Carnaig 400kV Substation EIA Report
Volume 1: Non-Technical Summary
October 2024

Scottish & Southern Electricity Networks

TRANSMISSION

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QUALITY MANAGEMENT

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INTRODUCTION

Overview

This Non-Technical Summary (NTS) forms part of the Environmental Impact Assessment Report ("EIA Report") prepared on behalf of Scottish Hydro Electric Transmission plc ("the Applicant") who, operating and known as Scottish and Southern Electricity Networks Transmission ("SSEN Transmission"), own, operate and develop the high voltage electricity transmission system in the north of Scotland and remote islands.

The proposed Carnaig 400 kV Substation is located approximately 9.5 km north east of Bonar Bridge. The specific location of the proposed Carnaig 400 kV Substation (hereafter referred to as the 'Proposed Development') is adjacent to the south western boundary of the existing 275 kV Loch Buidhe Substation at central grid reference NH 65053 97458. The Proposed Development is located within an area of commercial forestry, which has been partially felled. Lochbuie Road runs to the west of the Proposed Development.

The full results of the EIA (baseline information, survey findings and technical assessments) that are completed for the Proposed Development are presented in the main EIA Report (**Volume 2**). The findings of these studies are summarised and presented in this summary document in non-technical language.

The aim of this NTS is to summarise the content and the main findings of the EIA Report in a clear and consistent manner to assist the public in understanding what the environmental effects of the Proposed Development are likely to be. The full EIA Report (Volume 2: Main Report; Volume 3a: Figures; Volume 3b: Visualisations and Volume 4: Technical Appendices) provides a more detailed description of the Proposed Development, and the findings of the EIA.

The Proposed Development

The Proposed Development consists of:

- Two new bell mouths and access roads to the Proposed Development from the public highway;
- One new bell mouth and access road from the Proposed Development to the private forestry track;
- A temporary construction compound;
- Drainage and associated Sustainable Drainage System (SuDS) retention basins;
- A new level platform (approximately 530 metre (m) by 324 m) to be delivered through cut and fill earthworks. An outdoor AIS, 400 kV substation complete with 400 kV double busbar arrangement;
- Installation of three new SGTs and other associated equipment;
- A new substation control building (approximately 23 m by 48 m by 5.8 m);
- Erection of a 2.4 m high palisade security fencing with a 1.6 m electrified anti-climbing extension security fence around the perimeter of the platform;
- Post construction mitigation measures including peatland restoration and landscape mitigation planting;
- Biodiversity enhancement works including native species planting and habitat creation; and
- Erection of a deer fence around the perimeter of landscape planting and peatland restoration areas.

Notifications

Notice will be served for this application to the relevant planning authority, in this case The Highland Council, of the application for consent under the Town and Country Planning (Scotland) Act 1997.

In accordance with Regulation 21 (3) of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017, the application will be advertised in the following local newspapers:

- The Press and Journal (Inverness, Highlands and Islands); and
- Inverness Courier

It will also be advertised in the following regional newspaper:

- Edinburgh Gazette

Notice of the Planning Application, including this EIA Report, associated documents and figures, will be available for viewing at Kyle of Sutherland Hub, South Bonar Industrial Estate, Ardgay IV24 3AQ from:

- Monday – Thursday: 09:00 – 19:00.
- Friday – Saturday: 09:00 – 16:00.
- Sunday: 10:00 – 15:00.

Electronic versions of the consent application, including the EIA Report will be available to download from the Applicant's website at: https://www.ssen-transmission.co.uk/projects/project-map/loch-buidhe-area-400kv-substation/

The EIA Report is available in other formats if required. For details, including costs, contact:

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THE NEED FOR THE PROJECT

Renewable energy generation volumes connecting to the SSEN Transmission licensed area, particularly offshore wind, are expected to increase towards the end of the decade and into the 2030s. Most of this is likely to connect to the far north of the SSEN Transmission network and as a result of this increase there is a requirement for additional transmission system capacity to the north of Beauly to meet this demand.

The Network Options Assessment (NOA) undertaken by the National Grid Electricity System Operator (NGESO) is one of the documents that sit under the Pathway to 2030: A Holistic Network Design (HND) to support offshore wind deployment for net zero. The NOA 2021 / 22 Refresh is an update to the NOA 2021 / 22 that was published in January 2022 in accordance with standard condition C27 of the NGESO transmission licence. It now fully integrates the HND's offshore network and confirms the wider onshore network requirements.

Together, the HND and the NOA 2021 / 22 Refresh have identified 94 schemes that are required to meet the Government's ambition for 50 Gigawatt (GW) of offshore wind by 2030. This comprises 56 schemes that have been identified as HND essential options (options needed for 2030 for delivery of 50 GW offshore wind), and 38 optimal schemes from this NOA 2021 / 22 Refresh analysis.

NOA Option Beauly to Loch Buidhe 400 kilovolt (kV) reinforcement (BLN4) identifies the requirement to reinforce the electricity transmission network between Beauly Substation and the existing Loch Buidhe Substation and the need to create new electricity transmission between Loch Buidhe Substation and Spittal. This network reinforcement and creation also triggers the requirement to construct new standalone substations at Spittal, Loch Buidhe and Beauly capable of operating at 400 kV.

The scope of this NTS and associated EIA Report is the new substation proposed at Loch Buidhe, henceforth referred to as Carnaig 400 kV Substation. The new 400 kV overhead line (OHL) connecting Spittal, Loch Buidhe and Beauly, and the proposed substations at Beauly and Spittal are being progressed through separate consents and are, therefore, not within the scope of this NTS or the associated EIA Report.

SITE SELECTION AND ALTERNATIVES

The approach to site selection has been informed by SSEN Transmission's Substation Site Selection Procedures for Voltages at or above 132 kV[1] guidance document. The guidance document considers the approach to identification and selection of new electricity transmission substation sites and also covers requirements to extend existing substations.

Each stage is an iterative process and involves an increasing level of detail and resolution, bringing cost, technical and environmental considerations together in a way which seeks to achieve the best balance at each stage. The stages that are carried out can vary depending on the type, nature of and size of a project and consultation is carried out at each stage of the process.

Strategic Options Assessment (Stage 0)

A strategic options assessment was undertaken by SSEN Transmission. The outcome of this strategic options assessment identified the following key requirements for the new sites:

- Proximity to the existing 275 kV substation to minimise the amount of cabling required to connect to the network.
- Large enough to accommodate the proposed substation footprint, together with associated landscaping, contractor compounds, access and new connection routes.
- Capacity for future connections.
- In areas which do not contain environmental designations and minimise impacts on local environmental receptors.
- Enables connection.
- The outcome of the strategic options assessment informed the identification of sites to take forward as part of the Stage 1: Initial Site Screening Stage.

Initial Site Selection (Stage 1)

Stage 1 of the SSEN Transmission Site Selection process requires a comprehensive list of feasible site options to be identified. Five options were identified for the Carnaig Substation during the initial Site Selection Process. The first step of this process was to undertake a multi-criteria analysis (MCA) using publicly available Geographic Information Systems (GIS) datasets to provide a high-level environmental constraints map within 10 km. In addition, the site selection exercise undertaken in 2011 for the existing Loch Buidhe 275 kV Substation was reviewed to ascertain if this could yield potential site options or provide further background.

Using the data from the MCA, and assessing the 2011 site selection process, five initial site options were identified for the size of the proposed substation, and the challenging and remote nature of the terrain. Assessment of the five options was undertaken. This resulted in two of the options being discounted from further assessment based on access constraints, land use impacts and environmental sensitivities.

Detailed Site Selection (Stage 2)

This stage seeks to identify a preferred substation site from shortlisted options, which minimises where practicable physical, environmental and amenity constraints, is likely to be acceptable to stakeholders and is viable (taking into account engineering and cost requirements). The connections into new and existing assets forms a crucial part of this assessment to reduce the need for additional new infrastructure.

Following the completion of the Stage 1 initial screening process, a total of three sites were identified and taken forward to Stage 2.

[1] Scottish and Southern Electricity Networks (November 2020). PR-NET-ENV-502. Substation Site Selection Procedures for Voltages at or above 132 kV

Appraisal of options involved systematic consideration against a range of factors broadly covered under environmental, engineering and cost topic areas. A rating was applied to each factor within each topic area for each site option, indicating potential constraint(s) to development.

A preferred substation option was identified, and this option was subject to statutory, non-statutory and public consultation (**Volume 2 Chapter 3**). All consultation responses were considered, and adjustments made to the design where possible. The preferred substation option was then selected as the proposed substation and taken forward to the consenting phase of the project.

Further Design

Following appointment of the Principal Contractor and in parallel to the consenting phase of the Proposed Development, further adjustments to the design have been undertaken, such as micro-siting, changes in orientation and alternative arrangement of plant, to reduce environmental impacts, enable a safe and technically robust design and deliver the most cost-effective solution.

DESCRIPTION OF THE PROPOSED DEVELOPMENT

The proposed Carnaig 400 kV Substation (**Section 1.2**) construction will be undertaken in a phased delivery as detailed below.

Phase 1 - Forestry Clearance

Construction will require the removal of sections of commercial forest which would be undertaken in consultation with Scottish Forestry and the affected landowner. Any timber that is commercially viable would be transported off site to local timber markets and the remaining forest material would be dealt with in a way that delivers the best practicable environmental outcome and is compliant with waste regulations.

Phase 2 - Enabling works

Road improvements and Access

Detailed access proposals are being developed by the Principal Contractor.

The traffic route to the Proposed Development will be via the A9 / A949 through Bonar Bridge and then approximately 8 km along Lochbuie Road (U3521 public road), past Migdale before reaching the location of the Proposed Development.

Based on desk-based study analysis and preliminary walkover inspections, access to the Proposed Development will be established through a new bell mouth and access road from the public highway, located to the south west of the proposed Carnaig Substation.

The access will be achieved from the existing road network, with a bell mouth junction in the north onto a proposed site access from the forestry and existing substation access road. In the south a proposed site access will be taken directly off Lochbuie Road. A third access will service the proposed SuDS basin.

Assessments are currently being undertaken of the access route to determine if further works are required including bridge and culvert assessment and a review of existing street furniture and roadside vegetation.

A Construction Traffic Management Plan (CTMP) will be submitted for approval to THC to describe how the additional traffic generated due to the proposed construction works will be managed, with safety and improvement measures implemented so that the impact to the local area and persons will be minimised, as far as is reasonably practicable.

Temporary Site Compound

It is currently anticipated that a single main construction compound will be required. This will be located within the Proposed Development boundary approximately 50 m south west of the proposed Carnaig Substation, adjacent to the proposed Carnaig Substation site access road (south) and just off Lochbuie Road.

Phase 3 – Construction works

This phase would comprise:

- Installation of temporary construction drainage;
- Creation of a level platform through cut and fill earthworks;
- Relocation of excavated peat in line with the peat management plan;
- Installation of the control building and other infrastructure foundations;
- Installation of permanent site drainage (including retention basin);
- Erection of a control building;
- Erection of four buildings housing synchronous condensers;

- Installation of electrical plant (including air insulated switchgear, 400 kV substation complete with 400 kV double busbar arrangement and super grid transformers); and
- Installation of new 2.4 m palisade security fencing with a 1.6 m electrified anti-climbing extension and new gates

Phase 4 - Commissioning

The Proposed Development would be subject to an inspection and snagging process. This allows the Principal Contractor and the Applicant to check that the works have been built to specification and are safe to energise. The Proposed Development would also go through a commissioning procedure for the switchgear, communications, and protection controls through the substation. The circuits would then be energised so the Proposed Development can be connected to the National Grid.

Phase 5 - Reinstatement

Following commissioning of the Proposed Development, all construction sites will be reinstated. Reinstatement will form part of the contract obligations for the Principal Contractor and will include the removal of all temporary access tracks and compounds, all work sites and replanting in accordance with a Landscape and Ecological Mitigation Plan submitted for approval as part of the application for planning permission. Restoration of areas of peatland using peat excavated from the Proposed Development will be completed at this stage in line with the approved peat management plan. In order to protect landscape planting a deer proof fence and associated gates will be installed around the perimeter of the Proposed Development to reduce grazing pressure and increase the likelihood of successful establishment.

Reinstatement works will be undertaken in line with good practice, which is reflected in SSEN Transmission GEMPs (**Volume 4 Appendix 2.1**).

Reinstatement of Access Tracks

Reinstatement would involve replacement of topsoil, grading and installation of drainage. Graded areas shall be planted in line with the Landscape and Ecological Mitigation Plan or would be allowed to vegetate naturally.

Reinstatement of Construction Compound

The construction compound will be reinstated at the end of construction with all buildings and materials removed and soils reinstated. The location will be revegetated in line with the Landscape and Ecological Mitigation Plan.

CONSULTATION

Consultation on the preferred substation option was undertaken jointly with the proposed Spittal – Loch Buidhe – Beauly 400 kV OHL project. The public consultation events were held across a two-week period in late February and early March 2023; the events spanned towns and villages located along the route options for the proposed 400 kV OHL.

The public consultation events were followed by presentations to and engagement with the statutory consultees; representatives from The Highland Council, NatureScot and Historic Environment Scotland attended a consultation session on 10 March 2023. An invite was also issued to Scottish Environment Protection Agency (SEPA).

Information materials prepared for the consultations with the public and statutory authorities in March 2023 included a consultation booklet, public event banners and ArcGIS-based Storymaps that set out the context and background to the Proposed Development and its need, in addition to the process followed to assess site options and reach a short list.

Feedback from Statutory Consultees following the site selection process (**Volume 2 Chapter 3**) were broadly in favour of the preferred substation option over the other options with key themes as follows;

- Historic Environment Scotland indicated the preferred site option was furthest from scheduled monuments than the other site options under consideration and therefore probably likely to be least constrained;
- NatureScot indicated that the preferred site option was the most sensible site option in their view but that consideration was required of impact on hen harrier population which is the qualifying species of the Special Protection Area (an International Conservation Designation);
- The Highland Council indicated a preference for a consolidated site option (the preferred site option and the existing Loch Buidhe Substation) subject to assessment of landscape and visual Impact and to satisfying NatureScot comments in relation to impacts on protected species;
- The Highland Council indicated that micro-siting and cumulative landscape and visual effects should be heavily weighted in design; suggested that all configuration / layout options and technologies should be considered in order to bed the design into the landscape.

In March 2024 a scoping report was issued to The Highland Council. A Scoping Opinion was received from the Highland Council in May 2024. Pertinent points raised in the Scoping Opinion have been considered and are detailed within the appropriate technical chapters of **Volume 2** of this EIAR.

A further public consultation event was held on the 10th June 2024, at Bonar Bridge, undertaken jointly with the Spittal – Loch Buidhe – Beauly 400 kV OHL. Feedback from the events have been collated and considered by the SSEN team.

METHODOLOGY

The aim of the impact assessment process is to predict if the Proposed Development is likely to result in a significant impact on the environment.

EIA best practice suggests that the significance is assessed in relation to magnitude and sensitivity. The magnitude (scale) of change / effect is identified and compared to the existing baseline conditions. The sensitivity of the receiving environment to change is determined using professional judgement, consideration of existing designations and quantifiable data where possible.

Each change / effect is assessed taking account of the predicted magnitude of change / effect and the sensitivity of the receptor as shown in **Table 1** below to determine an overall significance.

Table 1: Matrix for Determining the Significance of Effects

		Sensitivity of Receptor/Receiving Environment to Change/Effect			
		High	**Medium**	**Low**	**Negligible**
Magnitude of Change/Effect	**High**	**Major**	**Major**	Moderate	Negligible
	Medium	**Major**	**Moderate**	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Major and moderate effects are considered to be significant in the context of the EIA Regulations. Minor and negligible effects are not considered significant.

Mitigation measures are identified to prevent, reduce or remedy any potentially significant adverse environmental effects identified, beyond that already taken into account as normal good practice, i.e. embedded mitigation for example, the Construction Environment Management Plan, or Species Protection Plans. Such measures would be implemented during detailed design, construction and / or operation of the Proposed Development. Any remaining predicted effects after taking into account available mitigation measures are known as residual effects.

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

General

The landscape and visual impact assessment for the Proposed Development has been undertaken in accordance with the Guidelines for Landscape and Visual Impact Assessment (3rd Edition) GLVIA 3 and following consultation on the scope of the assessment with The Highland Council.

The assessment has identified the baseline landscape and visual context to the Proposed Development and assessed the effects resulting from the Proposed Development during the construction phases in addition to the operational phase (at Year 1 and Year 15).

Baseline Landscape and Visual Conditions

The Proposed Development boundary is located on the eastern side of a broad, open valley area, on the lower, north west facing slopes of Meall Mor. These slopes are covered with coniferous plantation which is actively managed. Access to the Proposed Development is taken from the Lochbuie Road, a minor, single track road providing local access. The landscape surrounding the Proposed Development largely comprises moorland with small areas of farmland (typically found to the south, peatlands dominating the north). The Proposed Development is surrounded by coniferous woodland which extends to the east across the slopes of Beinn Domhnaill.

Visual receptors within the study area to the Proposed Development comprise users of Lochbuie Road, users on Carnegie Road and four scattered residential properties (Sleastary, Clashbahn, Badbog and Reidhbreac). Five viewpoint locations were selected for assessment of the Proposed Development. Four of these viewpoints are located on Lochbuie Road and illustrate the short duration change in views resulting from the Proposed Development. The location of the Proposed Development is immediately to the south west of the existing Loch Buidhe Substation. This substation is largely screened from views from Lochbuie Road by a combination of the existing landform and mature coniferous woodland.

Mitigation

The potential for landscape and visual impacts were identified at an early stage and helped guide the siting and design of proposed mitigation planting measures and the approach to mitigation of effects resulting from the earthworks. These measures helped to reduce the potential landscape and visual impact of the Proposed Development on the wider area.

Assessment of Effects on Landscape Character

The assessment identified that the Proposed Development would be sited in the Rounded Hills Caithness and Sutherland Landscape Character Type (LCT) and would not be sited within a designated landscape. The Proposed Development would result in a permanent change to the landscape within a discrete parcel of land, the Proposed Development resulting in the loss of commercial woodland and change to the landform as a result of the formation of the platform. Changes to the character of the landscape would be localised and Major at construction phase reducing to Major / Moderate (Year 1) and then Moderate / Minor 15 years after construction is completed when mitigation planting has established.

Assessment of Effects on Visual Amenity

Effects on visual amenity of visual receptors would be greatest during the construction phase, reducing as mitigation planting establishes. Effects would be greatest on users of Lochbuie Road and Carnegie Road where users are in close proximity to the Proposed Development and / or there is no screening of the Proposed Development by landform or vegetation. For users of Lochbuie Road effects would be Major at construction reducing to Moderate at Operational Phase Year 1 and further reducing to Moderate / Minor at Operational Phase Year 15. For users of Carnegie Road effects would be of a similar rating, effects at Construction Phase

being Major and reducing to Moderate at Operational Phase Year 1, reducing to Moderate / Minor at Operational Phase Year 15. Due to screening by landform and / or vegetation no significant effects on the visual amenity experienced from the four residential properties within the study area were identified.

Cumulative effects on landscape and visual receptors would be likely to arise as a result of the construction and operation of the proposed Spittal - Loch Buidhe - Beauly 400 kV OHL. It is predicted that for both landscape and visual receptors effects would be greatest during the construction phase of the OHL which would occur post-construction of the Proposed Development and while the mitigation planting to the Proposed Development is still at the early stages of establishment and that effects on both landscape and visual receptors would be significant and adverse.

As the planting matures, effects on landscape and visual receptors resulting from the Proposed Development would reduce as the planting helps to integrate the Proposed Development into the landscape and screen views of the built components. Due to its nature, views of the proposed OHL would remain. However, the cumulative effects would, by this stage, be assessed as Not Significant.

Conclusions

In conclusion, the Proposed Development would result in a permanent change to landscape features across the area of Proposed Development and in combination with the existing Loch Buidhe Substation, increasing the footprint of electricity transmission infrastructure within the Rounded Hills LCT. The Proposed Development would be likely to significantly affect landscape and visual receptors in the vicinity of the Proposed Development during the Construction Phase and Operational Phase Year 1. At Operational Phase Year 15, the establishment of mitigation planting would reduce visibility of the Proposed Development and integrate the substation into the landscape such that effects would be reduced to the extent that there would be no significant adverse effects at any of the viewpoint locations. Furthermore, the establishment of the mitigation planting would reduce the level of cumulative effects on landscape and visual receptors resulting from Proposed Development to the extent that there would be no residual significant adverse cumulative effects. Effects on the wider landscape and visual amenity of the surrounding experienced in the region of the Proposed Development would not be significant.

CLIMATE CHANGE AND CARBON BALANCE

An assessment has been carried out to evaluate the effects of the proposed Carnaig 400 kV Substation on climate change and carbon balance. The assessment is based on the Institute of Environmental Management and Assessment (IEMA) guidance for assessing greenhouse gas emissions (2022) and regarding climate change resilience and adaptation (2020). The climate change assessment is split into the following parts:

- A Climate Change Resilience (CCR) Assessment – the impact of climate change on the Proposed Development;
- An In-Combination Climate Impacts (ICCI) Assessment – a summary of the effects of climate change on environmental receptors assessed within the EIA Report; and
- A Greenhouse Gas (GHG) Assessment – assessing the influence of the Proposed Development on the climate.

CCR Assessment

The CCR assessment considers the vulnerability of the Proposed Development to projected climate change. UK Climate Projections published by the Met Office were used to determine the potential impacts of climate change in Scotland in 2081-2100, under the worst-case and more realistic predicted emissions scenarios. Professional judgement was then used to determine whether these projected changes would impact the Proposed Development.

Climate change is projected to increase temperatures in the UK, and shift precipitation patterns to cause drier summers and wetter winters. These changes are unlikely to affect the Proposed Development, and flooding is not expected to pose a significant risk to Proposed Development (**Volume 2 Chapter 11** Hydrology). Therefore, further assessment of the Proposed Development's vulnerability to climate change was scoped out.

ICCI Assessment

As with the CCR Assessment, climate projections have been used to assess the potential additive impact that climate change may have on receptors identified within other topics of this EIA Report. Ecology, ornithology, geology, and hydrology were identified as the topics where environmental receptors may be most affected by climate change.

It was determined that a shift to higher temperatures, drier summers, and wetter winters, could potentially impact habitats through affecting the composition and growth rates of plant communities. This would then have associated impacts to species, and also the carbon sink potential of habitats like peatlands. However, given the uncertainty in climate change projections, and how different species may respond to climatic changes, it is not clear whether any significant changes to the baseline environmental receptors would occur during the lifetime of the Proposed Development. No additional significant effects are therefore anticipated as a result of climate change.

GHG Assessment

The Scottish Government's Carbon Calculator for wind farms has been used to assess the impact of the Proposed Development on carbon losses from peatland and forestry, and the DEFRA Emissions Factor Toolkit was used to quantify GHG emissions from construction traffic. This modelling, in combination with professional judgement and comparison with annual UK emissions and future GHG emissions targets (UK carbon budgets and net zero), has been used to quantify the effect of the Proposed Development on the climate. Emissions related to construction materials and manufacturing were not included in the assessment as complete data was not available at the time of the assessment (and would not usually be available or confirmed until the construction phase).

Carbon losses associated with peatland disturbance and forestry felling were calculated as 110,590 tonnes CO_2 equivalent, with an additional 1,924.45 tonnes CO_2 associated with construction traffic, totalling 112,514.45 t CO_2 equivalent overall for the Proposed Development. These losses are potentially underestimated due to construction materials and manufacture not being included.

Overall, the losses would account for approximately 0.03% of the UK's annual territorial GHG emissions (384 Mt CO_2 equivalent in 2023), and approximately 0.0056% and 0.0068% respectively of the fourth (2023 to 2027) and fifth (2028 to 2032) UK carbon budgets. This has been assessed as a negligible magnitude impact on a very highly sensitive receptor, resulting in a minor adverse effect on the climate, which is not significant under the EIA Regulations.

However, proposed peatland restoration will contribute to the mitigation of this impact, as once established it will cause carbon savings by up-taking and storing carbon. The exact carbon savings associated with the proposed peatland restoration are uncertain, but savings of a maximum of approximately 45,566 t CO_2 equivalent could be possible. In addition, future compensatory forestry planting would likely lead to carbon savings.

Consideration should also be given to the purpose of the Proposed Development – to enable the connection, transmission, and distribution of renewable energy to meet demand. These renewable energy developments have associated carbon savings through replacing conventional electricity generation technologies, and they require infrastructure such as the Proposed Development to meet energy demand. The emissions saved from these developments would easily balance and exceed the losses associated with the Proposed Development, and other electricity infrastructure required to connect them to the grid. By way of illustration, when considering solely the approved wind farms within 25 km of the Proposed Development, their associated carbon savings would account for and exceed the carbon losses associated with the Proposed Development, thereby mitigating its impact on climate change.

ECOLOGY AND NATURE CONSERVATION

An assessment has been carried out which considers the potential impacts on non-avian ecology including designated sites, terrestrial habitats, and protected species, and reaches conclusions as to the predicted significant impacts. The assessment is based on best practice guidance including the Chartered Institute for Ecology and Environmental Management's (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland (2018).

The scope of the ecological assessment and baseline conditions were determined through a combination of desk-based study, field surveys, and consultation with relevant organisations. This process established ecological features that could potentially be impacted by the Proposed Development.

The Proposed Development is situated entirely within the Strath Carnaig and Strath Fleet Moors Special Protection Area (and Site of Special Scientific Interest) and is approximately 2 km upstream of the River Evelix Special Area of Conservation. On account of the qualifying features of the Strath Carnaig and Strath Fleet Moors Special Protection Area (and Site of Special Scientific Interest) being solely ornithological, these designated sites were not considered within the ecology and nature conservation assessment and are instead detailed within the ornithology chapter (**Volume 2 Chapter 8**).

The predominant habitats found within the survey area include commercial forestry plantation (approximately 383 ha), degraded blanket bog (77.5 ha) and grasslands (15.98 ha). Approximately 15.35 ha of the survey area was covered by developed land / artificially sealed surfaces, including forestry tracks, roads and the existing Loch Buidhe Substation platform and car park. Of the habitats classified four were considered to be potentially ground water dependent.

Protected species identified as present or likely to be present within the survey area include badger (*Meles meles*), pine marten, otter, water vole, red squirrel and common toad. Although evidence was not directly observed, the survey area is considered suitable for reptiles and it is assumed that a low density population of common lizard and adder are likely present.

The Proposed Development has been designed to minimise impacts on designated sites, important habitats, peatland and protected species as far as practicable. This has been achieved through embedded mitigation and an iterative design process. This process, combined with further commitments to certain mitigation measures preconstruction, during construction, and during operation, allowed potential effects on habitats and species present to be assessed as not significant. On account of the River Evelix being located approximately 2 km downstream of the Proposed Development and with the embedded mitigation measures proposed, no significant impacts are predicted.

Due to the proposed reuse of peat (excavated from within the Proposed Development) within the survey area and the associated restoration of peatland, impacts on blanket bog have been assessed as a significant beneficial impact. On account of the peatland restoration a large area of conifer plantation is likely to be lost due to excessive wetting of the ground rendering it unsuitable for commercial tree growth. Due to the requirement to replace woodland lost to the Proposed Development, when considering the need for compensatory and mitigation planting, loss of conifer plantation is not predicted to be significant.

Cumulative effects were assessed for the following developments within an assumed zone of influence of 2 km;

- Acheilidh (Lairg III) Wind Farm;
- Balblair Wind Farm;
- Communications mast 22/05825/FUL;
- Beauly – Spittal 400 kV Overhead Line; and,
- Carnaig – Loch Buidhe underground cable.

No cumulative effects are predicted between the Proposed Development and any of the developments identified within the 2 km zone of influence.

ORNITHOLOGY

An ornithology assessment was carried out to determine the potential effects of the construction and operation of the Proposed Development. The assessment follows current best practice and focused on potential direct and indirect effects on key ornithological features.

Relevant European, national and local guidance was referred to in order to determine key ornithological features. Reference was made to NatureScot guidance on determining target species for assessment. Designated sites with national / international ornithological interest situated within 20 km of the Proposed Development boundary, Special Protection Areas (SPA) and Ramsar sites, together with Site of Special Scientific Interest (SSSIs) situated within 2 km, were included within the initial assessment, together with bird species considered to be of high nature conservation importance (NCI). Species considered to be of NCI fulfilled one or more of the following criteria:

- An Annex I species (EU Birds Directive);
- A Schedule 1-listed species (Wildlife and Countryside Act 1981, as amended by the Nature Conservation [Scotland] Act 2004).
- A Red-listed species (British Trust for Ornithology Birds of Conservation Concern 5); and
- A Scottish Biodiversity List species.

The importance of features was also determined using professional judgement and taking account the results of baseline surveys, desk-based study information and the importance of features within the context of the region.

Baseline surveys were carried out between April 2023 and August 2024 comprised of:

- Breeding Bird surveys;
- Flight Activity (vantage point) surveys;
- Breeding raptor surveys;
- Black Grouse surveys;
- Winter raptor roost surveys; and
- Wintering goose surveys.

Breeding bird survey results indicated possible breeding by two NCI species, greenshank and siskin.

Flight activity surveys indicated low levels of activity by NCI species, with a total of 52 flights by 11 different species recorded between May 2023 and April 2024. Of these 13 flights involved birds flying over / partially over the area encompassed by the Proposed Development.

No breeding raptors were recorded within the area of survey (comprised of the Proposed Development boundary and a 2 km radius extending out from the boundary), nor were any raptors observed using the area for winter roosting.

Two black grouse leks were recorded, both situated out with the area of the Proposed Development boundary, but within the 1.5 km survey buffer area for this species.

Winter goose activity was low, with no geese observed to be using the nearby Loch Buidhe as a roost location, and with flight activity concentrated to movements of migratory greylag goose flocks on one day in mid-April 2024.

On the basis of the results obtained, together with desk-based study data, it was possible to 'scope out' the effects on a number of species of high NCI by virtue of their ecology, absence, distance from the Proposed Development, small numbers, low levels of activity and the nature and location of this activity.

One Designated Site, Strath Carnaig and Strath Fleet Moors SPA / SSSI, designated for its importance as a breeding location for hen harrier, was taken forward for assessment, together with six bird species:

- Black grouse;
- Greenshank;
- Osprey;
- Hen harrier;
- Merlin; and
- Siskin.

Habitat loss arising from the construction of the Proposed Development was ‘scoped out’ as the proposed habitat restoration were assessed to deliver tangible gain to the Designated Site being assessed and to the species of relevance, hen harrier.

Population reductions due to habitat change, displacement and / or collision mortality were also assessed as being not significant.

The contribution of adverse effects accrued by the Proposed Development to designated sites and associated NCI populations situated within 20 km of the Proposed Development boundary was assessed as being not significant and so cumulative effects of the Proposed Development with existing and planned developments in the region were judged as having no significant effects on existing bird populations.

It was concluded that the Proposed Development would have no significant effect on birds under the terms of the EIA Regulations, and that given the opportunity to deliver genuine improvement to the habitat of the Strath Carnaig and Strath Fleet Moors SPA, that there would be permanent operational beneficial effects from the delivery of the Proposed Development.

FORESTRY

The Proposed Development lies within the Achormlarie commercial conifer plantation. This forest is presently in the phase of felling and replanting in accordance with a long-term Land Management Plan. Areas of the Proposed Development have been previously felled and are presently lying fallow prior to replanting.

The Proposed Development is predicted to result in the direct loss of 23.52 ha of commercial conifer plantation land, for the construction and safe operation of the Proposed Development.

The area of woodland felling for the proposed substation includes the felling of a greater area to prevent predictable windblow. This broader extent of felling for the proposed substation is 69.54 ha which would include replanting as detailed in the Landscape and Ecology Mitigation Plan.

Given the Proposed Development would result in the permanent loss of woodland, the Applicant is committed to making arrangements to plant off-site the equivalent area of woodland as Compensatory Planting, meeting the Scottish Government's Control of Woodland Removal Policy objective of no net loss of woodland.

Furthermore, a change of land use of some 191.34 ha of commercial conifer plantation to peatland restoration is proposed within the Achormlarie forest unit. The previous and standing timber within this area are generally of a lower yield class detailed in the sub compartment records.

No ancient woodlands are affected by this Proposed Development however some native pinewood is noted in the Native Woodland Survey of Scotland within the Peatland Restoration Area. The design in this area has taken account of avoiding felling any standing Scots pine.

GEOLOGY AND SOILS

An assessment has been undertaken on geology, peat and soils (the geology and soils environment) during the construction and operational phases of the Proposed Development.

Information for the assessment was compiled using baseline data from a desk-based study which was verified by investigative field work.

The assessment has been undertaken considering the sensitivity of the receptors identified during the baseline study and considering the mitigation measures included in the development design.

The scope of the assessment was determined through a combination of professional judgement, reference to relevant guidance documents and consultation with stakeholders through a formal EIA scoping process and pre-application advice.

Construction and operation of the Proposed Development has the potential to result in the following effects: soil compaction and erosion; peat erosion or instability; adverse effects on geological designated sites and adverse effect on ground stability.

Implementation of the proposed mitigation measures and undertaking the construction works in accordance with best practice will mean that there are no significant residual effects from the Proposed Development on geology, soils and peat.

HYDROLOGY AND HYDROGEOLOGY

The Hydrology and Hydrogeology chapter considers potential impacts of the Proposed Development on the water environment such as groundwater, flood risk, water supplies and surface watercourses.

To inform the assessment field walkover surveys and a desk-based assessment was conducted to establish the baseline conditions at the location of the Proposed Development. The field and desk-based assessments indicate that the Proposed Development is located within the River Fleet catchment to the north and the Dornoch Coastal catchment to the south. The assessment identified that there are three Water Framework Directive (WFD) watercourses hydrologically connected to the Proposed Development:

- Allt Garbh-airigh (SEPA ID: 20073);
- Loch Buidhe (SEPA ID: 100096); and
- Abhainn an t-sratha Charnaig (SEPA ID: 20072).

An unnamed drainage channel is located within the Proposed Development boundary. Originally, this watercourse drained in a north westerly direction across the north eastern area of the Proposed Development. However, commercial forestry practices across this area are thought to have modified the upstream course of this watercourse. Aerial imagery indicates that the unnamed watercourse now drains along the boundary between the existing forestry line and area of cleared forestry. To the north of the Proposed Development, this watercourse enters a culvert, draining under the access road of the existing 275 kV Loch Buidhe Substation, before continuing in a north westerly direction, under Lochbuie Road, and towards Allt Garbh-airigh. Originally, the watercourse would likely have drained in a northerly direction across land to the north of Lochbuie Road, however, satellite imagery suggests this watercourse now drains west and then north but ultimately still discharges into Allt Garbh-airigh.

The potential for impacts and changes to the water environment due to the Proposed Development were assessed for all phases of the project. With the use of construction good practice measures, such as drainage measures, absorbent / pollutant spill pads and committing to restoring the site to its original conditions post construction, the potential impacts are considered to be negligible. The hydrology and hydrogeology impact assessment identified no significant effects and therefore no mitigation measures additional to those best practice measure are proposed.

TRAFFIC AND TRANSPORT

An assessment of traffic and transport effects on the public road network associated with the construction phase of the Proposed Development has been undertaken.

During construction and in the absence of mitigation, significant effects could arise for users of the U3521 in Bonar Bridge in relation to non-motorised pedestrian delay, non-motorised amenity and fear and intimidation.

To mitigate for these effects, a Construction Traffic Management Plan has been produced which includes traffic management measures to avoid conflicts with general traffic and non-motorised users of the U3521 in Bonar Bridge.

Following the implementation of the proposed package of mitigation measures, the assessment of residual effects indicated that there would be no significant adverse effects associated with the construction of the Proposed Development.

The effects of transporting abnormal loads would increase locally along the U3521, however the proposed mitigation measures for the Proposed Development include a Construction Traffic Management Plan, localised road enhancements and a Section 96 abnormal wear and tear agreement (as required and agreed with the Highland Council), would mitigate the effects of any change in access and routing.

CULTURAL HERITAGE

An assessment has been carried out to evaluate the effects of the proposed Carnaig 400 kV Substation on cultural heritage and archaeology.

The purpose of the assessment is to establish the archaeological and heritage baseline, assess the potential for direct effects to the archaeological resource from the Proposed Development, and assess nearby designated heritage assets for changes to setting that affect cultural significance as a result of the Proposed Development.

Two study areas have been identified for assessment, the 250 m study area and the 5 km study area. The 250 m study area was used to aid the assessment for potential unknown subsurface archaeology to survive within the Proposed Development boundary. A setting study area with a radius of 5 km from the Proposed Development boundary was used to identify assets that could potentially undergo a change to setting, as a result of the Proposed Development. All designated assets within this study area were assessed for changes to setting.

The assessment identified that there are eight non-designated assets located within the Proposed Development that are at risk of direct impact, for all of these, mitigation via avoidance has the potential to reduce impacts to negligible. Additionally, the construction phase of the Proposed Development may impact numerous other assets within the Proposed Development boundary, appropriate mitigation has been recommended to avoid impact to these assets.

Based upon the baseline results and field survey, the Proposed Development has a moderate potential for subsurface archaeology to be encountered during construction. This potential primarily relates to the assets located in forestry land to the south of the site. These comprise of prehistoric hut circles and post-medieval remains. This evidences land use of the area from at least the prehistoric and post-medieval periods.

Further archaeological investigation is required to determine the heritage value of the known and potential archaeological resource within the Proposed Development boundary. Any assessment around the likely direct impacts of the Proposed Development to the heritage resource and, consequently, the effect to cultural significance from said impacts cannot be assessed without first understanding the heritage value of these assets. Therefore, a programme of further archaeological works in the form of watching brief is recommended for the construction phase of the project.

In regard to the assessment of changes to setting that affect heritage significance, there is one category B listed building present within 5 km which had the potential for setting to be impacted as a result of the Proposed Development. However, the sitting of the asset in the landscape alongside existing floral screening is likely sufficient to interrupt any potential sight lines and therefore, the impact to this asset is likely to be negligible/none.

NOISE AND VIBRATION

Introduction

This chapter identifies the likely impacts on noise sensitive receptors associated with the construction and operation of the Proposed Development.

Transformers and other electrical equipment associated with substation developments emit noise at frequencies of twice the normal operating current frequency due to magnetostriction of the transformer core. In the UK the supply current frequency is 50 Hz, which results in 100 Hz and harmonics thereof being produced by the transformer. The nature of the noise generation mechanism results in tonal noise being emitted. The noise is steady state under normal operating conditions, however, with changes in electrical load, noise levels may fluctuate. The equipment is not expected to have any impulsive characteristics. Other sources of noise include cooling and heating, ventilation, and air conditioning systems, with a broadband spectrum.

There is the potential for construction activities to generate significant levels of noise and vibration that can impact surrounding communities. During key phases of construction—such as site clearance, excavation, and equipment operation—elevated noise and vibration levels may temporarily affect local residents. There is the potential for construction noise and vibration impacts from static, quasi static, and mobile plant items including crushing or blasting of rock, rotary piling during the construction of foundations, excavators, delivery of materials with lorries / dumper trucks, delivery and pumping of concrete; and installation of electrical infrastructure equipment.

Overview of methodology

The assessment is structured around the consideration of potential effects, including cumulative effects, of construction and operation of the Proposed Development on noise sensitive receptors surrounding the development.

Field surveys were carried out in and around the Proposed Development over respective 'study areas' to establish baseline noise environment conditions.

A desk-based construction noise appraisal has been prepared for the purpose of assessing the effects of the land levelling works on any nearby residents.

A detailed model of the Site and surrounding area has been constructed in using noise modelling software considering geometric spreading, topography, screening, meteorological conditions and detailed information regarding the sources of noise, allowing for analysis of the predicted operational impact of the Site for Noise Sensitive Receptors (NSRs).

Overview of baseline conditions

Noise measurements were taken at two (2) noise sensitive receptors, measurement positions were deemed to represent the background noise conditions for external amenity for the surrounding NSRs. In practice, there is no “single” background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment is a representative average and therefore should be representative of the period being assessed.

Noise levels are typical of a rural environment, with generally low noise at both daytime and nighttime with distant traffic consisting the dominant noise source, and slightly higher daytime levels with increased traffic and other anthropogenic noise sources dominant.

Overview of effects

There is the potential for significant effects due to the predicted noise levels from construction during the earthworks and civils work stages.

There are no significant effects predicted for construction traffic.

There are no significant effects predicted for construction vibration.

There is the potential for significant effects from operational noise during worst-case daytime operations, this is due to noise from the synchronous compensator units and its associated equipment, including external cooling and step-up transformer

Overview of proposed mitigation

Mitigation is required for construction noise. An updated detailed construction noise impact assessment is required when further information is available on the specific construction schedule. A construction noise management plan will be required to reduce noise for specific activities in accordance with the guidance and procedures outlined in BS 5228-1. The construction noise management plan is expected to be embedded within the Construction Environmental Management Plan. Procedures will include:

- minimising the noise as much as is reasonably practicable at source;
- attenuation of noise propagation;
- carrying out identified high noise level activities at a time when they are least likely to cause a nuisance to residents; and
- providing advance notice of unavoidable periods of high noise levels to residents

Mitigation is required for operational noise. An acoustically optimised design will be progressed during the detailed design phase of the project. There are various engineering solutions and potential mitigation strategies that could be implemented to reduce noise levels from these units. Options could include:

- specification of low noise units;
- use of an active fan system with variable speed drive;
- use of liquid to liquid cooling;
- housing the equipment indoors;
- a system with a larger number of fans operating at lower duty; and / or
- noise barriers to target propagation from specific noise sources.

An updated noise impact assessment is required during detailed design of the project with input from manufacturer equipment noise data. The assessment considers the likely noise level output of the Proposed Development based on non-acoustically optimised input data. Source noise levels of individual items of plant will vary as the final plant specifications and required control measures are determined during a commercial tendering process. Accordingly, the predicted noise levels presented in this report, or the noise levels at source, should not be used to specify particular noise level limits. Rather, it is more appropriate to consider the noise levels received at the nearest NSRs with regards to the existing sound levels in the area (as assessed by BS 4142). This allows appropriate levels of protection to be allocated to the nearest receptors, giving comfort to residents and the Local Planning Authority, whilst providing the developer with sufficient flexibility in the design and specification of plant during the tendering process.

Summary of likely residual effects

With the appropriate mitigation measures, it is predicted that no significant effects remain.

SOCIO-ECONOMIC

This chapter presents the assessment of the likely significant effects of the Proposed Development on socio-economics, recreation, and tourism. No significant adverse socio-economic effects are identified.

The assessment found that the Highlands has an existing strong and established construction sector which has upskilled the labour force. As such it is expected that, due to the size of the Proposed Development and existing baseline conditions, impacts on jobs would be absorbed. Adverse effects on employment and gross value added (GVA) during both construction and operation are therefore assessed as negligible. The construction and operation of the Proposed Development could also create some positive effects in terms of jobs and GVA and these effects are assessed as negligible.

In relation to recreation and tourism, there is potential for adverse effects on recreational fishing on Loch Buidhe. Embedded mitigation measures include adhering to the construction environmental management plan and traffic management controls. In addition, given the temporary nature of the construction phase no adverse significant effects are identified.

No adverse significant effects on recreation and tourism receptors were identified during operation.

SUMMARY

This Non-Technical Summary provides a summary of the EIA Report for the proposed Carnaig 400 kV Substation development. Likely significant residual effects (i.e. after mitigation) are:

- The Proposed Development will significantly affect the character of the landscape (the Rounded Hills Caithness and Sutherland Landscape Character Type) at the local level and visual receptors using the Lochbuie Road and the Carnegie Road in the vicinity of the Proposed Development during Construction and Operational Phase Year 1. The establishment of the proposed mitigation planting would reduce visibility of the Proposed Development and integrate the substation into the landscape such that effects would be reduced to not significant at year 15.
- The ecology chapter concluded that through restoration of peatland, impacts on blanket bog will result in a significant beneficial impact.
- The ornithology chapter identified that given the opportunity to deliver genuine improvement to the habitat of the Strath Carnaig and Strath Fleet Moors SPA, there are permanent operational beneficial effects from the delivery of the Proposed Development.
- An updated noise impact assessment is required during detailed design of the project with input from manufacturer equipment noise data with noise levels received at the nearest NSRs with regards to the existing sound levels in the area (as assessed by BS 4142). Mitigation will be identified at this point to accurately mitigate operational impacts identified.

All other chapters identified no significant residual effects from the Proposed Development following implementation of the recommended mitigation.