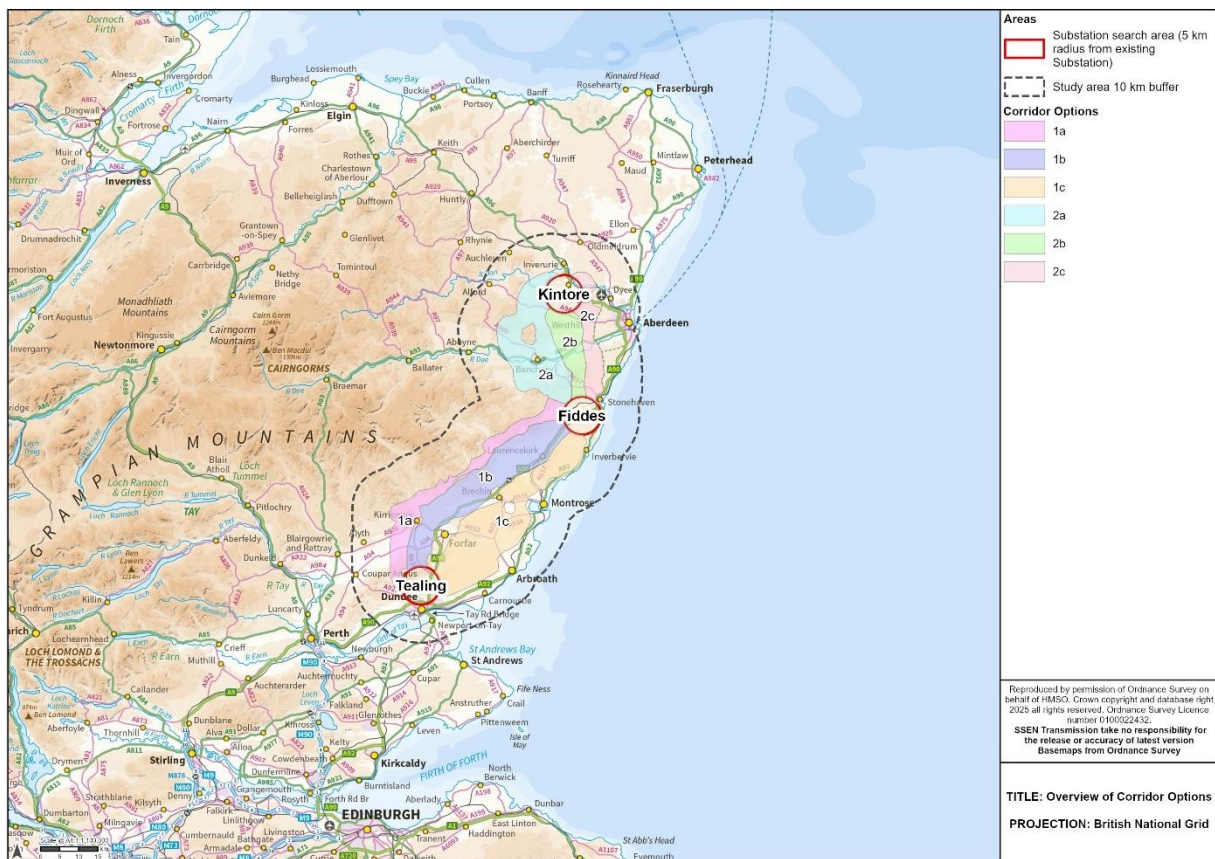
¹⁴ All documents prepared and issued as part of the consultation events are available on the SSEN Transmission Project Webpage: <https://www.ssen-transmission.co.uk/projects/project-map/kintore-tealing-400kv-ohl-connection/#panel-2>

4.5 Corridor Options Selection

Corridor Options Identification

- 4.5.1 Corridor options were identified as broad study areas within which route options for the Proposed Development could subsequently be identified.
- 4.5.2 The study area for the corridor options is located within the administrative areas of Angus and the southern part of Aberdeenshire in North East Scotland. The extent of this study area was primarily defined as the area between the North Sea coast to the east and upland terrain to the west which forms the lower slopes of the Cairngorm mountains. In the east, the study area was constrained by a number of other key considerations which included several small towns and other settlements, airport restricted zones, Montrose Basin (an internationally designated natural heritage site) and the A90 and A92 dual carriageways.
- 4.5.3 Due to the length of the Proposed Development (approximately 105 km), and to facilitate the presentation of information and appraisals, the corridor was separated into two sections: Section 1: Tealing to Fiddes (the southern section); and Section 2: Fiddes to Kintore (the northern section). Within each corridor Section, and drawing on the outputs of the constraints-based 'heat map' approach described in **Section 0**, three potential corridor options (referenced as a, b and c from west to east) were identified for appraisal (see **Volume 3, Figures 4.1.1 – 4.1.3: Overview of Corridor Options**, and **Plate 4.3: Corridor Options (May 2023)**).

Plate 4.3: Corridor Options (May 2023)



- 4.5.4 Section 1 covers the southern part of the study area between Tealing and Fiddes. Three corridor options were identified, from west to east: Corridors 1a, 1b and 1c (see **Volume 3, Figure 4.1.2: Corridor Options (Section 1)**). The Section passes through predominantly agricultural land interspersed with areas of woodland and drained by watercourses generally following a west to east course towards the North Sea. There are a number of small towns and villages in this Section and the A90 dual carriageway runs broadly north to south through a large portion of the corridor. The western boundary of Section 1 is formed by the rising topography towards the upland area which falls within the Cairngorms National Park and the eastern boundary broadly by the A92 public road.

- 4.5.5 Section 2 covers the northern part of the study area between Fiddes and Kintore. Three corridor options were identified which broadly follow a north-south orientation. These are, from west to east, Corridor 2a, 2b and 2c (see **Volume 3, Figure 4.1.3: Corridor Options (Section 2)**). Section 2 passes through predominantly agricultural land, with some areas of commercial forestry, particularly on areas of more elevated ground to the west. It is bound to the east by the A90 dual carriageway, avoiding the large settlements of Aberdeen and Stonehaven (to its east) and excludes the settlement of Banchory and elevated ground of the Hill of Fare to the west. Section 2 is generally constrained to the west by the rising ground topography towards the uplands located within the Cairngorms National Park.

Corridor Options Appraisal

- 4.5.6 Appraisal of the environmental, technical and cost constraints within the corridor options involved systematic consideration against the topic areas and criteria derived from SSEN Transmission's *Routeing Guidance* as detailed in **Section 4.4**.
- 4.5.7 A description of the findings of the appraisal of corridor alternatives, leading to identification of the Preferred Corridor, is set out below for Sections 1 and 2 of the Corridor study area. The reasons for the selection of the Proposed Corridor by the Applicant are then summarised. The corridor options appraisal is presented in full within the *Corridor Selection Consultation Document* (May 2023) (see **paragraph 4.4.17**). The key feedback from consultation on these options is presented in the *Report on Consultation* (November 2023) which is also referenced in **paragraph 4.4.17**.

Section 1: Tealing to Fiddes

- 4.5.8 The appraisal of alternatives identified Corridor 1b as the Preferred Corridor from an environmental, technical and cost perspective based on the following key findings:
- Whilst woodland areas were present across all the options, Corridor 1b contained the lowest proportion of Ancient Woodland and had localities within the corridor where floodplains were narrower and could be more comfortably spanned by an OHL. It did not intersect any Special Protection Areas (SPAs), whereas Corridor 1a and 1c did, and intersected fewer other designated sites of natural heritage importance than Corridor 1c (Ramsar, Special Area of Conservation (SAC), Site of Special Scientific Interest (SSSI), Local Nature Reserve (LNR) and Local Nature Conservation Site (LNCS)).
 - Corridor 1b was considered to have least constraint from a landscape and visual perspective with greater potential to avoid or reduce constraints presented by landscape sensitivities (including designated landscapes such as Special Landscape Areas (SLAs)) than Corridors 1a and 1c.
 - The terrain was relatively flat and at lower elevations than in Corridor 1a and further from the coast than Corridor 1c. Corridor 1b also largely avoided more densely populated areas, providing more flexibility for future OHL routeing from properties and with likely fewer technical challenges for construction due to the extent of the existing road and access network, reducing the need for new access infrastructure.
 - Corridor 1b represented the lowest cost option from both a capital and operational perspective. It avoided crossing existing high voltage OHLs and was located further from the coast than Corridor 1c where additional maintenance requirements to prevent corrosion would be anticipated.
- 4.5.9 As noted in the November 2023 RoC (see **paragraph 4.4.17**), following review of feedback from the May 2023 consultation relevant to the Corridor Options, no information was received which warranted further appraisal or review of the evidence base supporting the Applicant's preference for the Preferred Corridor. Therefore, the Proposed Corridor in Section 1 taken forward to the routeing stage was Corridor 1b as it was considered to be the least constrained option overall across the environmental, technical and cost considerations.

Section 2: Fiddes to Kintore

- 4.5.10 The appraisal of alternatives identified Corridor 2b as the Preferred Corridor from an environmental, technical and cost perspective based on the following key findings:
- From an environmental perspective, there was little to distinguish between Corridors 2b and 2c and they were relatively evenly matched in terms of level of identified land use, natural and cultural heritage constraints. Although Corridor 2a was considered to have a lower level of constraint with regards to natural heritage designations, each of the options was constrained to some extent particularly in relation to the Loch of Skene SPA in the northern part of the corridor.

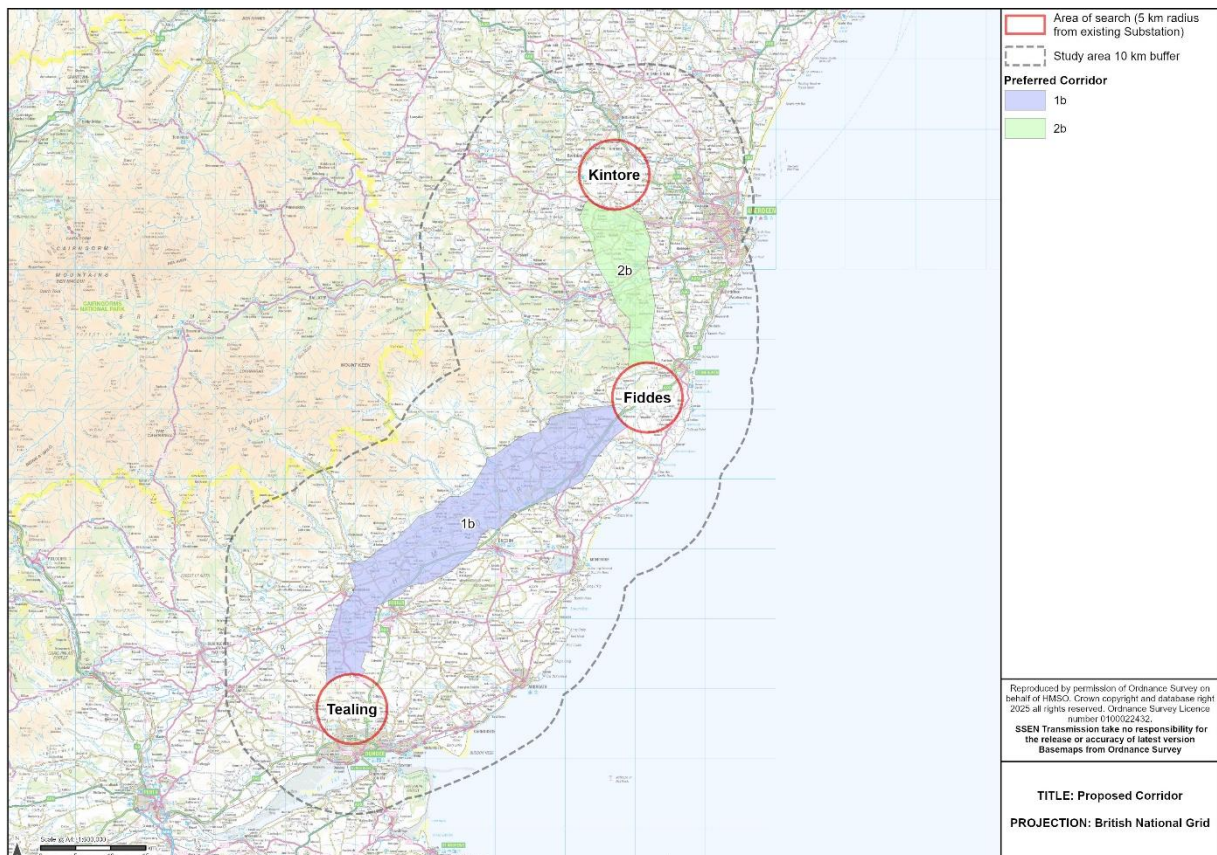
- Corridor 2b presented a more favourable alternative for the landscape and visual sub-discipline compared to Corridors 2a and 2c. It was considered to cross the sensitive and designated landscape associated with the River Dee valley in an area less constrained by other settlements. It is located in a less elevated area than Corridor 2a and with overall lower proximity to dwellings than Corridor 2c.
- There would likely be fewer technical challenges compared with Corridors 2a and 2c due to the flatter terrain at a lower altitude. The presence of an extensive existing road and access network within Corridor 2b would also result in less new access infrastructure being required compared to the other corridor options. Corridor 2b would require fewer crossings of existing high voltage OHLs compared to Corridors 2a and 2c, which would substantially reduce the technical complexity for installation and maintenance of the OHL.
- Corridor 2b represented the lowest cost option for both capital and operational costs and was also the shortest corridor option. It avoided crossing additional high voltage OHLs and was further from the coast than Corridor 1c where additional maintenance to prevent corrosion was anticipated.

4.5.11 Following review of feedback from the May 2023 consultation relevant to the Corridor Options, no information was received which warranted further appraisal or review of the evidence base supporting the Applicant's preference for the Preferred Corridor as noted in the November 2023 RoC (see **paragraph 4.4.17**). Therefore, the Proposed Corridor in Section 2 taken forward to the routeing stage was Corridor 2b as it was considered to be the least constrained option overall across the environmental, technical and cost considerations.

Overall Proposed Corridor

4.5.12 Overall, the Proposed Corridor comprised Corridor 1b and Corridor 2b (see **Volume 3, Figure 4.1.4: Preferred Corridor and Plate 4.4: Proposed Corridor (November 2023)**), taking into account the environmental, technical and cost appraisals, and the feedback received during the consultation period.

Plate 4.4: Proposed Corridor (November 2023)

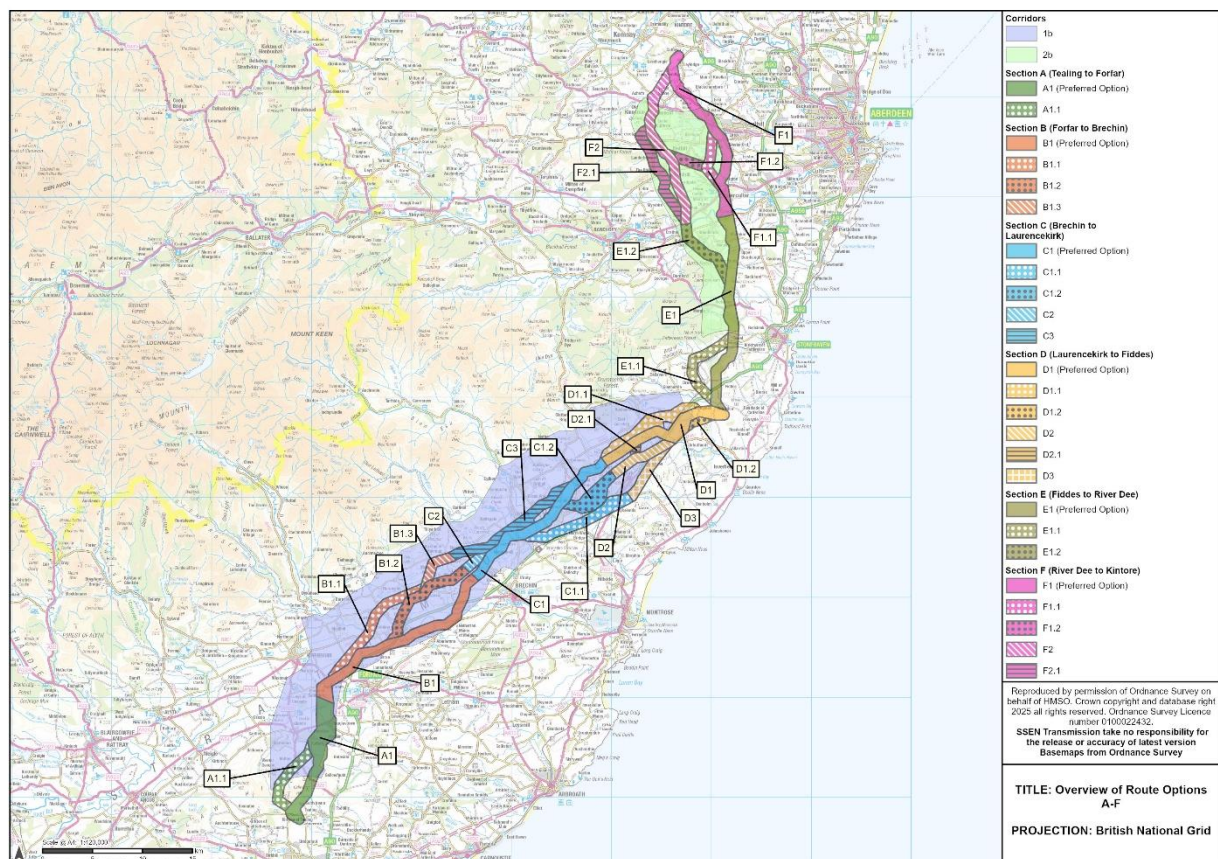


4.6 Route Options Selection

Overview of Route Alternatives Identification, Appraisal and Selection

- 4.6.1 The route selection stage involved the identification of route options within the Proposed Corridor and within which subsequent OHL alignments may be identified. Similar to the corridor stage, the heat map approach outlined in **Section 4.4** was continued for the route selection stage to inform identification and analysis of constraints. The majority of route options identified within the Proposed Corridor were approximately 1 km wide to allow for a reasonable number of alignment options to be derived (see **Volume 3, Figure 4.2a: Overview of Route Options – Sections A-F**). In some areas the route options were more constrained and were therefore narrower, whereas in other areas they were up to 2 km wide where there were more opportunities for identifying OHL alignments.
- 4.6.2 Due to the length of the Proposed Development, and to make the presentation of information and appraisals more easily comprehended and accessible, the Proposed Corridor was separated into six geographically separate route ‘Sections’ from south to north (Sections A to F). A number of route options, ranging between two and six, were identified within each Section depending on the extent of physical and environmental constraints across the corridor in each route section (see **Plate 4.5: Route Options (May 2023)**).

Plate 4.5: Route Options (May 2023)



- 4.6.3 To provide a consistent basis for comparative appraisal of the options in each route section, the options to be appraised were assembled into clear ‘end-to-end’ route alternatives which stretched for the full length of the OHL section. The options were then appraised following the methodology set out in **Section 4.4** above. In some Sections, options were derived to provide a means to avoid constrained areas which resulted in the identification of route options which provided a ‘branch’ or sub-option of some of the longer options that connected the full length of the Section. Notwithstanding this, all options identified were allocated an alpha-numeric descriptor code (eg A1, A1.1 etc) and were subsequently appraised in order to ensure that all combinations were fully considered.
- 4.6.4 The route options appraisal and consultation on route options was undertaken in two key stages. Firstly, route options identification and appraisal was undertaken up until consultation in May 2023, following the original proposal for the OHL to connect from the existing Kintore Substation at the northern end of the corridor in Aberdeenshire, to two new 400 kV

substations to be constructed at Tealing in Angus at the southern end of the corridor, and at Fiddes in Aberdeenshire approximately mid-way between Kintore and Tealing. These 'original' route options, the findings of their appraisal and the selection of the preferred alternatives are reported below under the section of this Chapter titled **Original Route Options Appraisal and Selection**.

- 4.6.5 A second stage of route optioneering work was undertaken subsequent to the Applicant's decision, taking account of feedback from the May 2023 consultation, to change the location of the intermediate proposed new substation from Fiddes to a new location in Fetteresso Forest (Hurlie) west of Stonehaven. Relocation of this substation to a site named Hurlie required substantial revision of the OHL routes connecting to it within Sections D and E. Information on the 'new routes' that were subsequently identified by the Applicant, their appraisal and the selection of the preferred alternatives is set out below under the section of this Chapter titled **New Route Options Appraisal and Selection**.
- 4.6.6 The final selection of the Proposed Route by the Applicant taking account of design development, reviews of minor amendments to route option boundaries and all consultation feedback (as captured in the summaries of key decisions within the November 2023 and August 2024 RoCs) is set out for each section of the route in the section of this Chapter titled **Proposed Route**.

Original Route Options Appraisal and Selection

- 4.6.7 The original route options appraisal was undertaken and presented in the *Route Selection Consultation Document (May 2023)* (see **paragraph 4.4.17** for document details, and **Volume 3, Figures 4.2.1 to 4.2.7: Overview of Route Options – Section A to F**). The key feedback from consultation on these options is presented in the *Report on Consultation (November 2023)* which is also referenced in **paragraph 4.4.17**. A summary of the route options considered, their environmental, technical and cost appraisal, and the reasons for the selection of the Preferred Route is provided in this section.

Section A: Tealing to Forfar

- 4.6.8 The following routes were identified within Section A and appraised during the route selection process and presented in the *Route Selection Consultation Document May 2023* (see also **Volume 3, Figure 4.2.2: Route Options – Section A**):
- Route A1: Follows a south to north direction, connecting from the proposed Emmock 400 kV substation near Tealing in the south to join Route B1 north of Douglstown, west of Forfar.
 - Route A1.1: Forms a western deviation from the southern section of Route A1 connecting from North Balluderon to Arniefoul.
- 4.6.9 The appraisal of alternatives in Section A identified Route A1 as the Preferred Route from an environmental, technical and cost perspective based on the following findings:
- Although Route A1 was slightly more constrained in terms of cultural heritage designations and had a slightly greater occurrence of natural heritage designations, there was little to distinguish between Route A1 and Route A1.1. In terms of landscape constraints, Route A1 was likely to give rise to fewer conflicts with key characteristics of the landscape and was considered to have an overall better fit with the grain of the landscape. Route A1 also avoided more of the settlements present in the area and was likely to be less visible within the landscape.
 - Route A1 was less constrained overall by technical considerations as it required fewer minor road crossings, crossed gentler slopes and required a lower number of angle supports.
 - Route A1 was identified as the lowest cost option as the route was shorter in length and it was anticipated that the requirement for new access roads to be constructed would be less than the requirement for Route A1.1 due to the proximity of links to the existing public highway.
- 4.6.10 The consultation process on these options and the review of the appraisal findings and feedback provided confirmed that Route A1 was considered to be less constrained than Route A1.1 from an environmental, community and technical perspective. Route A1 was therefore taken forward as the Preferred Route in Section A at this stage.

Section B: Forfar to Brechin

- 4.6.11 The following routes were identified within Section B and appraised during the route selection process and presented in the *Route Selection Consultation Document May 2023* (see **paragraph 4.4.17**) (see also **Volume 3, Figure 4.2.3: Route Options – Section B**):

- Route B1: Follows a northeastern course connecting from Route A1 in the south near Douglstown to Route C1 to the northwest of Brechin.
- Route B1.1: Forms a western deviation to the southern section of Route B1 from Haughs of Ballinshoe to connect with Routes B1.2 and B1.3 at Hilton of Fern before joining with Route C2 to the northeast of Findowrie.
- Route B1.2: This route forms a western deviation to the northern part of Route B1 from West Mains of Finavon to connect with Routes B1.1 and B1.3 at Hilton of Fern, before joining with Route C2 to the northeast of Findowrie.
- Route B1.3: Forms a western deviation to the northern sections of Routes B1.2 and B1.3, connecting from Hilton of Fern to join with Route C3 near Kirkton of Menmuir.

4.6.12 The appraisal of alternatives in Section B identified Route B1 as the Preferred Route from an environmental, technical and cost perspective based on the following findings:

- From an environmental perspective, there was little to distinguish between each of the route options in Section B. Route B1 was less constrained by forestry considerations and was located at a greater distance from the Caterthun Hillforts Scheduled Monument and Property in Care (PiC) than Routes B1.1, B1.2 and B1.3. It also had fewer watercourse crossings than Route B1.2 which was the most constrained route in this respect.
- In terms of landscape and visual constraints, Route B1 was preferred as the route followed the topography of the landscape and could make use of the low Foothills Landscape Character Type (LCT) as a backdrop which would reduce impacts, particularly when viewed from more densely populated areas to the east.
- The majority of technical constraints identified could be avoided or mitigated by careful design, micro-siting, and the implementation of good practice construction techniques. No preference was identified with regards to technical criteria, however Route B1 had a lower anticipated potential interface with National Gas pipelines.

4.6.13 Route B1 was initially selected as the Preferred Route. There was no clear preference from an environmental and cost perspective. There were no significant technical issues identified that could not be resolved and it was preferred due to the lower anticipated impact to residential and commercial properties and interface with gas pipelines (see **Volume 3, Figure 4.2.8: Preferred Route Prior to May 2023 Consultation**). Following the consultation process on these options, the review of the appraisal findings and feedback provided, including review of survey findings, it was subsequently considered that Route B1.1 would be slightly less constrained in terms of environmental considerations and property constraints, particularly in the vicinity of the settlements of Padanaram and Netherton. Route B1.1 also had a greater potential to avoid proximity to the River South Esk SAC and other flood risk areas associated with watercourses. Route B1.1 was therefore taken forward as the Preferred Route in Section B at this stage.

Section C: Brechin to Laurencekirk

4.6.14 The following routes were identified within Section C and appraised during the route selection process and presented in the *Route Selection Consultation Document May 2023* (see **paragraph 4.4.17**) (see also **Volume 3, Figure 4.2.4: Route Options – Section C**):

- Route C1: Follows a northeastern direction from Route B1 near Little Brechin to the north of Greenbottom Wood near Fettercairn where it joins Routes D1 and D1.1.
- Route C1.1: Forms a northeastern deviation to the northern section of Route C1 connecting from the west of Inchbare to the east of Laurencekirk where it joins with Route D3.
- Route C1.2: Forms a northeastern deviation to the northern section of Route C1 connecting from Luthermuir to the west of Laurencekirk where it joins with Route D2.
- Route C2: Forms a short western deviation to the southern section of Route C1 connecting from Route B1.1 to the northeast of Findowrie to the south of Balrownie Wood.
- Route C3: Follows a northeastern direction to the east of Edzell as a western deviation to the southern section of Route C1, connecting from Route B1.3 near Kirkton of Menmuir to Lady Jane's Plantation.

4.6.15 The appraisal of alternatives in Section C identified Route C1 as the Preferred Route from an environmental, technical and cost perspective based on the following findings:

- Route C1 would avoid the River North Esk and West Water Palaeochannels SSSI and Esle Moss SSSI which would both be intersected by Route C3. Route C1 crossed fewer watercourses and could span the wide floodplain associated with the West Water and the River North Esk in a narrower location than Routes C1.1, C1.2 and C2.
- A greater distance from the Caterthun Hillforts Scheduled Monument and PiC would be achieved by following Route C1, and it was considered that the route had an overall lower level of cultural heritage constraint. Despite Route C1 having some pinch points, it was the landscape and visual preference as the route avoided the most sensitive areas of landscape of the River North Esk valley, and crossed lower lying landforms than the other route options which would reduce the predicted long-distance visibility of an OHL. It also would enable an OHL to be developed at a greater distance from the settlement of Laurencekirk than the other route options.
- From a technical perspective, there was little to distinguish between the route options, however Route C1 avoided major road and rail crossings and had a narrower floodplain crossing.
- Route C1 was preferred with respect to cost considerations as it was the shortest route option and had relatively good road access which would reduce the cost requirement to construct new accesses.

4.6.16 The consultation process on these options and the review of the appraisal findings and feedback provided confirmed that Route C1 was considered to be less constrained than the other route options from an environmental, community and technical perspective. Route C1 was therefore taken forward as the Preferred Route in Section C at this stage.

Section D: Laurencekirk to Fiddes

4.6.17 The following routes were identified within Section D and appraised during the route selection process and presented in the *Route Selection Consultation Document May 2023* (see **paragraph 4.4.17** for document details) (see also **Volume 3, Figure 4.2.5: Route Options – Section D**):

- Route D1: Follows a northeastern direction, connecting from Route C1 to the north of Greenbottom Wood into the originally proposed Fiddes 400 kV substation site.
- Route D1.1: Forms a western deviation in the southern section of Route D1 connecting from Route C1 to the north of Greenbottom Wood to the east of the A90 dual carriageway at Pitskelly.
- Route D1.2: Forms a short eastern deviation in the central section of Route D1, connecting from Drumyochoer to Nether Craighill.
- Route D2: Follows a northeastern direction as a southern deviation to Route D1 connecting from Route C1.2 to the west of Laurencekirk to Whiteriggs.
- Route D2.1: Forms a short deviation between the northern section of Route D1 and the southern section of Route D2 which connects from near Haulkerton to the Mains of Pitarrow.
- Route D3: Follows a northeastern course as an eastern deviation to the southern section of Route D1, connecting from Route C1.1 near Laurencekirk to near Whiteriggs.

4.6.18 The appraisal of alternatives in Section D identified Route D1 as the Preferred Route from an environmental, technical and cost perspective based on the following findings:

- Route D1 was slightly more constrained by the crossing of the wide floodplain associated with the Luther Water when compared to Routes D2 and D3, although it was considered that this could be avoided with careful siting of OHL tower locations.
- Route D1 was less constrained by cultural heritage designations compared to Route D1.2 and D3 and was also preferred with regards to landscape and visual considerations as the route offered large stretches of open, low-lying land and was located over 1 km from the Braes of the Mearns SLA. Route D1 was located at a greater distance from the existing OHL which extended along the eastern edge of Route D3 and offered opportunities to back-cloth the OHL against the lower slopes of Mains of Kair.
- Route D1 would enable a more direct crossing of the A90 and the East Coast Main Line railway than the other alternatives, it maintained a reasonable distance from concentrations of settlements and provided opportunities within the route for alignments to avoid areas of woodland.
- Although Route D3 has a slightly lower level of technical constraint, Route D1 was preferred as it included a lower number of residential and commercial properties. The majority of the constraints identified could be avoided and where this was

not possible, they could be mitigated by careful design, micro-siting and the implementation of good practice construction techniques.

- 4.6.19 Initially, Route D1 was taken forward as the Preferred Route primarily because it included a lower number of residential and commercial properties (see **Volume 3, Figure 4.2.8: Preferred Route Prior to May 2023 Consultation**). However, following the Applicant's decision to change the location of the intermediate substation from Fiddes to an alternative location in Fetteresso Forest (Hurlie) to the west of Stonehaven, a substantial revision of the OHL routes connecting to it within Sections D and E was subsequently undertaken. Information on the 'new routes' subsequently identified within Section D, their appraisal and the selection of the preferred alternatives is set out below under the section titled **New Route Options Appraisal**. This change of preferred substation location is also detailed within the *Report on Consultation November 2023* (see **paragraph 4.4.17** for document details).

Section E: Fiddes to River Dee

- 4.6.20 The following routes were identified within Section E and appraised during the route selection process and presented in the *Route Selection Consultation Document May 2023* (see **paragraph 4.4.17** for document details) (see also **Volume 3, Figure 4.2.6: Route Options – Section E**):
- Route E1: Extends north from the originally proposed Fiddes 400 kV substation site in a northern direction to connect with Route F1 to the south of the River Dee near Craiglug Wood.
 - Route E1.1: Forms a western deviation to the southern section of Route E1, connecting from the site of the proposed Fiddes 400 kV substation to Nether Baulk.
 - Route E1.2: Forms a western deviation to the northern section of Route E1, connecting from Bank Hill in a northwestern direction through areas of Durris Forest to connect with Route F2 near Kirkton of Durris at the River Dee.
- 4.6.21 The appraisal of alternatives in Section E identified Route E1 as the Preferred Route from an environmental, technical and cost perspective based on the following findings:
- Route E1 and Route E1.1 were considered to have a similar level of environmental constraint. Route E1 was less constrained by Ancient Woodland than Route E1.2 and was less constrained by designated natural heritage sites than both other route options. Compared to Route E1.2, Route E1 was preferred as it did not intersect Park House GDL and the route would cross less-sensitive areas of the Dee Valley with fewer areas of native woodland than Routes E1.1 and E1.2.
 - Route E1 was considered to be less constrained by residential properties than Route E1.1, and was located at a greater distance from the settlements of Drumlithie and Kirkton of Durris than the other routes.
 - Route E1 was the lowest cost option as it was shorter than Route E1.1 and would not require the extensive woodland felling requirements and the subsequent compensatory planting costs of Route E1.2.

- 4.6.22 Route E1 was initially taken forward as the Preferred Route (see **Volume 3, Figure 4.2.8: Preferred Route Prior to May 2023 Consultation**). However, following the Applicant's decision to change the location of the intermediate proposed substation from Fiddes to an alternative location in Fetteresso Forest (Hurlie) to the west of Stonehaven, a substantial revision of the OHL routes connecting to it within Sections D and E was subsequently undertaken. In Section E this required consideration of new route options specifically in the southern part of the section, south of Rumbleyond. Information on these 'new routes', their appraisal and the selection of the preferred alternatives, is set out below under the section titled **New Route Options Appraisal**. However, the northern part of the original Route E1, from north of Rumbleyond, was unaffected by these changes and remained the Preferred Route in this area of Section E at that stage based on the Applicant's review of the appraisal findings and feedback provided.

Section F: River Dee to Kintore

- 4.6.23 The following routes were identified within Section F and appraised during the route selection process and presented in the *Route Selection Consultation Document May 2023* (see **paragraph 4.4.17** for document details) (see also **Volume 3, Figure 4.2.7: Route Options – Section F**):
- Route F1: Follows a north-northwestern direction from Route E1 at the River Dee to connect to the existing Kintore Substation.

- Route F1.1: Forms a western deviation to the central section of Route F1, connecting from Mid Anguston to Cairnie in the area located between Westhill and the Loch of Skene.
- Route F1.2: Forms a northern deviation to Route F1 and a southern deviation to Route F2, it follows in an east to west direction connecting from North Eddieston to East Finnercy.
- Route F2: A westerly option which starts at the River Dee to the north of Kirkton of Durris, and follows a northern direction over undulating ground to connect to the existing Kintore Substation.
- Route F2.1: Forms a western deviation to the southern section of Route F2 connecting from the River Dee to the north of Echt at Barmekin Hill.

4.6.24 The appraisal of alternatives in Section F identified Route F1 as the Preferred Route from an environmental, technical and cost perspective based on the following findings:

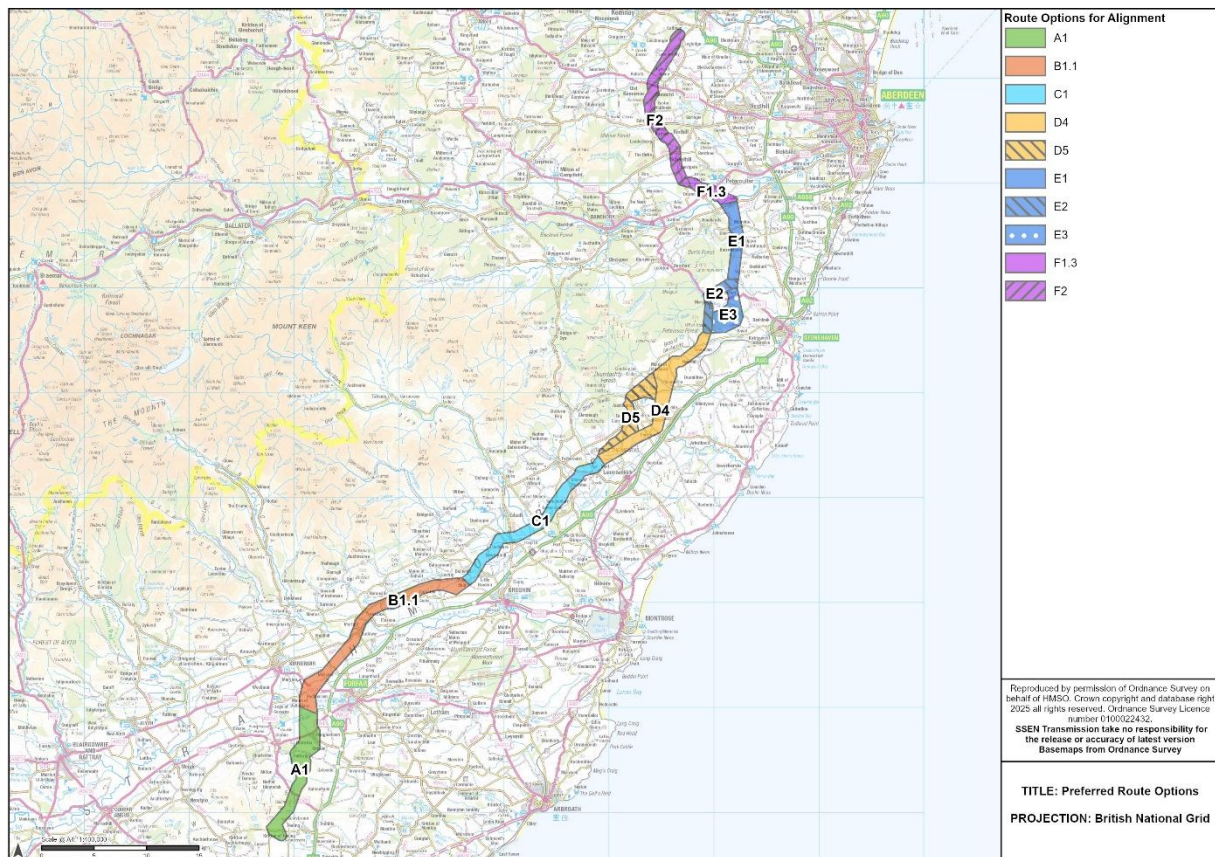
- Route F1 avoided intersecting the Loch of Park SSSI and LNCS compared to Routes F2 and F2.1, and enabled a crossing of the wide floodplain associated with the River Dee in a narrower location than the other options.
- With regards to cultural heritage considerations, Route F1 was located at a greater distance from Dunecht House GDL, Barmekin of Echt Fort Scheduled Monument and the New Wester Echt Stone Circle Scheduled Monument, and avoided Park House GDL which constrained Routes F2 and F2.1.
- Whilst all route options had the potential to impact on landscapes characterised by woodland and formally laid out estates, particularly near to Dunecht House, Route F1 avoided steep wooded terrain between Dunecht House and Barmekin Hill, and was therefore marginally preferred with respect to landscape and visual considerations.
- Whilst the route option was located in relatively close proximity to the Loch of Skene Ramsar and SPA, a sensitive area designated for wintering geese, all of the options were considered to be constrained to some extent by this designated site.
- Route F1 was the lowest cost option along with Route F1.1. The majority of the constraints identified could be avoided and where this was not possible, they could be mitigated by careful design, micro-siting and the implementation of good practice construction techniques.

4.6.25 Initially, Route F1 was taken forward as the Preferred Route (see **Volume 3, Figure 4.2.8: Preferred Route Prior to May 2023 Consultation**). Following the consultation process on these options, and the review of the appraisal findings and feedback provided, a new route option was identified as Route F1.3. This option formed a connection from the southern end of Route F1 and joining with Route F2 to the north of Drumoak near Coldstream Plantation. This route option was considered to enable the less environmentally constrained sections of Routes F1 and F2 to be utilised, and would provide a greater separation between the OHL and the designated Loch of Skene SPA compared with Route F1. Route F1.3 was also anticipated to avoid key constraints such as the Loch of Park (a SSSI and LNCS) and Park House (a GDL and Listed Building) which constrains the southern section of Route F2. The route also avoided areas of population concentration, amenity areas, and sites allocated within the Local Development Plan (LDP) on the western edges of Peterculter and Westhill. The Applicant therefore presented Route F1.3 and the northern section of Route F2 as the new Preferred Route at this stage, subject to consultation on this option which was undertaken together with the New Route Options (see below).

Overview of Preferred Original Route Options

4.6.26 Following review of consultation feedback, and the subsequent change of substation location from Fiddes to a site in Fetteresso Forest (Hurlie), the Preferred Route from Sections A to F (as presented in the Applicant's November 2023 RoC, see **paragraph 4.4.17** for document details) consisted of the following routes: A1, B1.1, C1, the northern part of E1, F1.3, and the northern part of F2 (see **Volume 3, Figure 4.2.9: Preferred Route Following May 2023 Consultation** and **Plate 4.6: Preferred Route Options (November 2023)**). At this stage, new options identification within Sections D and the southern part of Section E was being undertaken (to respond to the change of substation location from Fiddes to Hurlie), and information on their appraisal and selection is set out in the section below titled **New Route Option Appraisal and Selection**.

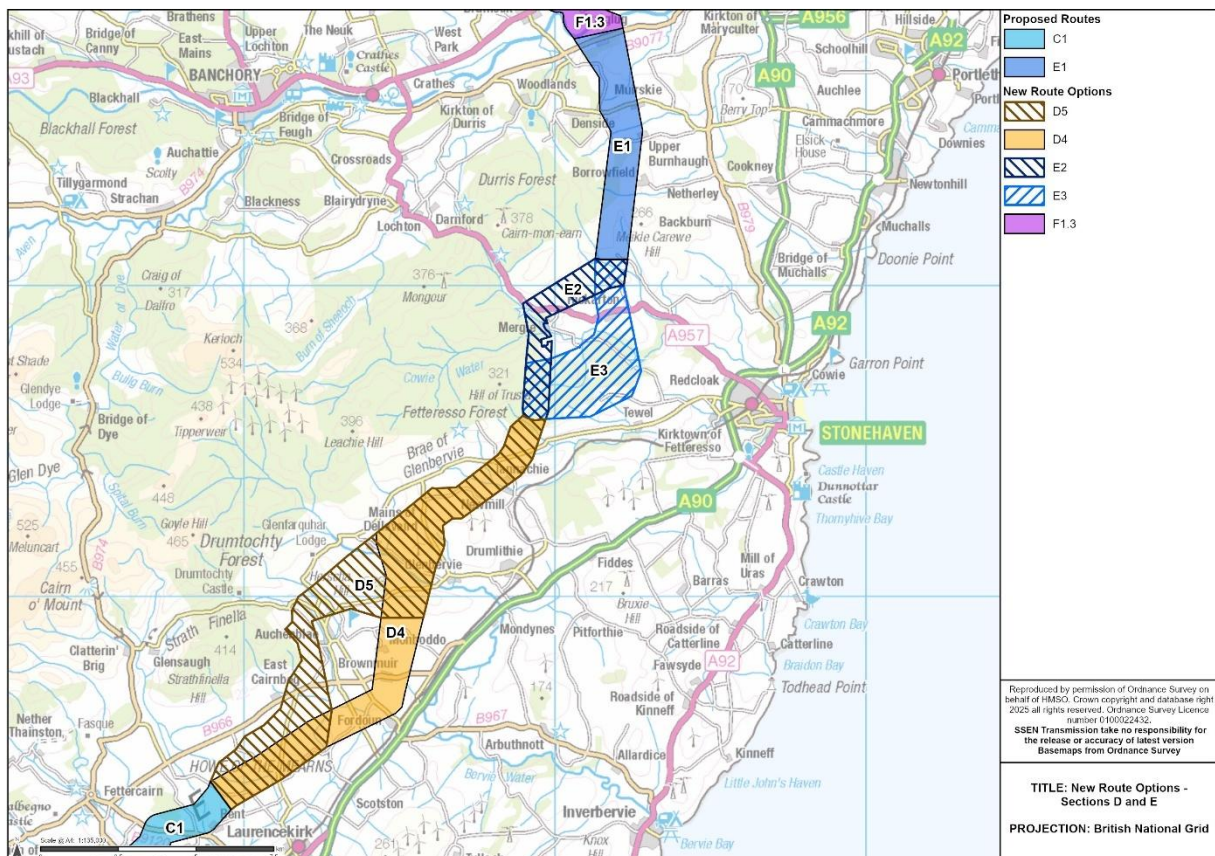
Plate 4.6: Preferred Route Options (November 2023)



New Route Options Appraisal and Selection

- 4.6.27 A new routeing exercise in Section D and in the southern part of Section E of the Proposed Corridor was undertaken to enable consideration of OHL route alternatives for the Proposed Development to connect with the new substation location in Fetteresso Forest (Hurlie) (see **Volume 3, Figure 4.3.1: Overview of New Route Options – Sections D and E**). The detailed findings of the new route options appraisal are presented in the *New Route Selection Consultation Document (February 2024)* (see **paragraph 4.4.17** for document details and **Plate 4.1: Summary of Design Evolution (2022 to 2025)**). The key feedback from consultation on these options, as well as on Option F1.3, is presented in the *Report on Consultation (August 2024)* which is also referenced in **paragraph 4.4.17**.
- 4.6.28 A summary of the new route options considered, the environmental, technical and cost appraisal, and the reasons for the selection of the Proposed Route is provided in this section. A graphical overview of the options is shown in **Plate 4.7: New Route Options Sections D and E (March 2024)**.

Plate 4.7: New Route Options Sections D and E (March 2024)



Section D

4.6.29 In Section D, two new routes (Routes D4 and D5) were identified that extend from the northern end of Preferred Route C1 in Section C to connect to the proposed Hurlie substation site, as detailed below (see **Volume 3, Figure 4.3.2: New Route Options – Section D**):

- Route D4: Connects from the northern end of Preferred Route C1 near Laurencekirk in a northeastern direction to the proposed substation site in Fetteresso Forest (Hurlie).
- Route D5: Forms a western deviation to the southern section of Route D4, from Preferred Route C1 near Laurencekirk, passing west of Auchenblae, and connecting with the northern part of Route D4 in the vicinity of North Blairs, then following the same route northeast to the proposed Hurlie substation.

4.6.30 Route D4 was identified prior to consultation as the Preferred Route from an environmental, technical and cost perspective based on the following appraisal findings:

- Although Route D4 was slightly more constrained by proximity to residential dwellings, it was less constrained by natural heritage designations, landscape designations and cultural heritage designations than Route D5 as it avoided Strathfinella LNCS, Auchenblae Conservation Area and the Braes of the Mearns SLA. The environmental constraints identified for Route D5 relating to the potential for greater impact on designated areas for landscape, natural and cultural heritage would be difficult to mitigate at later alignment stages.
- Route D4 was considered to be slightly more constrained with regards to the ability to maintain minimum separation distances to wind turbines and residential properties than Route D5. However, it offered the opportunity to avoid close proximity to the village of Auchenblae (associated with Route D5) which reduced the requirement for a higher number of angle towers. Route D4 crossed gentler slopes with lower gradients and therefore the amount of cut and fill required to develop the access tracks and construction compounds would likely be lower than for Route D5.
- Route D4 had a slightly lower estimated cost than Route D5, partially due to the gentler slopes and a lower number of major pipeline crossings.

- 4.6.31 Although Route D4 was not the preference with regards to technical considerations, it was considered to be less environmentally constrained and was the lowest cost option. The consultation process on these options and the review of the appraisal findings and feedback provided confirmed that Route D4 was considered to be less constrained than Route D5 from an environmental and community perspective. Therefore, Route D4 was taken forward as the Proposed Route in Section D.

Section E

- 4.6.32 In Section E, two route options (Routes E2 and E3) were identified to connect northwards from the proposed Hurlie substation site into the central section of the Preferred Route in Section E (tying in with Route E1 near Rickarton), as detailed below (see **Volume 3, Figure 4.3.3: New Route Options – Section E**):

- Route E2: Following a north then northeastern direction, this route connects from the proposed substation site in Fetteresso Forest (Hurlie) to the existing Preferred Route E1 in the central area of Section E.
- Route E3: Following a northeast then northerly direction, this route connects the proposed substation site in Fetteresso Forest (Hurlie) to the existing Preferred Route E1 in the central area of Section E.

- 4.6.33 Route E2 was selected prior to consultation as the Preferred Route from an environmental, technical and cost perspective based on the following appraisal findings:

- Both route options were considered to be broadly comparable. Route E2 was slightly more constrained by natural heritage designations as it would intersect a narrow strip of Ancient Woodland although this could be mitigated through sensitive OHL design. Route E3 was more constrained by commercial forestry considerations than Route E2 as the forested areas in this location were largely undisturbed by infrastructure.
- Routes E2 and E3 would both cross sections of Fetteresso Forest, however the presence of the existing Kintore to Fetteresso 275 kV/400 kV OHL to the immediate west of Route E2 provided the opportunity for an alignment to follow a wayleave and cleared Operational Corridor through the forest adjacent to the existing OHL infrastructure.
- Route E2 had the lowest estimated cost and was considered to be less constrained by the number of minor road crossings and angle towers required.

- 4.6.34 Although the environmental preference was marginal, Route E2 was less technically constrained and had the lowest estimated cost. The feedback from consultation confirmed that Route E2 was considered to be less constrained than Route E3, and therefore Route E2 was taken forward by the Applicant as the Proposed Route in the southern part of Section E.

Section F

- 4.6.35 Whilst the appraisal of Route F1.3 identified that it was considered to have fewer environmental, land use and technical constraints than the previously preferred option (Route F1, see also **Volume 3, Figure 4.3.4: New Route Option – Section F**), feedback from consultation on Route F1.3 highlighted some concerns from stakeholders on various environmental and community sensitivities in Drumoak, particularly in relation to proximity of the route to the village. Therefore, a further review process was undertaken to consider another alternative option which would provide a connection from Section E to Section F at a greater distance from Drumoak. Based on the feedback received, additional options were identified to take forward to alignment development in the northern area of Section E and the southern area of Section F:

- Option E4: this option would connect from the central section of Route E2 then passing north through the upland area of Durris Forest to the west of Kirkton of Durris and connecting to Option F3 at the River Dee. It runs broadly in parallel, and west of, Route E1.
- Option F3: this option is located to the west of the village of Drumoak, located within the southern section of the previous Route F2.1. It would provide the potential for an OHL connection extending from Option E4 at the River Dee near West Park to link with the previously identified Route F2 northwest of Drumoak.

- 4.6.36 The outcome at this stage was therefore to take forward both Option F1.3 and the further option E4 to F3 for OHL alignment design development. A comparison of these easterly and westerly options was subsequently undertaken in the appraisal of options for alternative alignment location 5 (see **Section 0**).

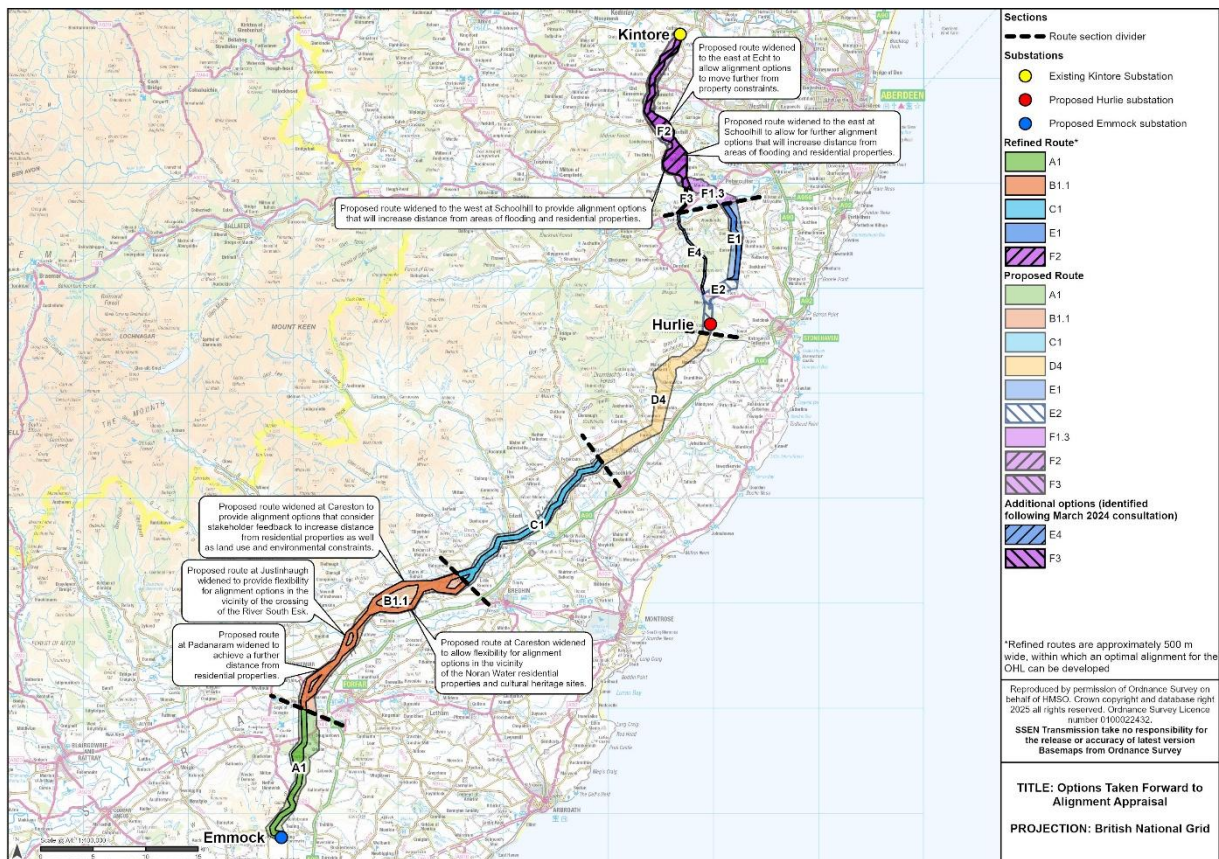
Overview of Preferred New Routes

- 4.6.37 Overall, the Preferred New Route within Sections D and E comprised of Route D4 and Route E2 (connecting into Route E1 (see **Volume 3, Figure 4.3.5: Proposed Options Following March 2024 Consultation**). Route Option F1.3 and a new option to be identified (E4/F3) were also taken forward as part of the Preferred Route.

Proposed Route

- 4.6.38 The identification of route option preferences followed a complex process through the stages described above where route options were identified, appraised and consulted on prior to and following a change in substation location from Fiddes to Hurlie. Through this process the Applicant revised certain route options to reflect consultation feedback to ensure that those selected to be taken forward for OHL alignment were optimised to reduce environmental and technical constraints as far as possible. Additional route options were also identified following the second route consultation (in Section E/F) to reflect feedback, and in these sections parallel options were both taken forward by the Applicant to be developed in more design detail as alignment alternatives.
- 4.6.39 Overall, the Proposed Routes taken forward to the alignment selection stage were: A1, B1.1, C1, D4, E1 (in the northern part of Section E), E2 (in the southern part of Section E) and F1.3 (extended into the previous Route F2 in the northern part of Section F), with the additional options of E4 and F3 as shown in **Plate 4.8: Options Taken Forward To Alignment Appraisal (August 2024)**.
- 4.6.40 At this stage, the Applicant also reviewed the boundaries for some of the route options (referred to as 'refined routes', see the August 2024 RoC for more details, which is also referenced in **paragraph 4.4.17**) by widening or narrowing certain locations of the Proposed Route to allow for greater flexibility in the design of the OHL alignment to avoid constraints, including: residential properties and settlements, land at risk of flooding, designated woodland areas, and designated sites. These were relatively minor amendments and are not discussed further in this Chapter.

Plate 4.8: Options Taken Forward to Alignment Appraisal (August 2024)



4.7 Alignment Selection

Alignment Options Identification

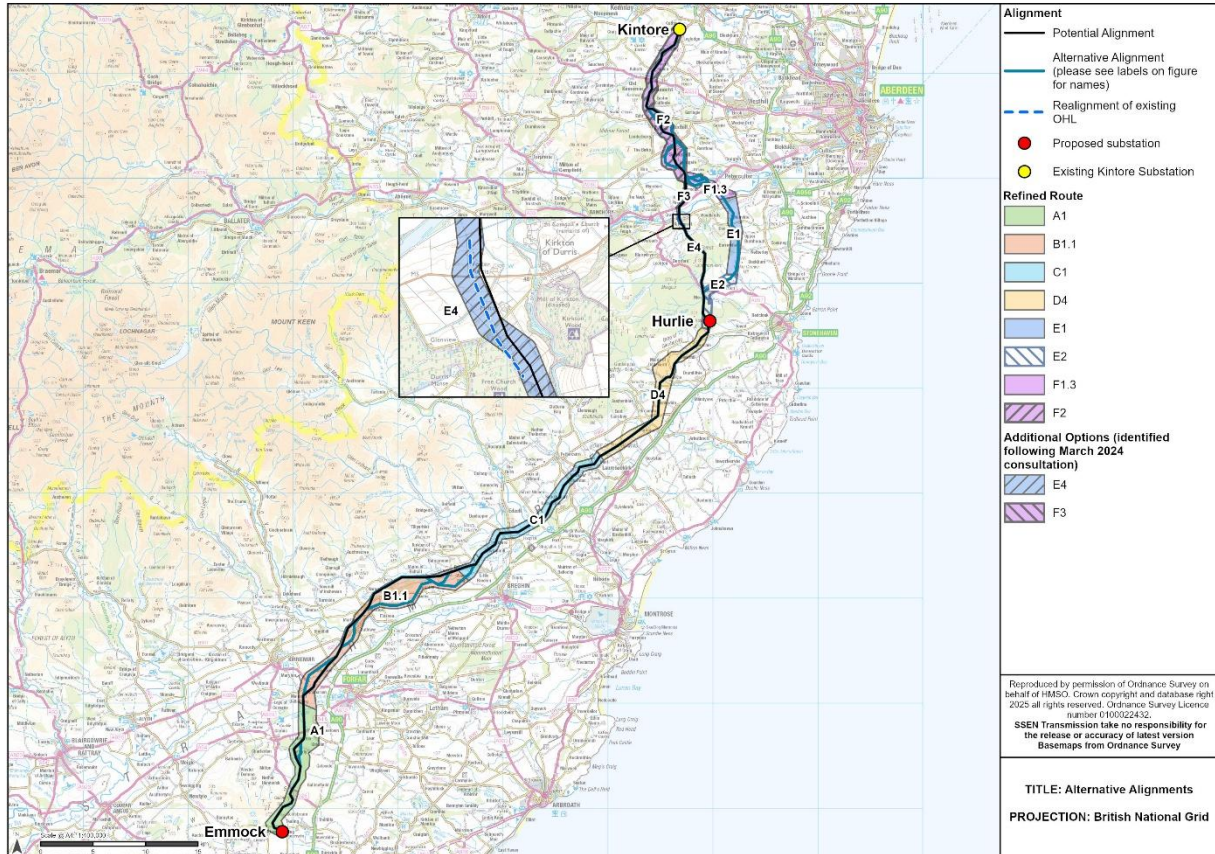
- 4.7.1 The alignment selection stage involved the development of a Potential Alignment¹⁵ for the OHL within the Proposed Route, which is technically feasible and economically viable, and which minimises disturbance to the environment wherever possible; and to those living, working, visiting or using the area in its vicinity for recreational purposes.
- 4.7.2 An iterative design development process was implemented involving SSEN Transmission's OHL Design Contractors with the land, environment and project design team as well as the professional EIA practitioners in developing a Potential Alignment. In some locations, where more significant, overlapping or complex constraints were identified and a preference for an OHL alignment could not be easily identified, additional OHL options were developed and referenced as "alternative alignments". The alternative alignments were then taken forward for more comprehensive appraisal, including of their environmental constraints, in order to select the Potential Alignment for consultation (see **Volume 3, Figure 4.4.1: Overview of Potential Alignment and Alternative Alignments – Section A – F**). Eight locations were identified where alternative alignments were developed and appraised in the following sections of the OHL:
- Location 1: Hayston Hill (two alternative alignments in Section A);
 - Location 2: Padanaram (two alternative alignments in Section B);
 - Location 3: Justinhaugh (two alternative alignments in Section B);
 - Location 4: Careston (five alternative alignments in Section B);
 - Location 5: Durris (two alternative alignments in Sections E and F);
 - Location 6: North of Drumoak (three alternative alignments in Section F)¹⁶;
 - Location 7: Schoolhill (three alternative alignments in Section F); and
 - Location 8: Echt (three alternative alignments in Section F).
- 4.7.3 Within each location, one of the alternative alignments identified formed part of the Potential Alignment. No alternative alignments were identified within Sections C and D. The detailed findings of the alternative alignments are presented in the *Alignment Consultation Document (September 2024)* (see **paragraph 4.4.17** for document details and **Plate 4.1: Summary of Design Evolution (2022 to 2025)**). The key feedback from consultation on these options is presented in the *Report on Consultation (January 2025)* which is also referenced in **paragraph 4.4.17**.

¹⁵ The Potential Alignment referred to the alignment options which the Applicant identified (following appraisal) as having the best balance of environmental and technical constraint. The Potential Alignment was taken to consultation (in autumn 2024) and the Applicant subsequently selected the Proposed Alignment for the OHL taking account of the findings of the appraisals and the consultation feedback received.

¹⁶ The alternative alignments developed at Location 6 are sub-options forming part of Alternative Alignment 5b and therefore would only be taken forward if Alternative Alignment 5b was preferred to 5a.

- 4.7.4 The alternative alignments considered in these locations and the findings of the appraisals are described in this section. The alternative alignments in each location are shown in **Volume 3, Figures 4.4.2 to 4.4.7: Potential Alignment and Alternative Alignments – Section A - F**. An overview of the locations of the alternative alignments is shown on **Plate 4.9: Alternative Alignments (September 2024)**.

Plate 4.9: Alternative Alignments (September 2024)



- 4.7.5 Outwith these eight locations, a Potential Alignment was identified through the process outlined above. However, in a few locations, the process of design development identified and evaluated some other smaller options as part of the multi-disciplinary approach to design of the Potential Alignment. These locations represented areas where there were localised constraints which involved iterative design review between the technical, environmental and land teams in order to consider alternatives and identify the least constrained alignment on balance. These considerations were undertaken through collaborative workshop reviews and did not require detailed appraisals. Further information summarising these options is presented at the end of this section, referred to as 'Design Development Locations'.

Alignment Options Appraisal

- 4.7.6 The comparative appraisal of alternative alignments followed the same overall approach as that undertaken for corridor and route selection and following SSEN Transmission's *Routeing Guidance* (see **Section 4.4**). The spatial extents of key identified environmental constraints were mapped within the area of the indicative LOD defined for each alternative alignment. Baseline information from desk-based and relevant field surveys was considered and an appraisal of the extent to which these had the potential to restrict the OHL development was undertaken. Further detail on the approach undertaken can be found in the *Alignment Consultation Document (September 2024)* (see **paragraph 4.4.17** for document details).
- 4.7.7 The horizontal LOD applied was 100 m either side of the indicative centreline of the OHL alignment for each alternative. The identification and reporting of key environmental constraints for the alignments at this stage was based on the indicative LOD around the alignment. The appraisal of alternative alignments took account of the indicative LOD so that potential constraints to the development of the OHL were not over-estimated in the appraisal and to maintain consistency in the comparison of alternative alignments.

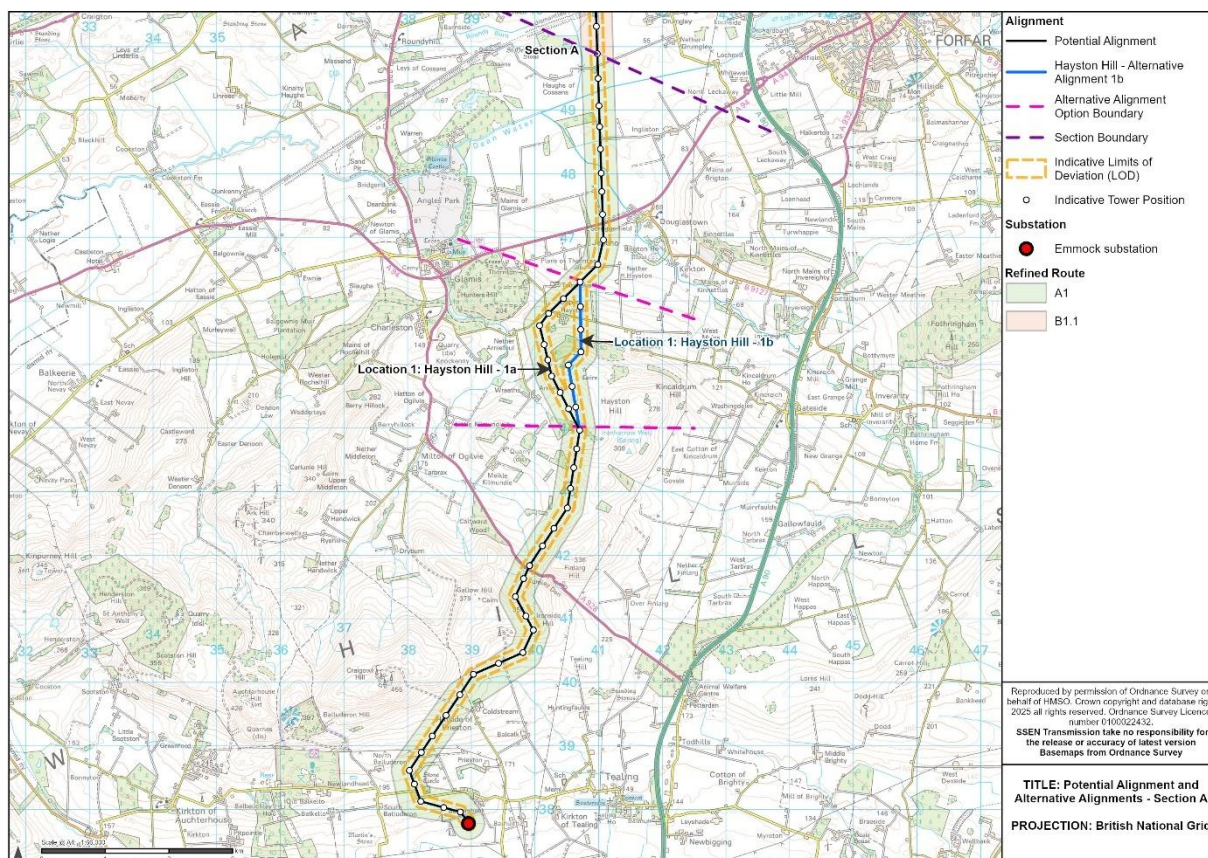
- 4.7.8 During the appraisal process, where a topic area or criteria was deemed not to be a significant constraint or where constraints would not be compromised by the alignment with no material difference between the Alternative Alignments, they were scoped out from the appraisal. This focused the comparative appraisal process on the material issues and constraints which informed selection of a preference.
- 4.7.9 The following sub-sections describe the locations where alternative alignments were developed due to the need to consider and appraise complex and competing constraints. The findings of the appraisal of the alternative alignments are set out, leading to the identification of a preference in each of the eight locations where alternatives were developed. In each location the preferred alternative was then identified as forming part of the Potential Alignment for the OHL. The appraisal of the alternative alignments is presented in the consultation document prepared for the Alignment Consultations held in September and October 2024 (see **paragraph 4.4.17** for document details).
- 4.7.10 Information is also provided for areas where design developments for the alignments were considered (referred to as ‘Design Development Locations’, as shown on **Volume 3, Figure 4.4.8: Design Development Locations**). A description is provided of the key issues and constraints considered in these locations in **Table 4.1: Selection of Potential Alignment in Design Development Locations**.

Alternative Alignments Selection

Location 1: Hayston Hill (Section A)

- 4.7.11 Between Hayston Hill and Upper Hayston, a key constraint to alignment development was the potential to impact on areas of land managed for agriculture to the east of Arniefoul. Avoiding this prime agricultural land would require an OHL alignment crossing the west flank of Hayston Hill at higher elevations and a steeper gradient. Two alternative alignments were developed in this area and taken forward for more detailed appraisal, as shown in **Plate 4.10: Potential Alignment and Alternative Alignment Options – Section A (September 2024)**:
- Alternative Alignment 1a (forming part of the Potential Alignment): following a westerly course between Nether Arniefoul and Upper Hayston to the east of Hunters Hill through generally lower lying land which is extensively managed for agriculture; and
 - Alternative Alignment 1b: lying to the east of Alternative Alignment 1a between Upper Hayston and Wester Foffarty and crossing the western flanks of Hayston Hill in an upland area predominantly managed as a grouse moorland.
- 4.7.12 Alternative Alignment 1a was chosen to be taken forward as the Potential Alignment from an environmental, technical and cost perspective based on the following key appraisal findings:
- Alternative Alignment 1a had lower potential to impact mixed scattered scrub and areas of upland heathland with the potential to support Annex 1 habitats associated with upland areas, and was also considered less likely to impact forestry operations.
 - Alternative Alignment 1a was less constrained by cultural heritage sites as it was located at a greater distance from the Scheduled Monuments located at Arniefoul Cairn and Nether Arniefoul Unenclosed Settlement.
 - There are more opportunities to back-cloth the OHL from some viewpoints in Alternative Alignment 1a as it avoids the highest point of Hayston Hill and generally follows the grain of the landscape reducing the extent of visual constraint compared to Alternative Alignment 1b.
 - Alternative Alignment 1a had gentler topography which would require less earthworks, and had fewer towers situated above 200 m Above Ordnance Datum (AOD).
 - Although Alternative Alignment 1a was slightly higher in cost, it was considered marginally less complex and had fewer constructability risks.
- 4.7.13 Having reviewed consultation feedback for this alignment location, including statutory consultee views, the Potential Alignment (Alternative Alignment 1a) was taken forward by the Applicant as part of the Proposed Alignment in Section A. The information and responses provided from consultation and subsequent review did not identify that Alternative Alignment 1b would be less constrained. On balance and considering the potential to mitigate potential effects on hydrological receptors (which were identified as a slightly greater constraint for the Potential Alignment 1a than for Alternative Alignment 1b), it was considered that the Potential Alignment 1a remained less constrained in relation to the environmental and technical criteria appraised. There were no material differences in predicted costs for the two alternative alignments.

Plate 4.10: Potential Alignment and Alternative Alignment Options – Section A (September 2024)



Location 2: Padanaram (Section B)

4.7.14 Northwest of the village of Padanaram, several constraints were identified, including high-pressure gas pipelines, Scheduled Monuments, hydrological constraints (including floodplains and number of watercourses and field drains) and a proposed solar array. Avoiding these would require aligning the OHL closer to the village of Padanaram. Two alternative alignments were developed in this area and were taken forward for more detailed appraisal, as shown on **Plate 4.11: Potential Alignment and Alternative Alignment Options - Section B (September 2024)**:

- Alternative Alignment 2a (forming part of the Potential Alignment): follows the northwestern side of the settlement of Padanaram. It crosses a dismantled railway track south of Mains of Ballindarg then across a minor B public road and the A926 public road to the west of Padanaram. The Alignment then continues northeastwards, past properties at Woodhead of Ballinshoe and the edge of woodland at Mossie of Ballinshoe, traversing over sloping terrain to the east of Forestmuir Wood and Woodside LNCS; and
- Alternative Alignment 2b: follows a northeasterly direction crossing the dismantled railway track near Mains of Ballindarg and then the A926 public road. It continues in a northeasterly direction east of Ballinshoe Castle and through a small area of felled LEPO woodland at Haughs of Ballinshoe, a minor public road, and the Black Burn to the east of Forestmuir Wood and Woodside LNCS.

4.7.15 Alternative Alignment 2a was chosen to be taken forward as the Potential Alignment from an environmental, technical and cost perspective based on the following key appraisal findings:

- Alternative Alignment 2a offered greater opportunity to minimise the potential for felling through the southern edge of Forrestmuir Wood, which is also part of the Woodside LNCS, and avoided interaction with areas of commercial forestry. The Alignment also limited the interaction with designated cultural heritage assets, including Ballinshoe Castle and Fletcherfield Enclosure compared with the alternative.
- Alternative Alignment 2a offered greater flexibility to locate the OHL beyond 200 m from residential properties, and to locate the OHL further from sensitive visual receptors.

- Alternative Alignment 2a represented the lower flood risk, reduced gas pipeline interaction and had a marginally lower cost.

4.7.16 Following review of consultation feedback, including statutory consultee views, the Potential Alignment (Alternative Alignment 2a) was taken forward as part of the Proposed Alignment in Section B. The information and responses provided, and the subsequent review, did not identify that Alternative Alignment 2b would be less constrained overall. On balance and considering the potential to minimise tree loss in the woodland at the Woodside LNCS, it was considered that the Potential Alignment 2a remained slightly less constrained overall in relation to environmental and technical criteria, and it was the slightly lower cost option.

Location 3: Justinhaugh (Section B)

4.7.17 The crossing of the River South Esk constrained the development of an alignment in this location as it was considered to be particularly sensitive in relation to landscape and habitat constraints. A pinch point of residential properties to navigate around Justinhaugh and Craigeassie further constrained a feasible path for an OHL alignment, with undulating topography contributing to some constructability and visual constraints. Two alternative alignments were developed in this area and were taken forward for more detailed appraisal, as shown on **Plate 4.11: Potential Alignment and Alternative Alignment Options - Section B (September 2024)**:

- Alternative Alignment 3a (forming part of the Potential Alignment): following a northern path from the north of King's Seat towards Foreside of Cairn, crossing the River South Esk to the east of Inshewan and passing across the northwest of Craigeassie; and
- Alternative Alignment 3b: from the north of the King's Seat, the alignment passes northeast through the pinch point of residential properties between Wolflaw and Battledykes, over complex, undulating landform to the northwest where it crosses the River South Esk northeast of Craigeassie.

4.7.18 Alternative Alignment 3a was chosen to be taken forward as the Potential Alignment from an environmental, technical and cost perspective based on the following key appraisal findings:

- Alternative Alignment 3a was less constrained by habitats and biodiversity and avoided the placement of towers in the 200-year future flood extent of the River South Esk, and therefore had lower potential for this alignment to compromise quality and/or quantity of surface or groundwater.
- Alternative Alignment 3a intersected the southeastern edge of Inshewan House Non-Inventory Designed Landscape (NIDL), however as this part of the designed landscape comprises open arable farmland without key designated features, an OHL alignment here could be located away from the core elements of the NIDL and would not intrude into key views from the House.
- Alternative Alignment 3a was considered to have a slightly lower level of landscape and visual constraint as the visual prominence of the OHL and its intervisibility with the surrounding area would be less than the alternative.
- Alternative Alignment 3a was technically less challenging as Alternative Alignment 3b would require additional angle towers and pipeline crossings.

4.7.19 Having reviewed consultation feedback for this alignment location, the Potential Alignment (Alternative Alignment 3a) was taken forward as part of the Proposed Alignment in Section B. The information and responses provided, and the subsequent review, did not identify that Alternative Alignment 3b would be less constrained overall. On balance and considering the potential to minimise tree loss in the sensitive river crossing area (a designated SAC), it was considered that the Potential Alignment 3a was less constrained overall in relation to environmental and technical criteria. There was no material difference in costs between the two alternative alignments appraised.

Location 4: Careston Alternative Alignments (Section B)

4.7.20 The development of an alignment in the area from Baldoukie to Nether Belliehill encountered a variety of constraints. Responses to the March 2024 consultation regarding the proximity of the southern edge of Route B1.1 to settlements encouraged alternative alignments to be explored further north, to provide greater separation of the OHL from community areas. Alongside cultural heritage constraints presented by Scheduled Monuments at Vayne Castle, Careston Castle and Windsor Cairn, key issues which constrained identification of an alignment included agricultural and agri-tech operations, residential properties (including those at the Careston settlement), wet woodland, semi-natural woodland and commercial

forestry areas, complex hydrology and an LNCS. Five alternative alignments were developed in this area and were taken forward for more detailed appraisal, as shown on **Plate 4.11: Potential Alignment and Alternative Alignment Options - Section B (September 2024)**:

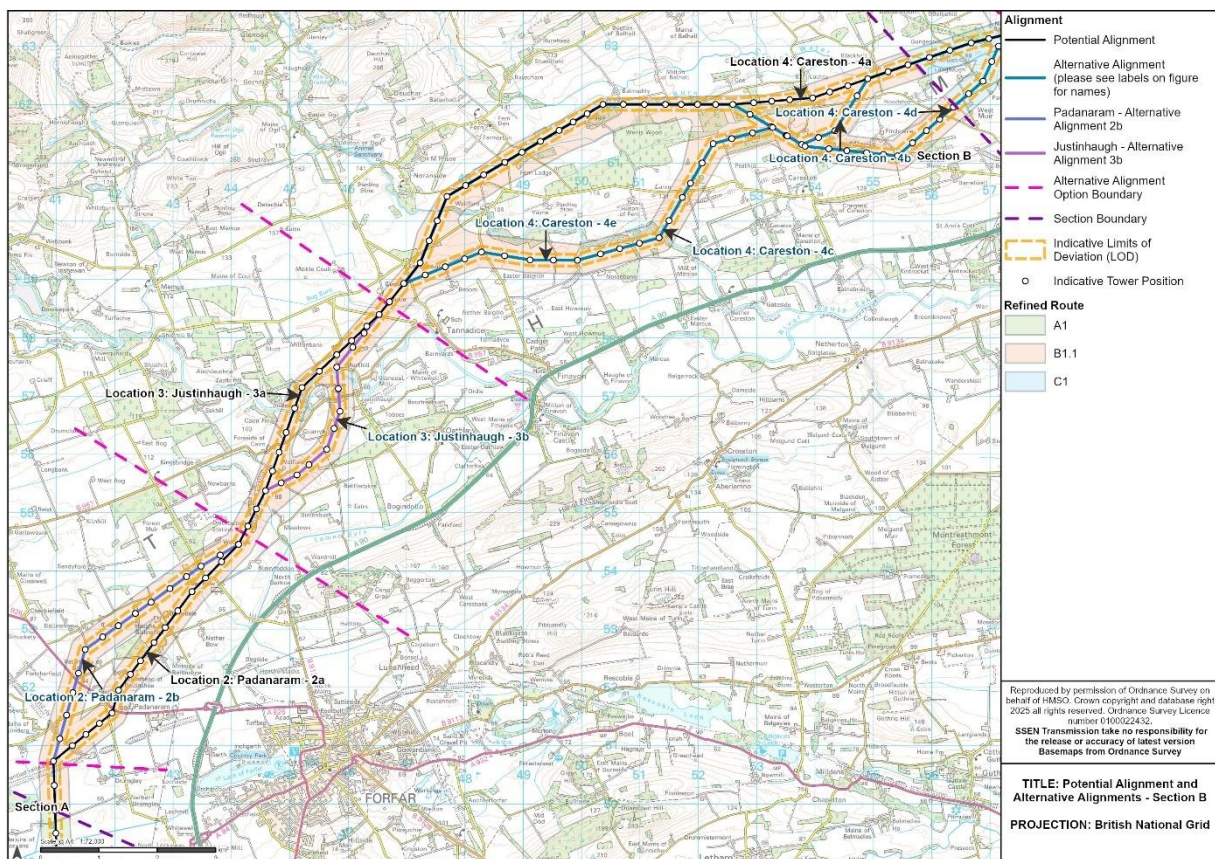
- Alternative Alignment 4a (forming part of the Potential Alignment): following a northeasterly course from Baldoukie, passing the northern side of Wellford as it crosses the Noran Water. The alignment follows a straight path avoiding North Wood to the south through Lochty Wood, with the OHL continuing across and to the north of Findowrie and Hoodston;
- Alternative Alignment 4b: following the same path from Baldoukie to North Wood as Alternative Alignment 4a, once it intersects North Wood, the OHL continues in a southerly direction, passing west of Findowrie and around the properties at Hoodston and Mill of Cruick;
- Alternative Alignment 4c: identified to the south of the route boundary, it follows a more south-southeasterly course than Alternative Alignments 4a and 4b, running parallel with the Noran Water from north of Noranbank to northwest of Waterston Ford. Once the alignment intersects North Wood, it follows the same path as Alternative Alignment 4b;
- Alternative Alignment 4d: initially following the more northern path as for Alternative Alignments 4a and 4b, as it passes through North Wood, the alignment follows a southerly trajectory to the south of residential properties at Montboy and Findowrie before continuing north of West Muir; and
- Alternative Alignment 4e: following the initial southerly path common with Alternative Alignment 4c, it then follows the same path as Alternative Alignment 4d east of its intersection with North Wood.

4.7.21 Alternative Alignment 4a was chosen to be taken forward as the Potential Alignment from an environmental, technical and cost perspective based on the following key appraisal findings:

- Although Alternative Alignment 4a intersected a small strip of ancient woodland of semi-natural origin where it crossed the Noran Water, tower micro-siting and sizing would help to mitigate felling required for the OHL, minimising woodland loss. Additionally, this alignment avoided interacting with Barrelwell Bog LNCS.
- Despite Alternative Alignment 4a being located in close proximity to the Scheduled Monument at Wellford Enclosure, there was flexibility to provide some separation of the OHL from the monument.
- Alternative Alignment 4a avoids the locally prominent ridgeline at Hilton of Fern which would be crossed by Alternative Alignments 4c and 4e. It was also considered to provide the opportunity to maintain a greater distance between the OHL and residential properties, particularly around the groups of properties in the area of Careston.
- Alternative Alignment 4a had the smallest number of angle towers, overall followed the shortest route, had no gas pipeline crossings and was the lowest cost option.

4.7.22 Having reviewed consultation feedback for this alignment location, the Potential Alignment (Alternative Alignment 4a) was taken forward as part of the Proposed Alignment in Section B. The information and responses provided, and the subsequent review, did not identify that any of the other Alternative Alignments would be less constrained overall than the Potential Alignment 4a. Considering the potential to mitigate some of the constraints associated with crossing areas of established LEPO woodland, and to avoid areas of potentially ecologically important wetland habitats, it was considered that the Potential Alignment 4a remained the least constrained option overall, notwithstanding it was considered to have a slightly higher level of environmental constraint than Alternative Alignment 4d. The Potential Alignment 4a had the shortest length and was the lowest cost alternative. It was also considered to provide separation of the OHL from the larger settlements to the south around Careston and Little Brechin.

Plate 4.11: Potential Alignment and Alternative Alignment Options - Section B (September 2024)



Location 5: Durris (Sections E and F)

4.7.23 The number and density of residential properties at the settlement of Drumoak (and Drumoak Primary School) constrained the development of alternative alignments in this area. Following review of the feedback received at the New Routes consultation (March 2024), as well as ongoing landowner and community engagement, two alternative alignments were developed in this area. The first alternative alignment was identified through the Proposed Routes E2, E1 and F1.3 (Alternative Alignment 5b), and a second more westerly alternative alignment broadly following the line of the existing Kintore to Fetteresso 275 kV/400 kV OHL through Durris Forest along the path of Option E4, and which joins with Option F3 in Section F (Alternative Alignment 5a). The alternative alignments are shown on **Plate 4.12: Potential Alignment and Alternative Alignment Options – Section E (September 2024)**, and are as follows:

- Alternative Alignment 5a (forming part of the Potential Alignment): starting from the common point for both alternative alignments just north of the proposed Hurlie substation site, it follows the existing 275 kV OHL passing through the northeast edge of Fetteresso Forest and then through Durris Forest. The alignment then passes to the west of the settlement of Kirkton of Durris, crosses over the River Dee near Wester Durris and north to join the Potential Alignment at Coldstream Plantation northwest of Drumoak; and.
- Alternative Alignment 5b: starting from the common point for both alternative alignments just north of the proposed Hurlie substation site, after passing Mergie, it leads northeastwards towards Rumbleyond, then north along the western slopes of Meikle Carewe Hill. A northerly path is then followed for approximately 5 km before crossing the River Dee near Craiglug. It then weaves through residential properties in a northwesterly direction towards Drumoak, where it passes the eastern side of the village, south of Drum Castle.

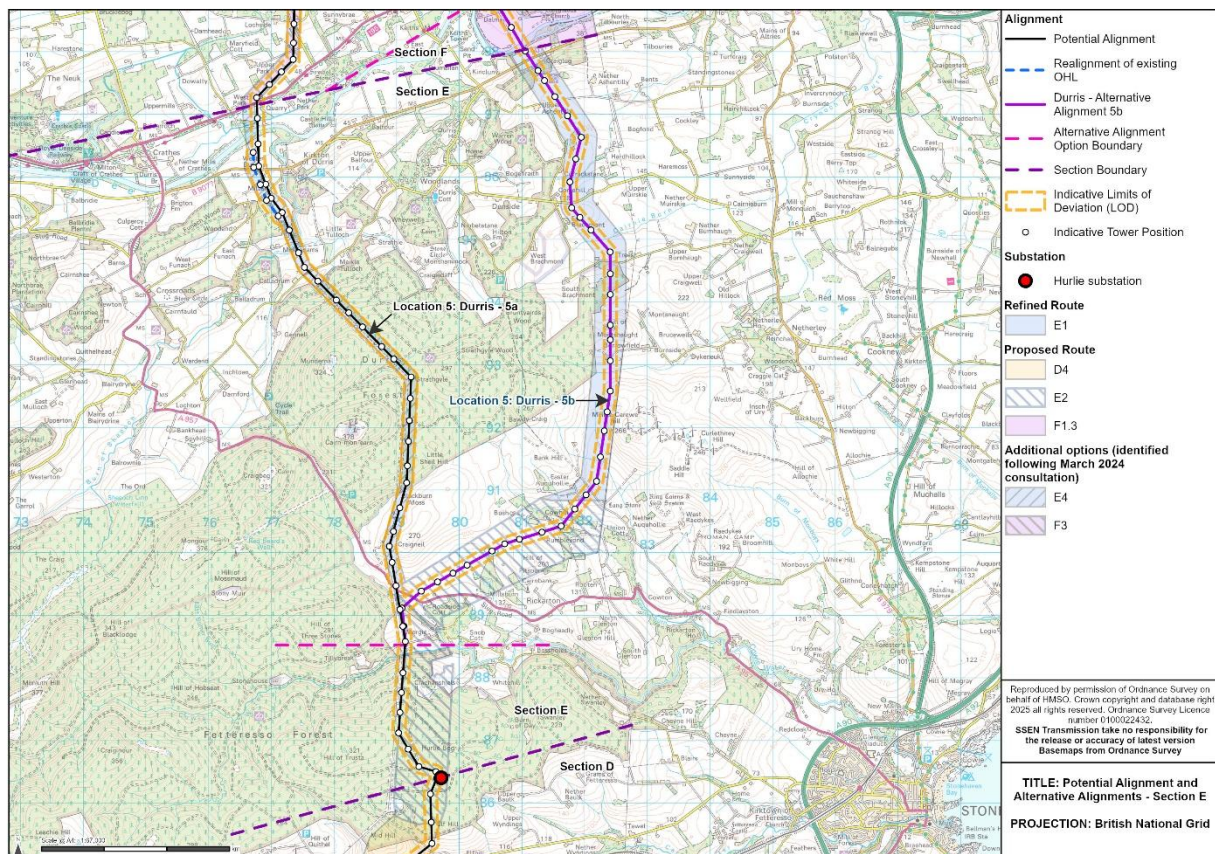
4.7.24 Alternative Alignment 5a was chosen to be taken forward as the Potential Alignment from an environmental, technical and cost perspective based on the following key appraisal findings:

- Alternative Alignment 5a was located closer to Park House GDL than Alignment 5b, however it was further from Drum Castle GDL and the associated Category A Listed Building at Drum Castle.

- Alternative Alignment 5a was located further from a high number and density of residential properties, particularly at Drumoak (including a primary school), and therefore was considered to be less constrained in relation to proximity to dwellings, sensitive receptors, views and visual amenity.
- Alternative Alignment 5a had a significantly lower interaction with high pressure gas pipelines and would require less mitigation to resolve interference through induced voltage effects.
- Alternative Alignment 5a had a significantly lower number of angle towers overall, was a shorter route and was further from a higher number of properties.
- Alternative Alignment 5a was less constrained technically, however it would involve realignment of a section of the existing Kintore to Fetteresso 275 kV/400 kV OHL which is technically complex. It was also the lower cost of the two alternative alignments considered.

4.7.25 Following review of consultation feedback, the Potential Alignment (Alternative Alignment 5a) was taken forward as part of the Proposed Alignment in Sections E and F. The information and responses provided, and the subsequent review, did not identify that Alternative Alignment 5b would be less constrained overall. On balance and taking account of a slightly amended alignment design to reduce proximity to properties, and the potential to mitigate construction impacts from tower works in proximity to the River Dee crossing and Loch of Park SSSI, the Applicant considered that the Potential Alignment 5a remained less constrained overall. It was less constrained technically (although it would require realignment of a section of existing OHL) and it would be the lower cost option. The Potential Alignment 5a was also considered to provide greater separation of the OHL from a larger number and density of residential properties, particularly at Drumoak.

Plate 4.12: Potential Alignment and Alternative Alignment Options – Section E (September 2024)



Location 6: North of Drumoak (Section F)

4.7.26 The alternative alignments developed at Location 6 are sub-options forming part of Alternative Alignment 5b and therefore would only be taken forward if Alternative Alignment 5b was preferred to 5a. The alignment section north of Drumoak is constrained by proximity to residential properties. A longer alternative alignment was developed to the west (see Alternative

Alignments developed for Location 5: Durris above) however, additional sub-options were also reviewed in Location 6 to attempt to mitigate the property constraints around Drumoak associated with Alternative Alignment 5b.

- 4.7.27 As the Potential Alignment 5a between Hurlie (in Section E) and Coldstream Plantation north of Drumoak (in Section F) was taken forward as part of the Proposed Alignment, none of the alternative alignments considered in Location 6 was taken forward to the Proposed Alignment. The comparative appraisal of Alternative Alignment 5b with the Potential Alignment 5a was based on the section north of Drumoak following the line of Alternative Alignment 6a as the least constrained alternative in this location. Further information, including the appraisal of the sub-options in Location 6, are detailed within the *Alignment Consultation Document (September 2024)* (see **paragraph 4.4.17** for document references).

Location 7: Schoolhill (Section F)

- 4.7.28 The area to the north and northeast of Schoolhill presented challenges aligning an OHL that avoided close proximity to residential properties. To address these constraints, three alternative alignments were developed and taken forward for more detailed appraisal, as shown on **Plate 4.13: Potential Alignment and Alternative Alignment Options – Section F (September 2024)**:
- Alternative Alignment 7a (forming part of the Potential Alignment): continues from the section of the Potential Alignment to the immediate south, following a northward course towards Quiddies Mill Croft and to the west of the settlement of Schoolhill;
 - Alternative Alignment 7b: lies to the west of Alternative Alignment 7a; located between Candyglirach LNCS and properties at Lower Candyglirach and Schoolhill, before heading northeast to the north of Westerton; and
 - Alternative Alignment 7c: lies to the east of the Potential Alignment between Quartains Moss and properties at Murphiehowe and Schoolhill, crossing the Gormack Burn, before turning northwest to the northeast of properties at West Cullery.
- 4.7.29 Alternative Alignment 7a was chosen to be taken forward as the Potential Alignment from an environmental, technical and cost perspective based on the following key appraisal findings:
- Alternative Alignment 7a was not constrained by Candyglirach LNCS, and was considered to have more opportunity to avoid the flood risk area of the Gormack Burn and associated watercourses.
 - Alternative Alignment 7a had a lower potential to compromise the setting of two Scheduled Monuments, at Tillyhorn Moated Homestead and East Finnercy Cairn, and was less constrained by the effect of woodland loss on landscape character.
 - Alternative Alignment 7a reduced the interaction with gas pipelines and was also the lowest cost option.
- 4.7.30 Following review of consultation feedback for this alignment location, particularly in relation to the constraints posed by the Potential Alignment (7a) for proximity to dwellings and the resultant potential visual and noise impacts to properties, the Applicant undertook further design development work particularly to review and refine the design for Alternative Alignment 7(c). Drawing on consultation and land manager feedback, and the findings of field surveys for hydrology and ground conditions, the alignment design was refined to reduce the level of constraint initially identified relating particularly to flood risk and gas pipeline crossings. Drawing on this updated design development, and in light of consultation feedback, Alternative Alignment 7c was selected to be taken forward as part of the Proposed Alignment in Section F instead of the Applicant's pre-consultation preference for Potential Alignment 7a. The information and responses provided, and the subsequent review and design development determined that Alternative Alignment 7c would be slightly less constrained on balance than Potential Alignment 7a.
- 4.7.31 Taking account of design amendments and surveys, Alternative Alignment 7c was considered to have fewer technical constraints than the previous Potential Alignment 7a particularly in relation to flood risk avoidance and reduced interaction with a high pressure gas pipeline. It also provided greater separation from a number of residential properties near Quiddies Mill and Milton of Cullerlie, and it was considered to have a similar level of environmental and cost constraint.

Location 8: Echt (Section F)

- 4.7.32 The area northeast of Echt was constrained by residential properties located in and around the village of Echt and east towards South Monecht. A consented development of 25 dwellings on the northeast edge of Echt further constrained this area and narrowed the less constrained path available to develop an OHL alignment. Further south, blocks of LEPO woodland

constrained the area between Milton of Finnercy and the B9119 public road, and undulating landforms north of the road pose landscape and visual constraints for tower siting. Dunecht House GDL located to the northeast of Echt also constrained alignments between the village and the southwestern side of the GDL. Three alternative alignments were developed and taken forward for more detailed appraisal, as shown on **Plate 4.13: Potential Alignment and Alternative Alignment Options – Section F (September 2024)**:

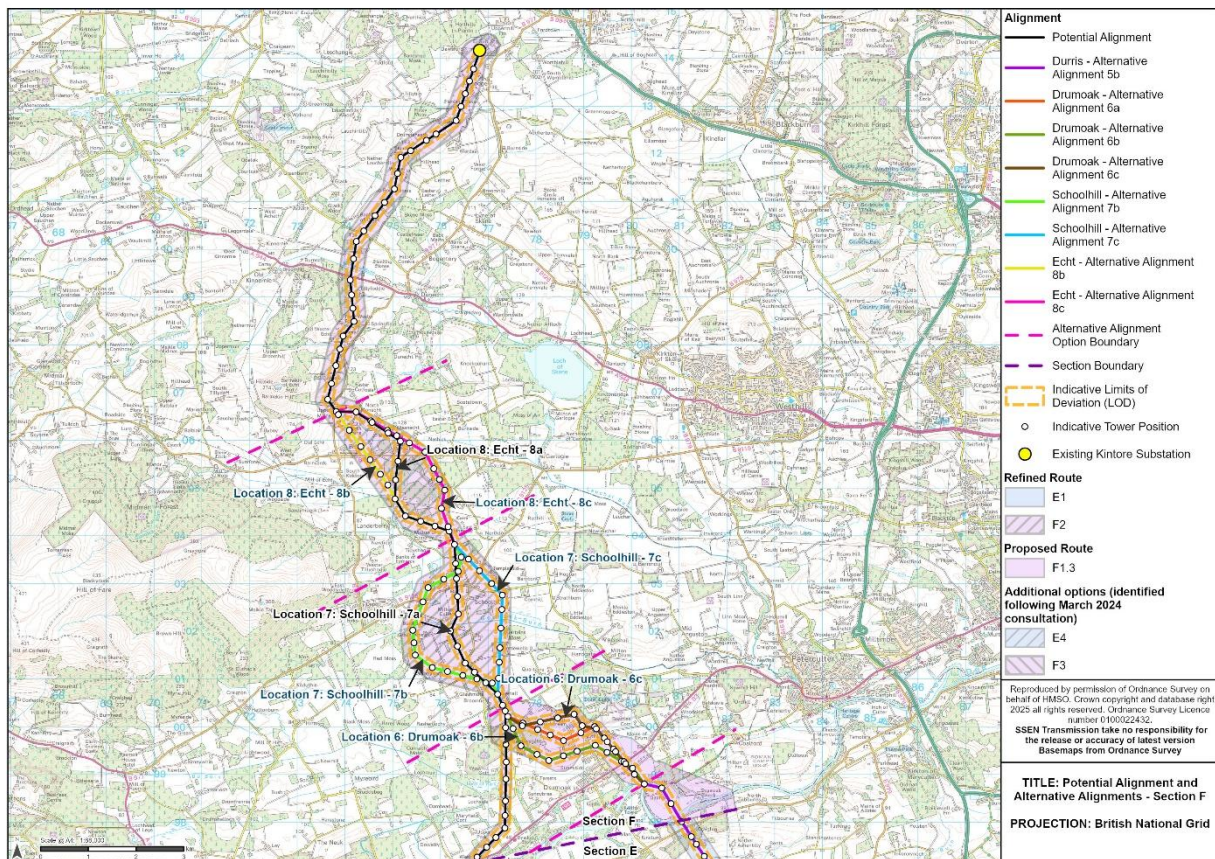
- Alternative Alignment 8a (forming part of the Potential Alignment): the central of the three alternative alignments follows a course north of Landerberry through North Kirkton Wood to join Alternative Alignment 8b north of South Monecht;
- Alternative Alignment 8b: follows a westerly direction around the northern side of Milton of Finnercy and Landerberry, before continuing in a straight, northwesterly path past the eastern edge of the village of Echt towards Upper Mains; and
- Alternative Alignment 8c: heads in a more northerly direction from Little Finnercy than the other alternative alignments. It passes through Braigiewell Wood and Stellars Moss before diverting on a northwesterly course after crossing the B9119 road.

4.7.33 Alternative Alignment 8a was chosen to be taken forward as the Potential Alignment from an environmental, technical and cost perspective based on the following key appraisal findings:

- All alternative alignments passed close to the southwestern edge of Dunecht House GDL. However, there was flexibility to position the alignments to avoid any direct impact on the designated area. Alternative Alignments 8a and 8b followed a course to the south of the GDL for a slightly greater distance than Alternative Alignment 8c.
- Alternative Alignment 8a was less constrained in relation to proximity to dwellings, sensitive receptors and visual amenity than Alternative Alignment 8b as it was located at a further distance to a larger number and density of residential properties at Echt (and a primary school). There were also fewer sensitive visual residential receptors with potential views of an OHL, especially in the vicinity of Echt village.
- Alternative Alignment 8a did not cross any locations with proposed or consented planning applications, whereas Alternative Alignment 8b partially intersected the boundary of the consented planning application within the northeast part of Echt village. There was limited flexibility to avoid this constraint and achieve the target distance of 170 m between the OHL and the planned residential properties.
- Alternative Alignment 8a passed through fewer watercourse and surface water flood risk areas.

4.7.34 Following review of consultation feedback for this alignment location, the Potential Alignment (Alternative Alignment 8a) was taken forward as part of the Proposed Alignment in Section F. The information and responses provided, and the subsequent review, did not identify that any of the other Alternative Alignments would be less constrained overall. On balance, the Potential Alignment 8a was therefore considered to be the least constrained option in this location. The Potential Alignment 8a was also considered to provide greater separation of the OHL from a larger number and density of residential properties particularly at Echt.

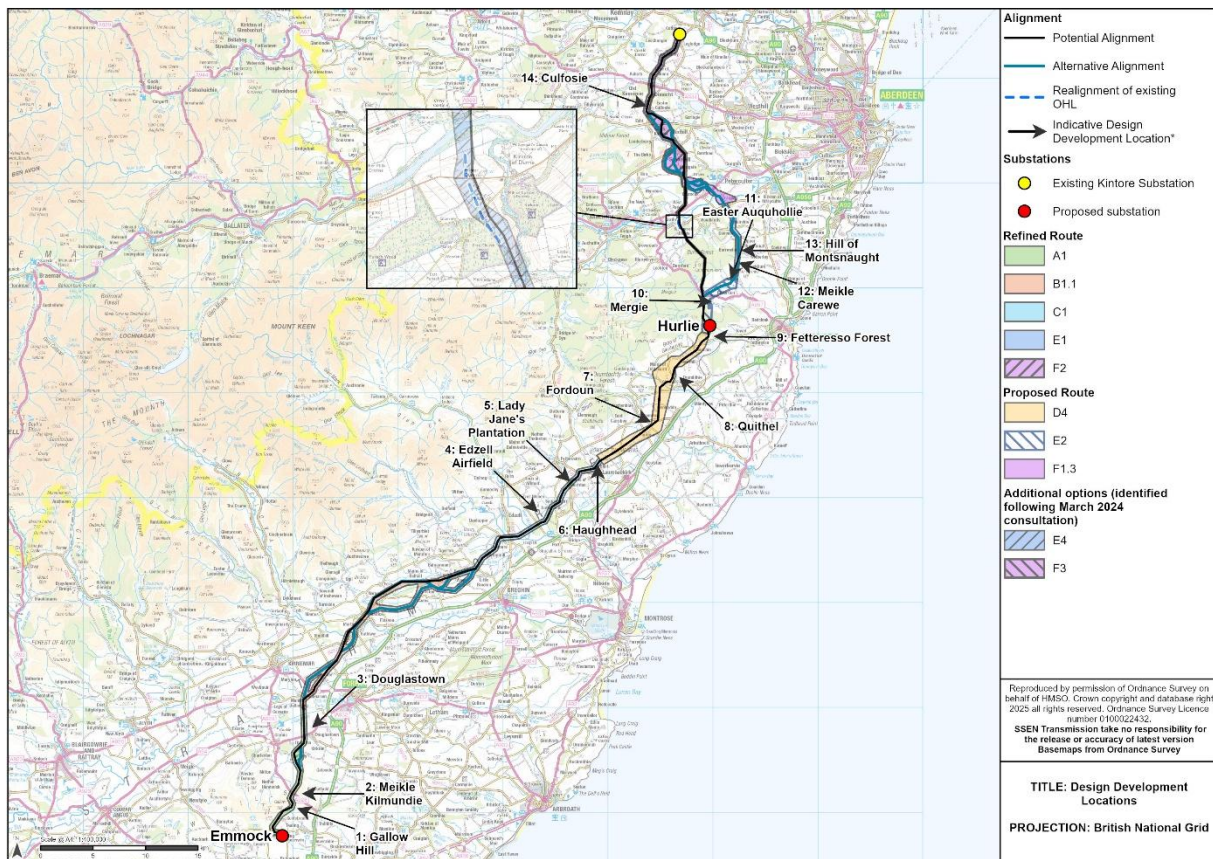
Plate 4.13: Potential Alignment and Alternative Alignment Options – Section F (September 2024)



Further Design Development Locations

4.7.35 Further design development was considered in a number of locations throughout the OHL alignment. Design development locations were identified within Sections A, C, D, E and F. These locations represented areas where there were generally localised constraints to OHL alignment development and where iterative design review was undertaken between the environmental, technical and land teams to consider opportunities to refine the design and further minimise any localised constraints. These considerations were undertaken through collaborative workshop reviews. Whilst they were not subject to detailed appraisals, the key issues considered and the drivers for selection of the Potential Alignment in each case are reported in this section. The Design Development Locations are shown on **Volume 3, Figure 4.4.8h: Design Development Locations**, and **Plate 4.14: Design Development Locations (September 2024)**.

Plate 4.14: Design Development Locations (September 2024)



4.7.36 A description of the key issues and constraints considered in these locations¹⁷ is summarised in **Table 4.1: Selection of Potential Alignment in Design Development Locations** together with the key reasons for selection of the Potential Alignment in each case.

¹⁷ The design development considered in locations 11, 12 and 13 in Table 4.1 are within Alignment Alternative 5b which was not taken forward as part of the Proposed Alignment. They have been included however for completeness and as they formed part of the optimisation of the alignment design for this alternative prior to the appraisal undertaken in Location 5.

Table 4.1: Selection of Potential Alignment in Design Development Locations

Design Development Location	Key Constraints	Reasons for Selection of Potential Alignment
Section A		
1. Southeast of Gallow Hill between Hillside of Prieston and Ironside Hill	The proximity to a communications mast requiring a buffer distance from the OHL of 1.5 times the mast height.	Alignments were considered to the east and west of the mast. Despite the eastern alignment's closer proximity to some hydrological constraints, it would traverse lower elevations and flatter ground which would minimise the potential landscape and visual impact and on balance was preferred.
2. East of Meikle Kilmundie north of Lumley Den	The presence of prime agricultural land across the route section north of the A928.	Several alignments were considered to minimise the loss of prime agricultural land taking account of other people, landscape and natural heritage constraints. The alignment selected was located on the west side of Hayston Hill which reduced agricultural land take and woodland loss in an area with relatively few visual receptors.
3. Douglastown west of Ingliston	The Dean Water northwest of Douglastown with extensive floodplain and surface water risks and potential presence of peat. The settlement of Padanaram to the north and properties at East Ingliston to the southeast. A gas pipeline to the north of Ingliston.	Eastern and western alignments were considered to minimise the level of environmental, property and technical constraints. Despite construction challenges due to some towers requiring placement in flood risk areas, the western alignment selected was located further from properties in Padanaram than the eastern alignment and it would reduce interference with gas pipeline infrastructure.
Section C		
4. Edzell Airfield, between Bathgate and Primrosehill	The disused Edzell Airfield, primarily due to the potential presence of unexploded ordnance (UXO) and radon. Consultation responses indicated that the alignment should remain 1 km from the airfield to mitigate the risk of encountering such areas.	An alignment was developed to minimise tree felling that would be required further east of the airfield, running parallel with an existing access through Inverury Wood, and avoiding a property south of the woodland at Gawloch. Despite being located within 1 km of the airfield, this alignment represented the least constrained path.
5. Lady Jane's Plantation north of Gourdon to the Dowrie Burn	Properties east and west of Lady Jane's Plantation. The woodland is designated LEPO, but the trees on the eastern side are comprised of native species more valuable than those to the western side, where parts are heavily wind-blown.	To provide separation from properties, an alignment was developed to run parallel to the western side of an existing track through the wood. This would minimise potential impact to the higher quality areas of woodland on its eastern edge and ensure retention of a windfirm edge for the woodland.
6. Haughhead and Greenbottom Wood	Consultation feedback identified concerns regarding the biosecurity risk posed by the development of an alignment due to high-value horticulture operations in this location.	An alignment towards Haughhead across the horticulture operations was taken forward as the Potential Alignment with careful consideration of tower siting around the agricultural and commercially managed areas. This enabled a greater distance to be achieved from a higher number of residential properties which constrained other alignments.
Section D		
7. Around the area of Red Hall House, north of Fordoun	In the Fordoun area, alignment development was heavily constrained by a range of constraints relating to residential properties, potential UXO risk, infrastructure crossings such as gas pipelines, listed buildings, airfields and presence of woodlands.	Two alignments were considered to minimise the interface with various constraints identified. The more westerly alignment taken forward would require some tree felling from Woods of Redhall but passes north of the listed building at House of Redhall, avoiding cutting across key views over the formal gardens. It was also less constrained by properties around Auchenzeoch and Pittengardner and would avoid a high-pressure gas pipeline to the east.

Design Development Location	Key Constraints	Reasons for Selection of Potential Alignment
8. Quithel, around Droop Hill	Agricultural operations, proximity to residential properties and hydrological constraints.	An alignment was developed across agricultural land near Annamuick farm and across the west and north of the properties at Cuttiesouter. Towers would be microsit to avoid compromising agricultural operations. This alignment reduced interaction with properties, an existing OHL and with constraints posed by watercourse crossings, including the Killer Burn.
9. Entrance to the southern area of Fetteresso Forest	Due to the complexity of connecting the proposed OHL into and out of the proposed Hurlie 400 kV substation, alignments were explored in the area connecting into the substation.	A more eastern alignment across Elf Hill into the substation was taken forward to maintain a wider path from the existing substation than the western alignment considered, which would facilitate future connections into the substation. It would also follow more favourable topography and minimise the requirement for tree felling.
Section E		
10. Mergie, between Clachanshiels and Slug Road	The development of an alignment north of Fetteresso Forest was constrained by proximity to residential properties at Mergie, particularly to the east of the alignment, and an existing OHL constraining the alignment to the west.	The alignment was microsit to achieve a property buffer of between 100-170 m from the closest residential property. An alignment further west was not taken forward due to the complexity and cost of relocating the existing 275/400 kV OHL, also requiring further tree felling and temporary power disruptions while the existing line was diverted. To mitigate the constraint, OHL towers were located as far as possible from the property and long conductor spans used to minimise key views from it.
11. Easter Auquhollie, north of Rumbleyond	Whilst properties were the primary constraint in this location, the presence of windfarms to the north, sensitive habitats, areas of peat and complex hydrology further north posed additional challenges in designing an alignment.	An eastern alignment, north of Rumbleyond, was taken forward. Whilst the alignment would be sited on slightly higher ground than a more westerly alignment, towers were microsit to reduce the visual constraints on views from residential properties north of Rumbleyond. Compared with other alignments reviewed it avoided encircling residential properties and would have lower potential impacts on sensitive habitats and aquifer sources.
12. Meikle Carewe Hill	The presence of complex hydrology to the north of Southward and northeast of Bank Hill as well as the presence of sensitive bog habitats. Proximity to Meikle Carewe wind farm also constrained the OHL alignment.	A least constrained alignment was identified which would be sited lower on the slopes of Meikle Carewe Hill than the original alignment considered. Careful micrositing was required to ensure the towers were strategically placed out of the blanket bog and on more suitable heathland and shrub habitat types.
13. Hill of Montsnaught, from Borrowfield to Newlands	Various constraints to the north of Montsnaught and south of Newlands, including a high-pressure gas pipeline, an existing 275 kV OHL to the east, elevated terrain, residential properties, and woodland east of South Brachmont.	An alignment was developed to the west of Hill of Montsnaught which provided a balanced approach in mitigating constraints compared with alignments considered further east and west. This was selected to minimise interface with the gas pipeline whilst avoiding residential properties and other existing infrastructure.
Section F		
14. Culfosie. east of Barmekin Hill	An alignment in this area was likely to involve numerous large angle tower structures to avoid key constraints including residential properties, private water supplies (PWS) and Dunecht House GDL.	An alignment was explored to reduce the number of angle towers between Dunecht GDL and the scheduled New Wester Echt Stone Circle. This enabled the OHL to be sited further from properties east of Barmekin Wood, but closer to properties west of Easter Culfosie. It avoided higher ground, reducing the number and size of angle towers required, minimising the potential for impacts on visual receptors, despite their closer proximity.

4.8 Further Consideration of Alternatives During the EIA Process

4.8.1 The earlier sections in this Chapter focus on the consideration of alternatives by the Applicant prior to this EIA stage, during the project development and consultation phases. However, during this EIA process, the Applicant has continued to reflect upon: (i) the use of alternative technology types for the Proposed Development; and (ii) the means by which effects of the selected technology type, OHL, could be further minimised. The considerations that have formed part of this EIA process are summarised in this section.

Alternative technology types: whole/partial use of UGC

4.8.2 As highlighted in **Sections 4.3 and 4.4**, the policy support and cost analysis that informs the initial selection of proposed reinforcements provides the strong starting presumption for use of OHL infrastructure. EN-5 also recognises the engineering feasibility and environmental impacts of alternatives influence this policy and any resulting decision on national infrastructure technology selection. In this regard, the following section outlines additional considerations that have influenced the selection of OHL and support why the use of alternative technologies has not been taken further.

Technical and Environmental Considerations of HVDC Subsea Cable

4.8.3 The benefits and limitations of subsea HVDC systems are explored within this section:

- One of the key benefits of High Voltage Direct Current (HVDC) subsea cable is its ability to transmit electricity uninterrupted over large distances of greater than 500 km without the need to construct interim substations to manage the performance of the cable.
- The use of subsea cable can avoid challenges seen onshore, such as avoiding developed areas such as cities and towns, as well as isolated dwellings, which impact on the available routes for OHLs.
- The current capacity of proven HVDC technology at 525 kV is 2 GW, whereas the equivalent High Voltage Alternating Current (HVAC) OHL technology operating at 400 kV is approximately 6 GW, offering approximately three times the capacity. Therefore, to achieve the capacity of one 400 kV OHL, three HVDC systems would be required.
- The use of three HVDC systems to achieve the same capacity as one 400 kV OHL would require more substation infrastructure than the equivalent OHL, with each HVDC system requiring its own Converter Station (footprint of approximately 93,000 m² (9.3 ha)), resulting in the need for, on average, three converter stations at either end of the cable route, as opposed to one substation site required for HVAC technology. This would result in more converter stations with a number of buildings to house the equipment. The HVDC technology still requires connection to the Alternating Current (AC) network, and so the use of HVDC does not remove the need for AC substations and can lead to larger substations to enable the three HVDC systems to connect to the AC system. The HVDC converter stations would be required in addition to the current proposed AC substations.
- The current cost of HVDC systems is significantly higher than the equivalent HVAC OHL system. Therefore, in addition to having substantially less capacity than HVAC, there would be additional cost to the consumer to install this technology to achieve the same capacity. Recent findings published by the Institution of Engineering and Technology (IET)¹⁸ found that offshore HVDC subsea cable was five times more expensive than an OHL.
- With an HVDC system, additional Converter Stations would be required at any point along the routes not to manage the flow of electricity but to connect the system back to the existing network to either supply the Distribution Network or allow Generators or large Demand users to connect on HVAC. This would be necessary to ensure security of supply. The construction of this additional infrastructure to allow connection to the existing HVAC network drives further costs to the consumer (through increased energy bills), as well as requiring land take with localised impacts.
- HVDC underground cable requires a smaller footprint than an equivalent HVAC underground cable when considered on an individual basis. However, with three HVDC cables required to achieve the equivalent capacity of one 400 kV HVAC system, the construction footprint becomes similar between HVDC and HVAC. This may not represent the best solution for landowners due to the greater footprint and associated impact on agricultural land, and the same issues with regards to operation and maintenance needs apply to the use of HVDC underground cables as previously described.

¹⁸ 100110238_001-rev-j-electricity-transmission-costs-and-characteristics_final-full.pdf

- Similar to onshore infrastructure, subsea cables present environmental and technical challenges, and there are significant constraints in the marine environment that can limit the infrastructure that can be placed subsea, such as (but not limited to) existing and planned offshore windfarms, offshore oil and gas infrastructure, designated Marine Protection Areas, crossing existing and planned cables and pipelines, as well as potential impacts to the seabed and marine environment, including protected species.

Environmental and Technical Considerations of HVAC Underground Cable

4.8.4 The benefits and challenges of using HVAC UGC are set out below.

- A key benefit of the use of UGC is it can reduce landscape and visual impacts in certain circumstances by removing the need for OHL infrastructure. However, as noted in **Section 4.3** the requirements for reactive compensation and further substation infrastructure can introduce different localised environmental impacts.
- UGC is present in a limited capacity on the SSEN Transmission network, mainly at 132 kV. However, 132 kV cabling requires reduced width working and operational corridors in comparison to 275 kV and 400 kV, being circa half the width required for these voltages. This provides for a reduced footprint of this infrastructure and can assist with managing the challenges associated with UGC set out in this section. In this context it is important to note that, the 132 kV network is not critical to the operation of the transmission network however the 275 kV and 400 kV network connected to the Main Interconnected Transmission System are. Therefore, issues with operability can be more acceptable on radial 132 kV UGC dependent on the connections it is facilitating.
- In order to deliver the necessary capacity for the Proposed Development, which requires a three phase 400 kV double circuit, up to 30 parallel cables would be required underground. For electrical and thermal reasons, these cables need to be suitably spaced out. To achieve the required spacing, a group of trenches at a combined width of over 40 m wide would need to be excavated, typically between 1 m and 3 m deep. During the construction period, a working corridor of over 70 m wide is required for cable installation to accommodate access tracks, working and storage areas. UGC construction requires a continuous access along the entire length of the UGC section.
- UGC construction differs from OHL construction where construction access is generally restricted to the tower locations and does not need to be continuous along the alignment. The specialised equipment for UGC construction and weight of cable drums can require more substantial access infrastructure to accommodate heavier and larger equipment compared to OHL construction. An additional impact is the requirement for cable joint bays. UGC can only be transported in certain lengths ranging from 500 m – 1000 m and therefore cable joints are required at these intervals. These are generally below ground concrete structures where the cable joints are located. For up to 30 cables, these structures are approximately 45 m in width and space restrictions may drive cable alignments to where joint bays can suitably be located. In addition, the joint bays require permanent access for operation and maintenance purposes.
- The installation of UGC can have lasting impacts on the surrounding environment. Woodland removal may be required to install transmission circuits within a corridor that has been cleared of trees and other vegetation for installation and operational purposes—this being required for both OHLs and UGC. UGC operational corridors need to maintain a set width and be clear of trees, to ensure root growth does not damage cables, limiting opportunities for tree retention in design, construction, and operation.
- In an agricultural setting, UGC can offer benefits that, once installed, the ground can be farmed provided the UGC is able to be installed at depths below that at which the field is ploughed. This can allow farmers to utilise the full area of their fields.
- Peat and carbon-rich soils present a significant challenge to UGC. The Scottish Government’s National Planning Framework 4 (NPF4) clearly sets out that development proposals should seek to avoid or minimise impacts to peatland, carbon-rich soils and priority peatland habitat. Where the development of essential infrastructure will affect peatland, NPF4 clearly sets out that it would only be considered where there is a specific locational need and where it can be clearly demonstrated that no other alternative options are available to avoid excavating peat. Installing cables in peatland presents significant risks of movement as watercourses and ground conditions change over time which can cause cable damage and faults. To mitigate against this, cables need to be installed in solid structures, like ducts and trenches, which can result in additional environmental impacts such as amending ground water flows, damaging the surrounding peatlands. In addition, due to the heat generated by the cables, this can impact reinstated peat via drying and damaging this habitat.

- Excavations involved with underground trenches have a higher likelihood to disrupt shallow groundwater systems which can result in the lowering of groundwater levels in the immediate vicinity of the excavations. In contrast, OHLs are unlikely to alter groundwater flows. Cable trenches can also modify water drainage pathways to groundwater flows, with potential impacts on environmentally sensitive wetland habitats such as marshes, flushes; and heightened risk to groundwater fed PWS.
- Due to UGC being unable to dissipate the heat generated during operation, they are less efficient in terms of their capacity than the equivalent OHL. To overcome this, additional cables would be required in comparison to the number of OHL conductors necessary to achieve the same overall capacity. Recent studies undertaken by the IET found that UGC is estimated to cost a minimum of 4.5 times more than the equivalent OHL which is driven through items such as increased cable numbers and requirements for large excavations and land take.
- It is more challenging to find a suitable route and install UGC on undulating terrain and steep slopes such as those associated with upland areas. Where there is rock near to the surface this can require significant rock breaking activities. This can permanently alter the landscape setting removing the natural appearance and creating hard edges, where a cable trench is positioned.
- It is noted that minor faults occur with less frequency with UGC in comparison to OHL. However, restoring power in the event of an underground cable fault can take significantly longer than for an OHL. Underground cable faults often require extensive works, specialist resource, tools and equipment to locate the fault, followed by significant civils work to expose the damage, replace the damaged section and carry out the repairs. This presents significant risks to security of supply and network reliability. It also impacts on SSEN Transmission's ability to meet its licence obligations of maintaining an efficient transmission network. Undergrounding cables over a significant length can have additional risk to the electricity transmission network in the event of cable failure and consequent outages. On the 400 kV network this could impact a significant number of customers due to the critical nature of these circuits.
- The installation of UGC can often require crossing of infrastructure such as public roads or railways. These cannot be excavated in the same manner as other areas therefore Horizontal Directional Drilling (HDD) is often used. The use of this method leaves the cable section within the drill section inaccessible for repair and maintenance due to the installation method "sealing" behind it. In the specific areas where HDD installation is deployed it also results in the cable operating closer to cable ratings due to the depth at which it is installed. This can reduce the operational life of the cable.
- UGC can present risks of environmental pollution to watercourses due to cable surround material being washed out during flood events. In addition, joint boxes/bays (where cable sections are jointed) need to be raised substantially to avoid all flooding as water ingress to these installations affects the operation of the cable and reduces its operational life. Moreover, the link boxes/bays will need to be kept clear of vegetation. Permanent vehicular access is required to all link boxes/bays.
- UGCs pose more challenges from an operational perspective than OHLs. The ongoing maintenance and inspection of UGC is significantly more difficult due to them being buried and therefore less accessible to both locate and subsequently fix the faults. Although minor faults are less common in UGC, when they occur, they result in major disruption to the electricity network and take significantly longer to resolve, often requiring extensive works. UGCs have an operational life of approximately 40 years, similar to an OHL conductor, whereas steel lattice towers and conductors have an operational life of approximately 50-70 years. When the Proposed Development's OHL conductor reaches the end of its design life, it can be replaced with limited impact to landowners, whereas the replacement of an UGC would be significantly more disruptive to both landowners, the local community, and the environment.

Further Economic Considerations

- 4.8.5 A recent study by the IET¹⁹ released in 2025 ("the 2025 IET Report") provides a further source of guidance on the indicative costs of different transmission technologies (as an update to the 2012 Parsons Brinckerhoff Report). The 2025 IET Report found that OHL was the most economic form of electricity transmission in comparison to onshore UGC and subsea cables. The 2025 IET Report²⁰ includes [within Section 5] a cost comparison based on the parameter of the lifetime cost to transmit one Mega

¹⁹ 100110238_001-rev-j-electricity-transmission-costs-and-characteristics_final-full.pdf

²⁰ Institute of Engineering and Technology (2025) A comparison of electricity transmission technologies: Costs and characteristics: 100110238_001-rev-j-electricity-transmission-costs-and-characteristics_final-full.pdf

Watt (MW) by a distance of 1 km. The indicative costs are necessarily based upon assumptions as recorded in the report (eg typical circuit lengths, operational voltages and configurations across the National Grid), but nonetheless offer a useful guide to the factors that generally make OHL the most cost-effective technology. **Table 4.2: IET Indicative Cost Comparison** below summarises the IET report table 5.3 and as illustrated within the supporting Flyer²¹. For present purposes, the lifetime cost of UGC was estimated to be 4-5 times greater than OHL (page 8).

Table 4.2: IET Indicative Cost Comparison

Technology	Cost - £/MW km
OHL	£1190/MW km
UGC	£5350/MW km
Subsea Cable	£6400/MW km

- 4.8.6 The cost of investing in the electricity transmission network is paid for by electricity consumers. As noted above in **Section 4.2** of this Chapter, Section 9(2) of the *Electricity Act 1989* places a duty on the Applicant to develop and maintain an efficient, coordinated and economical system of electricity transmission. As noted in the 2025 IET Report, UGC is currently (at the date of the 2025 Report) estimated to be at least 4.5 times more expensive than OHL, and therefore in line with the Applicant's electricity transmission licence obligation, cost is a key consideration directing the use of OHL technology.
- 4.8.7 Balancing the potential benefits of partial UGC against its significant disbenefits, all as set out in detail above, the Applicant is clear in its view that, having conducted the careful routeing exercise identified in this Chapter, a continuous OHL solution is the most appropriate one to meet the need for new infrastructure, and that UGC (whole or partial) is not a potential alternative amenable to further detailed study.

4.9 Summary of Selection of Alternatives

- 4.9.1 Following establishment of the need for the project and taking account of SSEN Transmission's statutory and licence duties, technology options were considered. It was determined that a 'do nothing' approach would not meet the network requirements defined by the HND and NOA processes. Taking account of technical, cost and environmental requirements, SSEN Transmission considered overhead line (OHL) and underground cable (UGC) technologies. The practical application of 400 kV UGC was not considered to be a reasonable alternative technology for the Proposed Development for a range of cost, technical and environmental reasons. Therefore, the Proposed Development has been progressed as a high voltage onshore OHL.
- 4.9.2 The appraisals that were undertaken during the corridor, route and alignment stages enabled a rigorous consideration of reasonable alternatives with respect to corridor and route options and alignment selection for the Proposed Development.
- 4.9.3 A summary of the OHL alternatives considered and those selected during the corridor, route and alignment stages, is presented in **Table 4.3 Summary of Selected Corridor, Route and Alignment Alternatives**.

Table 4.3: Summary of Selected Corridor, Route and Alignment Alternatives

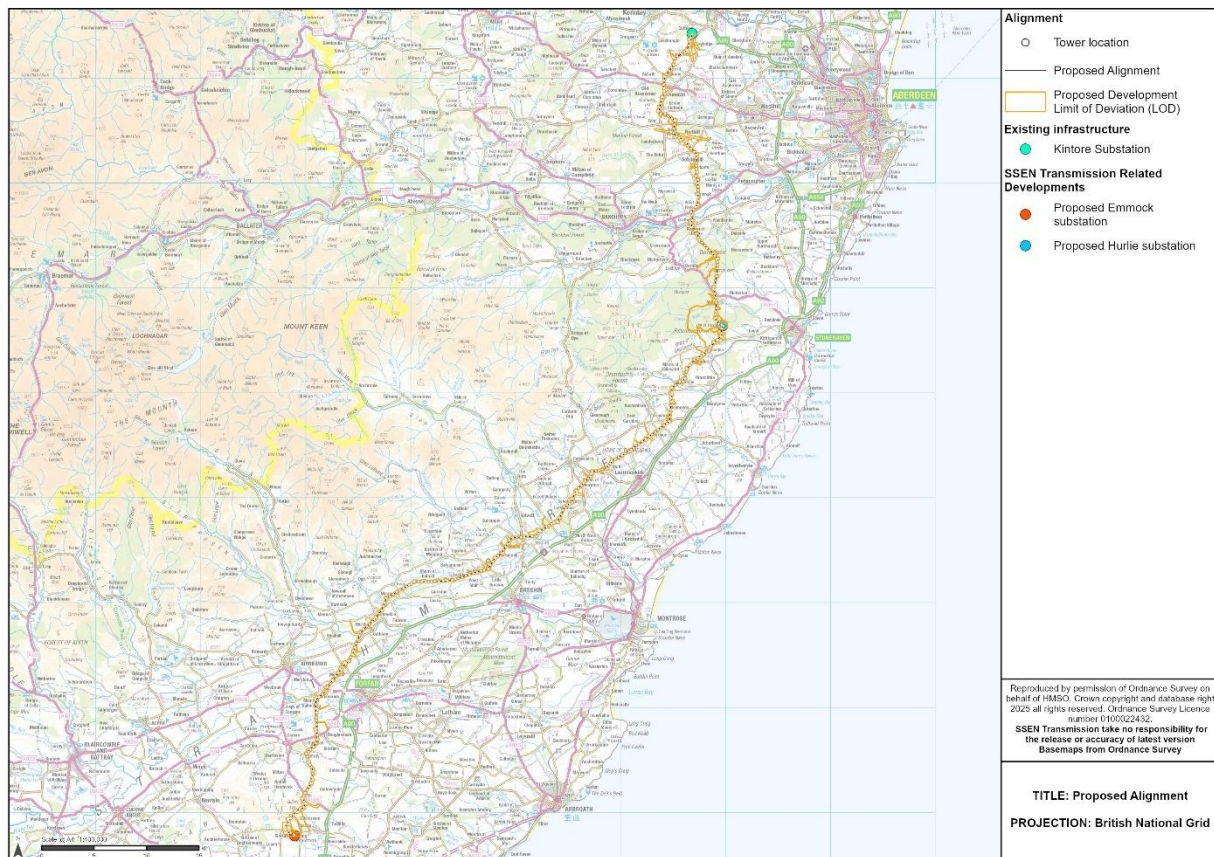
Alternatives Considered	Alternatives Selected	
Corridor Option Selection		
Corridor 1a, 1b, 1c	Corridor 1b	The Proposed Corridor
Corridor 2a, 2b, 2c	Corridor 2b	
Original Route Options Selection		
Route A1, A1.1	Route A1	Proposed Route (Section A)
Route B1, B1.1, B1.2, B1.3	Route B1.1	Proposed Route (Section B)
Route C1, C1.1, C1.2, C2, C3	Route C1	Proposed Route (Section C)
Route D1, D1.1, D1.2, D2, D2.1, D3	Route D1	Preferred Route, then revised under New Route Options

²¹ Institute of Engineering and Technology (2025) Electricity technologies Flyer: electricity-transmission-technologies-flyer-2pp-v9_print-ready.pdf

Alternatives Considered		Alternatives Selected	
Route E1, E1.1, E1.2		Route E1 (North)	Proposed Route (Northern part of Section E)
Route F1, F1.1, F1.2, F2, F2.1 Route F1.3 (post consultation)		Route F1.3	Preferred Route, consulted on with New Route Options
New Route Options Selection			
Route D4, D5		D4	Proposed Route (Section D)
Route E2, E3		E2	Proposed Route (Southern part of Section E)
Route F1, F1.3		F1.3/F2	Proposed Route (southern part and northern part of Section F)
Route E4, F3		E4, F3	Alternative Proposed Route (Section E into Section F)
Route Options Confirmed for the Proposed Route			
Route A1			The complete Proposed Route taken forward to Alignment stage
Route B1.1			
Route C1			
Route D4			
Routes E2/E1 & E2/E4			
Routes F1.3/F2 & F3/F2			
Alignment Selection			
Alternative Alignment 1a, 1b		Alternative Alignment 1a	The Proposed Alignment in locations where alternative alignments were considered
Alternative Alignment 2a, 2b		Alternative Alignment 2a	
Alternative Alignment 3a, 3b		Alternative Alignment 3a	
Alternative Alignment 4a, 4b, 4c, 4d, 4e		Alternative Alignment 4a	
Alternative Alignment 5a, 5b		Alternative Alignment 5a	
Alternative Alignment 6a, 6b, 6c		Alternative Alignments in this location did not form part of the Proposed Alignment.	
Alternative Alignment 7a, 7b, 7c		Alternative Alignment 7c	
Alternative Alignment 8a, 8b, 8c		Alternative Alignment 8a	

4.9.4 The finalised Proposed Alignment which was identified following the consideration of alternatives is presented in **Volume 3, Figure 4.4.9: Proposed Alignment** and **Plate 4.15: Proposed Alignment (January 2025)**.

Plate 4.15: Proposed Alignment (January 2025)



4.9.5 Following review of consultation feedback and taking account of ongoing survey findings, the design of the Alignment was reviewed and refined in some locations. Design development required some minor adjustments to the indicative tower positions from those identified in the Potential Alignment which were presented for consultation. These were typically required to avoid localised constraints identified from field work or landowner requirements; for example, to achieve buffer distances from residential properties and environmentally sensitive areas or to reduce potential conflicts with other infrastructure such as high-pressure gas pipelines. These adjustments were undertaken by the Applicant within the indicative LOD for the Potential Alignment, with changes to the alignment generally no greater than 50 m as reported in the *Report on Consultation – Alignment Selection (January 2025)* (see document reference in **paragraph 4.4.17**). This alignment was then taken forward as the Proposed Alignment and as the design for the Proposed Development which was subject to EIA and to support the Section 37 application. The design of this alignment was similarly subject to minor adjustments to minimise environmental and technical constraints and is described further in **Volume 1, Chapter 3: Project Description**.