Offshore Wind Power Limited

West of Orkney Windfarm Onshore EIA Report

Volume 1, Chapter 14 - Air Quality

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XODUS

West of Orkney Windfarm

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CONTENTS

14 AIR QUALITY

Chapter summary

This chapter of the Onshore Environmental Impact Assessment (EIA) Report assesses the potential effects from the onshore Project on air quality receptors. This includes direct, indirect, whole project assessment, cumulative, inter-related effects, inter-relationships and transboundary effects. The primary focus of the assessment is the generation of dust and other emissions, especially in dry and windy conditions and the potential impacts of this on human health and ecological receptors.

Within the air quality onshore study area, human and ecological receptors have been identified, in line with the Institute of Air Quality Monitoring (IAQM) 2014 and IAQM 2020 guidance, that have the potential to be impacted by dust and particulate. Human receptors within 500 m of the air quality onshore study area include multiple residential properties (the closest of which overlaps with the study area), a number of non-residential sites and amenity areas. Ecological receptors within 100 m of the air quality onshore study area include a number of nationally designated sites which include the River Thurso Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI); Achanarras Quarry SSSI; Ushat Head SSSI; and Loch Lieurary SSSI.

The following impacts were identified as requiring assessment:

- Construction and decommissioning:
  - Dust emissions associated with the onshore Project works (onshore substation); and
  - Dust emissions associated with mobile activity (onshore export cables laying).

The assessment has taken account of embedded mitigation measures for the assessment of potential effects.

It is anticipated that dust emissions from the onshore Project works including onshore export cables installation and onshore substation installation will occur at a low intensity and will be highly localised where construction is occurring. The embedded mitigation measures employed will further reduce the intensity of impacts experienced by receptors through minimising dust generation and migration from the onshore Project area, ensuring dust pollution at receptors is minimal and ensuring the construction activities on site consider the potential dust generation. Following the construction period, full rapid recovery of the baseline environment is expected which will result in very slight or imperceptible changes to the baseline conditions. Any decommissioning activities are expected to also be low intensity and localised. Therefore, the magnitude of impact is deemed to be negligible for all identified receptors.

No significant impacts to air quality receptors are predicted, either for the onshore Project or cumulatively with other plans or projects. Additionally, the potential for inter-related effects between the onshore Project stages have been considered and effects have been identified as not significant. There are no potential inter-related effects within an onshore Project stage. There is no potential for whole Project effects or transboundary impacts upon air quality receptors due to construction and decommissioning of the onshore Project. The potential impacts are localised and will not affect other European Economic Area (EEA) states.

14.1 Introduction

This chapter of the Onshore Environmental Impact Assessment (EIA) Report presents the receptors of relevance to air quality and assesses the potential impacts from the construction, operation and maintenance and decommissioning of the onshore Project on these receptors. Where required, mitigation is proposed, and the residual impacts and their significance are assessed. Potential cumulative and transboundary impacts are also considered.

Table 14-1 below provides a list of all the supporting studies which relate to and should be read in conjunction with the air quality impact assessment. All supporting studies are appended to this Onshore EIA Report and issued on the accompanying Universal Serial Bus (USB).

Table 14-1 Supporting studies

DETAILS OF STUDY	LOCATIONS OF SUPPORTING STUDY
Climate and Carbon Assessment	Onshore EIA Report, Supporting Study (SS) 1: Climate and carbon assessment.

The impact assessment presented herein draws upon information presented within other impact assessments within this Onshore EIA Report. Equally, the air quality impact assessment also informs other impact assessments. This interaction between the impacts assessed within different topic-specific chapters on a receptor is defined as an 'inter-relationship'. The chapters and impacts related to the assessment of potential effects on air quality are provided in Table 14-2.

Table 14-2 Air quality inter-relationships

CHAPTER	IMPACT	DESCRIPTION
Terrestrial non-avian ecology (chapter 10, Onshore EIA Report)	Indirect effects on habitats or protected species, e.g. due to pollution or sedimentation.	Indirect effects on habitats and species that may arise as a result of construction and decommissioning activities include the effects of dust.
Terrestrial ornithology (chapter 11, Onshore EIA Report)	Indirect effects on habitats used by birds e.g. due to pollution or sedimentation.	Indirect effects on habitats and species that may arise as a result of construction and decommissioning activities include the effects of dust.
Land-use and other users, including forestry (chapter 12, Onshore EIA Report)	Temporary and permanent loss of forestry, agricultural land and soils including peatland.	The construction and decommissioning of the Project may result in an adverse impact on existing forestry, agricultural land and soils which may also result in impacts to dust generation.

CHAPTER	IMPACT	DESCRIPTION
Access, traffic and transport (chapter 16, Onshore EIA Report)	Impacts arising from the increased generation of traffic.	Potential increases to traffic flows, including Heavy Good Vehicles (HGVs) on the local and wider road networks as a result of construction and decommissioning traffic may increase impacts from dust generation.

The following specialists have contributed to the air quality assessment:

- Xodus Group Limited (Xodus): undertook the baseline description, impact assessment and Onshore EIA Report chapter write up.

14.2 Legislation, policy and guidance

Over and above the legislation presented in chapter 3: Planning policy and legislative context, the following legislation, policy and guidance are relevant to the assessment from the onshore Project on air quality:

- Legislation:
  - Environment Act 1995: this includes important provisions relating to air quality, with particular regard to preparing a National Air Quality Strategy;
  - Part III of the Environmental Protection Act 1990: this legislation identifies dust as a nuisance. The provisions of Part III of the Environmental Protection Act 1990 relating to statutory nuisance were enacted in Scotland by the Environment Act 1995; and
  - Air Quality Standards (Scotland) Regulations 2010: these regulations set air quality standards for key pollutants and implement policies on air quality management and assessment.
- Policy:
  - United Kingdom (UK) Air Quality Strategy: this was originally adopted in 1995 and has since been periodically updated and revised. The Clean Air Strategy was most recently published in 2019 (Department for Environment, Food and Rural Affairs (Defra), 2019). The strategy sets out the air quality standards and objectives which have been set to benchmark air quality in terms of protecting human health and the environment;
  - Cleaner Air for Scotland 2 – Towards a Better Place for Everyone: this strategy updates Cleaner Air for Scotland and sets out the strategies, objectives and actions to improve air quality in Scotland (Scottish Government, 2021);
  - National Planning Framework 4 (NPF4) (Scottish Government, 2023a): sets out key national planning policies that form part of the statutory development plan. Policy 23 (Health and Safety) is specifically related to this chapter as it intends to support proposals that will not have significant adverse effects on air quality, proposals that will improve air quality, and reduce exposure to poor air quality; and
  - Highland-wide Local Development Plan (HwLDP) (The Highland Council (THC), 2012): sets out a strategy to support the growth of all communities across THC region. It seeks to enable sustainable Highland communities, safeguard the environment, support a competitive, sustainable and adaptable Highland. Specific policies related to this chapter include: Policy 73 Air Quality.

- Guidance:
  - Guidance on the assessment of dust from demolition and construction (Institute of Air Quality Monitoring (IAQM), 2014);
  - Guidance on land-use planning and development control: planning for air quality (IAQM, 2017);
  - Air Quality Monitoring in the vicinity of demolition and construction sites (IAQM, 2018);
  - A guide to the assessment of air quality impacts on designated nature conservation sites (IAQM, 2020);
  - Pollution Prevention Guidelines 6 (PPG6): Working at construction and demolition sites (currently under review) (Scottish Environment Protection Agency (SEPA), 2012); and
  - THC – Highland's Statutorily Protected Species (THC, 2013)

14.3 Scoping and consultation

Stakeholder consultation has been ongoing throughout the EIA and has played an important part in ensuring the scope of the baseline characterisation and impact assessment are appropriate with respect to the Project and the requirements of the regulators and their advisors.

The Scoping Report was submitted to Scottish Ministers (via Marine Scotland - Licencing Operations Team (MS-LOT[1])) and THC on 1st March 2022, who then circulated the report to relevant consultees[2]. A Scoping Opinion was received from The Highland Council on 9th May 2022. Relevant comments from the Scoping Opinion specific to air quality are provided in Table 14-3 below, which provides a response on how these comments have been addressed within the Onshore EIA Report. The Scoping Opinion supersedes any pre-application advice provided by THC which was received on the 10th February 2021.

[1] MS-LOT have since been renamed Marine Directorate - Licensing Operations Team (MD-LOT).

[2] The Scoping Report was also submitted to Orkney Islands Council (OIC), as the scoping exercise included consideration of power export to the Flotta Hydrogen Hub, however, this scope is not covered in this Onshore EIA Report and will be subject to a separate Planning Application to OIC.

Table 14-3 Comments from the Scoping Opinion relevant to air quality

CONSULTEE	COMMENT	RESPONSE
Environmental Health, THC	I have read the relevant sections of the EIA Scoping report - noise, dust and potential nuisance. There are no objections to the proposals and it is acknowledged that further detail will be provided when the subsequent reports are produced.	Further detail of the dust impacts to air quality receptors are provided in this chapter of the Onshore EIA Report (see section 14.6). For detail on noise and vibration impacts, see chapter 15: Noise and vibration of the Onshore EIA Report.
THC	The EIAR needs to address all relevant climatic factors which can greatly influence the impact range of many of the preceding factors on account of seasonal changes affecting, rainfall, sunlight, prevailing wind direction etc. From this base data information on the expected impacts of any development can then be founded recognising likely impacts for each stage of development including construction, operation and decommissioning. Issues such as dust, air borne pollution and/or vapours, noise, light, can then be highlighted. Consideration must also be given to the potential health and safety risks associated with lightning strikes given the proximity of recreational routes through the site.	An assessment of the existing air quality including factors such as the prevailing wind and precipitation are considered as part of the baseline data provided by THC to support the assessment on dust impacts during construction and decommissioning stages of the onshore Project. Chapter 15: Noise and vibration, provides an assessment of noise generated by the onshore Project and takes account of relevant best practice guidance. As agreed with THC, a detailed assessment and background noise survey has been undertaken to inform the assessment. Consideration of the onshore Project to lightning strikes and other adverse weather conditions is provided within SS1: Climate and carbon assessment.
THC	Depending on the proximity of the working area to any houses etc the applicant may be required to submit a scheme for the suppression of dust during construction. Particular attention should be paid to construction traffic movements and routing.	Dust effects are relatively localised, within 100 metres (m) of the source. Nonetheless, as discussed in section 14.4.3, residential properties are located throughout the onshore Project area, and as such, depending on the final routing of the onshore Project, may be prone to impacts from dust during construction. However, embedded mitigation will be adhered to as detailed in section 14.5.4.

CONSULTEE	COMMENT	RESPONSE
		These measures will be established within a Construction Dust and Air Quality Management Plan (DAQMP), which will be submitted post-consent once the final design details of the onshore Project are known and will be appended to the final Construction environment management Plan (CEMP). This will detail both the monitoring and mitigation strategies to minimise impacts from dust. The detail of the DAQMP will take account of the final location of the onshore infrastructure and identify best practice included within IAQM Guidance (2014) and PPG 6: Working at Construction and Demolition Sites (SEPA, 2012).
THC	A number of the aforementioned matters could be addressed by a Construction Environmental Management Document (CEMD) for the proposal. While acceptable in principle we would request that an outline CEMD is included with the application.	An Outline CEMP (OMP1: Outline CEMP) is provided alongside the Application for Planning Permission in Principle (PPP). The final CEMP will include a DAQMP which will be submitted post-consent once the final design details of the onshore Project are known.
THC	Activity is planned adjacent to sensitive properties and measures must be in place to enable a swift response to implement the suggested mitigation. For example, water suppression must be on site and ready to action.	To reduce impacts on sensitive properties, embedded mitigation will be adhered to as detailed in section 14.5.4. The final CEMP will include a DAQMP, which will be submitted post-consent once the final design details of the onshore Project are known. This will detail both the monitoring and mitigation strategies to minimise impacts from dust.

14.4 Baseline characterisation

This section outlines the current baseline for air quality within the air quality onshore study area.

Desk-based studies were used to inform the baseline characterisation for the air quality within the air quality onshore chapter.

14.4.1 Study area

The air quality onshore study area is defined by the onshore Project area, encompassing the landfall, onshore export cable corridor and onshore substation search area (Figure 14-1) and the ecological and human receptor buffers, as detailed below. The onshore Project area has been developed forming broad corridors between the potential landfalls and the grid connection at Spittal. The onshore export cable corridor has been based on significant routing work, which considered key technical, environmental and land-use constraints. The onshore substation search area at Spittal will be located near to the new Scottish Hydro Electric Transmission plc (SHET-L) Spittal 2 substation. The current preferred location of this substation (at the time of application) is north of Spittal Hill at Banniskirk, to the east of the onshore substation search area on the other side of the A9 trunk road (Scottish and Southern Electricity Networks (SSEN), 2023).

A buffer of 100 m for ecological receptors, and 500 m for human receptors, around the onshore Project area has been assumed for the purpose of the assessment. This buffer is inclusive of the preferred 50 m for ecological receptors and 350 m buffer for the identification of human receptors, as specified by the IAQM, Guidance on the assessment of dust from demolition and construction (IAQM, 2014).

Climate change issues associated with Greenhouse Gases (GHGs) are on a global scale, hence no specific study area has been defined for this aspect of the assessment. Nonetheless, GHG emissions associated with the onshore Project have been accounted for within SS1: Climate and carbon assessment.

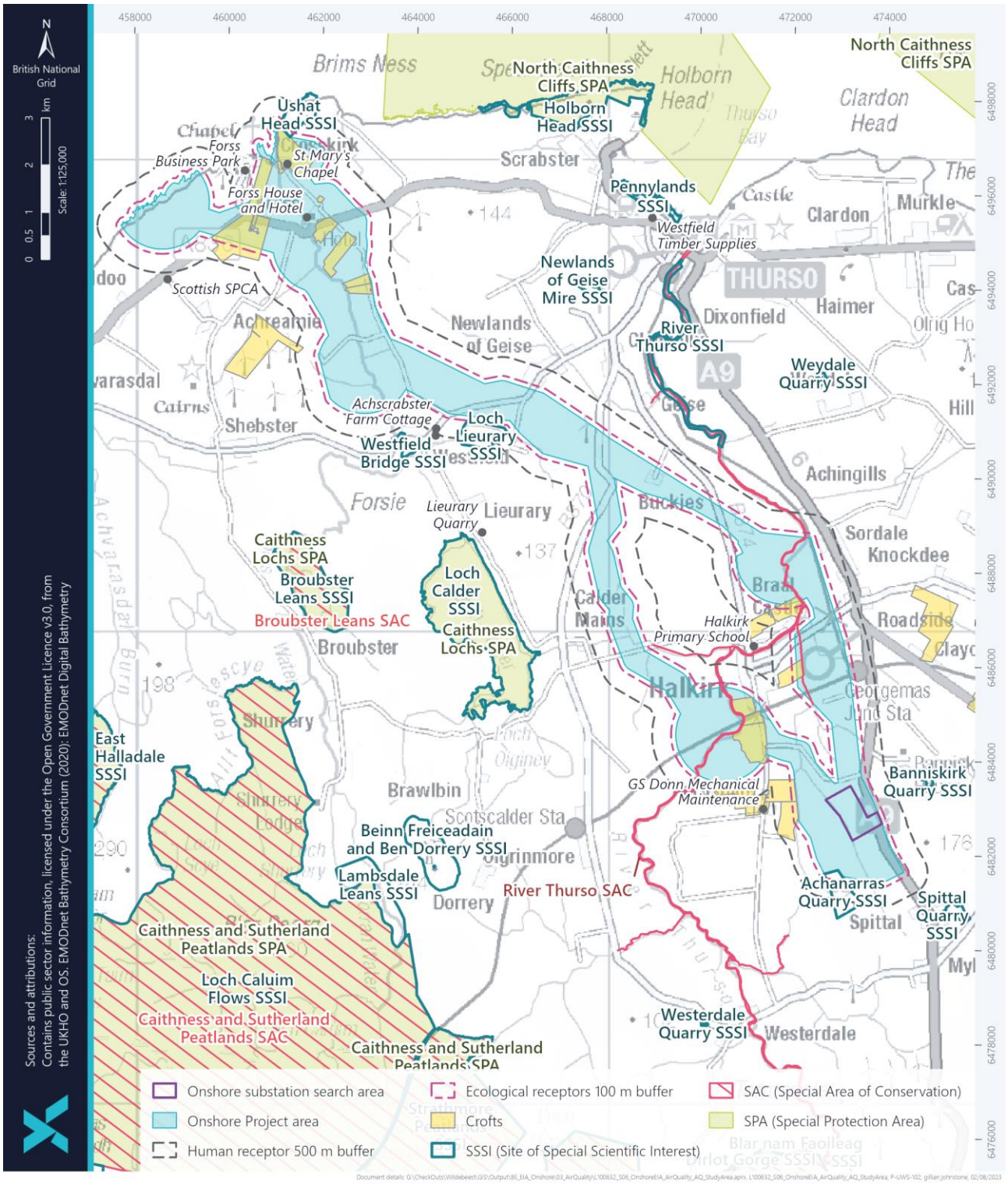

Figure 14-1 Air quality onshore study area

14.4.2 Data sources

Information on background air quality in the UK is typically available from two main public sources:

- Local Authority Review and Assessment (R&A) of air quality with reference to local monitoring and modelling studies; and
- The National Air Quality Information Archive (NAQIA) includes projections of pollutant concentration for years up to 2020 for each 1 kilometre (km) grid square in the UK (Department for Environment, Food and Rural Affairs (Defra), 2022).

This information can be supplemented with reference to historical monitoring campaigns undertaken in the onshore study area or by undertaking a study specific monitoring campaign. In the case of this assessment, there is sufficient information available from the NAQIA and the results of R&A's undertaken by THC to inform a robust impact assessment on air quality without the need for any Project specific air quality monitoring.

The existing data sets and literature with relevant coverage to the onshore Project, which have been used to inform the baseline characterisation for air quality are outlined in Table 14-4.

Table 14-4 Summary of key datasets and reports

TITLE	SOURCE	YEAR	AUTHOR
2015 Updating and Screening Assessment (USA) for THC	https://www.highland.gov.uk/downloads/file/16576/2015_updating_and_screening_assessment_for_the_highland_council	2015	THC
Air Quality in Scotland	http://www.scottishairquality.scot/laqm/aqma	2021a	Air Quality in Scotland
Air Quality Monitoring Stations for THC – Inverness City Centre	https://www.scottishairquality.scot/latest/site-info/INV2	2021b	Air Quality in Scotland
Air Quality Monitoring Stations for THC – Strath Viach	https://www.scottishairquality.scot/latest/site-info/SV	2021c	Air Quality in Scotland
Air Quality Monitoring Stations for THC – Fort William	https://www.scottishairquality.scot/latest/site-info/FW	2021d	Air Quality in Scotland
Highland 2022 Annual Report	https://www.highland.gov.uk/downloads/file/26392/2022_air_quality_report	2022	THC

TITLE	SOURCE	YEAR	AUTHOR
1:25,000 Ordnance Survey (OS) data	N/A	N/A	OS
UK-AIR Quality Information Resource (Defra Background Concentration Map)	https://uk-air.defra.gov.uk/data/gis-mapping/	2022	Defra

In addition, information from the Project team has also been referenced in the preparation of this assessment.

14.4.3 Existing baseline

A review of literature and available data sources, augmented by the Scoping Opinion and desk-based surveys has been undertaken to describe the current baseline environment for air quality.

Local authorities are required to review air quality levels in their areas every three years and each three-year period is referred to as a round. An USA is produced by the local authority during the three-year period; this is known as the first stage. This assessment indicates whether any of the national air quality objectives are likely to be exceeded by any pollutant. If an exceedance is likely, a Detailed Assessment (DA) on the specific pollutant is then carried out. The DA includes two stages known as the second and third stage. If the DA identifies any exceedances at relevant receptor locations an Air Quality Management Area (AQMA) is declared. A stage four assessment is undertaken one year after the AQMA declaration and if the Air Quality Standard (AQS) objectives are still exceeded, an Air Quality Plan (AQP) is produced. If a DA is not required, i.e. if no exceedances are anticipated, the local authority produces progress reports on the general air quality of the area.

THC published the USA in 2015 and this did not identify any need to proceed to DA for any pollutant in relation to any Air Quality Objective (THC, 2015). The only AQMA in the THC area is in Inverness City Centre approximately 121 km south of the onshore Project area and therefore not representative of the onshore Project area or relevant to the assessment. THC have three automatic air quality monitoring sites; these are located in Strath Viach, Inverness, and Fort William and are approximately 100 km, 120 km, and 210 km, respectively, from the onshore Project area. Through 2018, there was an additional 29 non-automatic monitoring sites for Nitrogen Dioxide utilising passive diffusion tubes in Inverness, Dingwall and Fort William (THC, 2022). All of THC monitoring locations are too far from the onshore Project area to be representative. However, the lack of monitoring would suggest that there are no potential air quality issues identified in the onshore study area. The onshore Project area is largely rural and as such is assumed to have a relatively high air quality level.

Existing local sources of particulate matter and dust likely includes windblown dust from agricultural land, exhaust emissions from road vehicles, active quarries in the area (see section 14.6.1), and domestic heating sources. A number of developments including Baillie Windfarm, Forss Windfarm, and the existing Spittal Substation are located within the onshore study area. However, the developments are already in operation, therefore are not anticipated to give rise to dust or particulate matter.

Wind speed and direction will influence the dispersion of dust and particulate matter from the onshore Project works. Locally, in the Scrabster/Thurso area, the prevailing wind direction is west-south-west with average wind speeds of 5.7 m/s indicating that the study area of Caithness is a particularly windy environment (Windfinder, 2018). For the UK, wind direction is predominantly south-westerly, and wind speeds are generally in the range of 9 to 9.4 metres per second (m/s) (European Centre for Medium-Range Weather Forecasts' (ECMWF) Reanalysis v5 (ERA5) global climate model). The average wind speed across the UK (2001 to 2022) is 4.2 m/s (Statista, 2023a).

Additionally, the grain size and friability of superficial deposits may also influence dust dispersal radius. As described in chapter 8: Geology and hydrology the main soil types encountered within the vicinity of the study area are found to be mineral gleys, peaty podzols, peat and brown soils. The actual materials encountered during excavations will depend on the final onshore cable routing and onshore substation location, however it is noted that the larger particle size materials (sand and gravel) are less likely to give rise to dust. Clay based material, is more likely to give rise to dust due to its small particle size.

A review of the 1:25,000 OS map of the onshore Project area was used to identify human and ecological receptors in line with IAQM 2014 and IAQM 2020 guidance, which have the potential to be impacted by dust and particulate matter within onshore study area. The findings are as summarised in Table 14-5 and are presented in Figure 14-1.

Table 14-5 Receptors within the air quality onshore study area

RECEPTOR TYPE	WITHIN ONSHORE STUDY AREA BUFFER	SPECIFIC RECEPTOR
Hospitals, care homes and schools	Present within 500 m.	No receptors identified.
Residential properties	Present within 500 m.	Multiple residential properties.
Non – residential properties	Present within 500 m.	• Forss Business & Energy Park; • Achscrabster Farm Cottage; and Forss House Hotel.
Amenity areas	Present within 500 m.	• North Coast 500 (NC500) route; • Lochan Buidhe; • Achanarras Quarry Nature Reserve; • St Mary's Chapel car park; • St Mary's Chapel; • Sibster Forest; • Spittal woodland; and • Alder woodland on floodplains[3].

[3] *Alder woodland on floodplain (National Vegetation Classification (NVC) W6) is indicated as being and amenity space and is present in the onshore Project area, as detailed in chapter 10: Terrestrial non-avian ecology.*

RECEPTOR TYPE	WITHIN ONSHORE STUDY AREA BUFFER	SPECIFIC RECEPTOR
Designated sites*	Present within 100 m.	• River Thurso Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI); • Achanarras Quarry SSSI; • Ushat Head SSSI; and • Loch Lieurary SSSI.
Species listed in the International Union for Conservation of Nature (IUCN) Red List*,**	Present within 100 m.	• Atlantic salmon (*Salmo salar*) (V); • European Eel (*Anguilla anguilla*) (CR); • Otter (*Lutra lutra*) (NT); • Curlew *(Numenius arquata)* (NT); • Lapwing *(Vanellus vanellus*) (NT); • Eider *(Somateria mollissima*) (NT); • Oystercatcher *(Haematopus ostralegus*) (NT); • Rook *(Corvus frugilegus*) (V); • Snipe *(Gallinago gallinago)* (V); • Slavonian grebe *(Podiceps auritus)* (NT); and • Red-breasted merganser *(Mergus serrator*) (NT).

**** IUCN Red List Ecology receptors recorded through ecology surveys (see chapter 9: Freshwater ecology, chapter 10: Terrestrial non-avian ecology and chapter 11: Terrestrial ornithology for further details) and ICUN Red List species which are qualifying features of designated sites are only considered if present within the 100 m buffer, as per the 2014 IAQM guidance.***

***** Listed as Critically Endangered (CR), Endangered (EN), Vulnerable (V) or Near Threatened (NT).***

The baseline air quality concentration for the onshore study area has been taken from the Scottish Government and Defra background concentration maps for the 1 km x 1 km grid squares that cover the onshore study area. The average mean concentration for:

- Nitrogen Dioxide (NO_2) is 1.70 µg/m^3;
- Particles < 10 µm (PM_{10}) is 5.42 µg/m^3; and
- Particles < 2.5 µm ($PM_{2.5}$) is 3.17 µg/m^3 (Defra, 2022).

The baseline Nitrogen Oxides (NO_x) concentration is relevant for sensitive ecological receptors. All background concentrations within the onshore study area are significantly below the annual mean AQSs:

- NO_x is 30 µg/m^3;
- NO_2 is 40 µg/m^3;
- PM_{10} is 18 µg/m^3; and
- $PM_{2.5}$ is 10 µg/m^3 (Defra, 2022).

In relation to construction dust, the generation, release and dispersion of fugitive dust are particularly dependent upon weather conditions and the nature of the handled material. The most important climatic parameters governing the emission and magnitude of the impact of dust are:

- Wind direction determines the broad transport of the emissions and the direction in which it is dispersed; and
- Wind speed will affect ground level emissions by encouraging the dispersion of the emissions. It may comparatively increase the potential for dust entrainment.

Rainfall is also an important climatological parameter in the generation of dust; sufficient amounts of rainfall can suppress dust at the source and eliminate the pathway to the receptor. Rainfall greater than 0.2 millimetre (mm) per day is typically regarded as being sufficient to suppress dust emissions (K. W. Nicholson, 1988). The Scottish Highlands usually experiences more than 1,500 mm of rain per year (Statista, 2023b). On a monthly basis, based on data from Halkirk on average the area experiences a minimum of 56 mm of rainfall a month (SEPA, 2023).

14.4.4 Future baseline

This section describes future climate projections and the potential indirect impact of climate change on physical receptors. The future climate projections described are based on modelled data and the timescales considered for the different receptors are dependent on the availability of the modelled data. The primary data source used in the preparation of this chapter is the UK Climate Projections 2018 (UKCP18) climate projections (Lowe *et al.*, 2018) which are recommended for use in the Institute of Environmental Management and Assessment (IEMA) EIA guide to climate change resilience and adaptation (IEMA, 2020). The UKCP18 projections were downloaded from the Met Office website (Met Office, 2018).

Analysis of observed and modelled wind data can be used to identify long-term trends in weather patterns. The frequency and intensity of storms within the north of Scotland are increasing. However, there is low confidence in attributing these historical changes in weather patterns to climate change and the high degree of variability in the data also creates difficulties in identifying historic trends over time (Wolf *et al.*, 2020).

Future predictions for storms and high winds are uncertain, and it is expected that natural variability will continue to contribute to the trends observed in the frequency and intensity of waves and storms. In addition, the low confidence in attributing historical trends in storms and waves to climate change also presents difficulties in adequately predicting future trends. Nevertheless, climate change may influence storm tracks with knock-on effects on winds. Climate projections, under the Under Representative Concentration Pathway (RCP) 8.5 (high emissions scenario), indicate that wind speeds are likely to increase between 2050 and 2100 across the UK, with an increase in the frequency of winter storms (Met Office, 2019a).

Precipitation levels are generally expected to continue to increase in winter but decrease in summer. Under RCP 8.5, by 2070, it is predicted that the change in winter precipitation levels will range from a 1% decrease to a 35% increase and summer precipitation levels will range from a 47% decrease to a 2% increase, when compared to the 1981 to 2000 mean. The overall trend of reduced precipitation levels in summer is expected to be lower in the north of Scotland compared with the south of the UK (Met Office, 2019b).

The UKCP18 projections also indicate that the intensity and frequency of heavy rainfall events in summer and autumn are likely to increase (Met Office, 2021). Further details on climate projections are provided in SS1: Climate and carbon assessment.

It is considered that the current air quality baseline is likely to improve in the future due to the uptake of lower emission vehicles, the replacement of older vehicles which use fossil fuels and the change of domestic heating fuel usage.

It is important to note that the future baseline is a projection, with a range of possible future conditions, and it is subject to uncertainty associated with the available projections. Across the lifetime of the Project, it is considered highly likely that the future baseline will be broadly comparable to the existing baseline described above.

14.4.5 Summary and key issues

The key sensitive receptors and key issues for the air quality onshore study area are provided below in Table 14-6.

Table 14-6 Summary and key issues for air quality

SUMMARY AND KEY ISSUES	ONSHORE STUDY AREA
	• The onshore study area is largely rural and as such is assumed to have a relatively high air quality level. GHG emissions relating to air quality and global climate change will be covered in a separate GHG assessment presented within SS1: Climate and carbon assessment; • Existing local sources of particulate matter and dust likely includes windblown dust from agricultural land, exhaust emissions from road vehicles, active quarries and domestic heating sources; and • Proximity to human and ecological receptors.

14.4.6 Data limitations and uncertainties

All relevant and publicly available data sources have been accessed during the desk study. As such, it is considered that there are no gaps in the current baseline understanding of air quality. The are some key uncertainties / difficulties associated with assessing the impact of air quality into the future: These include:

- Uncertainty around the response of the physical environment to changes in climate variables; and
- Difficulties in attributing changes in the physical environment to climate change.

Overall, the current baseline data is considered appropriate to support a robust impact assessment.

14.5 Impact assessment methodology

14.5.1 Impacts requiring assessment

The impacts identified as requiring consideration for air quality are listed in Table 14-7. Information on the nature of impact (i.e. direct or indirect) is also described.

Table 14-7 Impacts requiring assessment for air quality

POTENTIAL IMPACT	NATURE OF IMPACT
Construction and decommissioning*	
Dust emissions associated with the onshore Project works (onshore substation)	Direct
Dust emissions associated with mobile activity (onshore export cables laying)	Direct

**** In the absence of detailed information regarding decommissioning works, and unless otherwise stated, the impacts during the decommissioning of the onshore Project considered analogous with, or likely less than, those of the construction stage, as detailed in section 14.6.2.***

14.5.2 Impacts scoped out of the assessment

The impacts scoped out of the assessment during EIA scoping, and the justification for this, are listed in Table 14-8.

Table 14-8 Impacts scoped out for air quality

IMPACT SCOPED OUT	JUSTIFICATION
Construction and decommissioning	
Dust (access roads/tracks)	Groundworks and the use of aggregates associated with the construction of temporary access roads does not have the potential to give rise to significant local dust issues due to negligible amounts of dust on vehicles and tracks. Hence, the impact has been scoped out of the EIA.
Dust and emissions from vehicle use	A temporary increase in vehicle use on and near the onshore Project during construction and decommissioning does not have the potential to give rise to significant local dust or air quality issues. Dust emissions from vehicle use are considered to be negligible, while GHG emissions from vehicle use associated with the onshore Project is covered in SS1: Climate and carbon assessment. Construction traffic will be controlled by the Construction Traffic Management Plan (CTMP) (submitted alongside the PPP Application) which is detailed in chapter 16: Access, traffic and transport, and OMP2: Outline CTMP. Hence, the impact has been scoped out of the EIA.

IMPACT SCOPED OUT	JUSTIFICATION
Operation and maintenance	
Dust and emissions resulting from operation and maintenance works	It is not expected that any significant volumes of dust or vehicle emissions will be generated once construction is complete. The number of vehicle trips required during operation will be limited where possible. Hence, the impact has been scoped out of the EIA.

It should be noted that, GHG emissions from the onshore Project, notably, NO_x, Sulphur Oxides (SO_x), CO, CO_2 are quantified and assessed in SS1: Climate and carbon assessment. Gaseous emissions from vehicles and their impact on local air quality has been scoped out of the air quality Onshore EIA Report chapter for both construction, operation and maintenance and decommissioning and this aspect is not considered further.

14.5.3 Assessment methodology

An assessment of potential impacts is provided separately for the construction and decommissioning stages.

The assessment for air quality is undertaken following the principles set out in chapter 7: EIA methodology. The sensitivity of the receptor is combined with the magnitude of impact to determine the impact significance. Topic-specific sensitivity and magnitude criteria are assigned based on professional judgement, as described in Table 14-9 and Table 14-10.

Table 14-9 Sensitivity criteria

SENSITIVITY CRITERIA	DEFINITION
High	Receptor with no capacity to accommodate a particular effect and no ability to recover or adapt. These high sensitivity receptors may include: • Hospitals, Care homes, Schools within 100 m of source; • >10 residences within 20 m of source; • >10 residences within 50 m of source; • Areas of high level amenity where people will spend long periods of time e.g. museum; • Long-term carparks; • Internationally designated sites where the qualifying feature is sensitive to air pollution within 50 m; • Nationally designated sites where the qualifying feature is sensitive to air pollution (e.g., SSSI) within 20 m; and/or • Red Data list species within 50 m.

SENSITIVITY CRITERIA	DEFINITION
Medium	Receptor with very low capacity to accommodate a particular effect with low ability to recover or adapt. These medium sensitivity receptors may include: • >10 residences within 50 m of source; • >2-10 residences within 20 m of source; • Non-residential properties where people are present for long periods of time e.g. offices within 20 m; • Areas of amenity value where people may linger e.g. parks; • Medium-term carparks; and/or • Nationally designated sites where the qualifying feature may be sensitive to air pollution e.g. SSSI within 50 m.
Low	Receptor some tolerance to accommodate a particular effect or will be able to recover or adapt. These low sensitivity receptors may include: • 1 residence within 20 m of source; • >10 residences within 100 m of source; • Transient exposure groups, people moving through an area i.e. footpaths; • Short-term carparks; • Non-residential properties where people are present for long periods of time e.g. offices within 50 m; and/or • Locally designated sites where the qualifying feature may be sensitive to air pollution.
Negligible	Receptor is generally tolerant and can accommodate a particular effect without the need to recover or adapt such as those which are generally abundant around the UK with no specific value or concern.

Table 14-10 Magnitude criteria

MAGNITUDE CRITERIA	DEFINITION
High	Impact occurs over a large spatial extent resulting in widespread, long term or permanent changes in baseline conditions, or affecting a large proportion of receptor population. The impact is very likely to occur and/or will occur at a high frequency or intensity.
Medium	Impact occurs over a local to medium extent, with short to medium term change to baseline conditions, or affecting a moderate proportion of receptor population. The impact is likely to occur and/ or will occur at a moderate frequency or intensity.

MAGNITUDE CRITERIA	DEFINITION
Low	Impact is localised and temporary or short term, leading to detectable change in baseline conditions, or noticeable effect on small proportion of receptor population. The impact is unlikely to occur or may occur but at low frequency or intensity.
Negligible	Impact is highly localised and short term with full rapid recovery expected to result in very slight or imperceptible changes to baseline conditions, or receptor population. The impact is very unlikely to occur and if it does, will occur at very low frequency or intensity.

The consequence and significance of effect is then determined using the matrix provided in chapter 7: EIA methodology.

14.5.4 Embedded mitigation

As described in chapter 7: EIA methodology, certain measures have been adopted as part of the Project development process to reduce the potential for impacts to the environment, as presented in Table 14-11. These have been accounted for in the assessment presented below. The requirement for additional mitigation measures (secondary mitigation) will be dependent on the significance of the effects on air quality receptors.

In accordance with the onshore PPP Application, the embedded mitigations listed below have been attributed to particular Development Zones within the onshore Project area, these are detailed in Table 14-11 and the Development Zones shown in Figure 14-2.

14.5.5 Worst case scenario

As detailed in chapter 7: EIA methodology, this assessment considers the worst case scenario for the onshore Project parameters which are predicted to result in the greatest environmental impact, known as the 'worst case scenario'. The worst case scenario represents, for any given asset and potential impact, the design option (or combination of options) that would result in the greatest potential for change.

Given that the worst case scenario is based on the design option (or combination of options) that represents the greatest potential for change, the development of any alternative options within the design parameters will give rise to no worse effects than those assessed in this impact assessment. Table 14-12 presents the worst case scenario for potential impacts on air quality during construction and decommissioning.

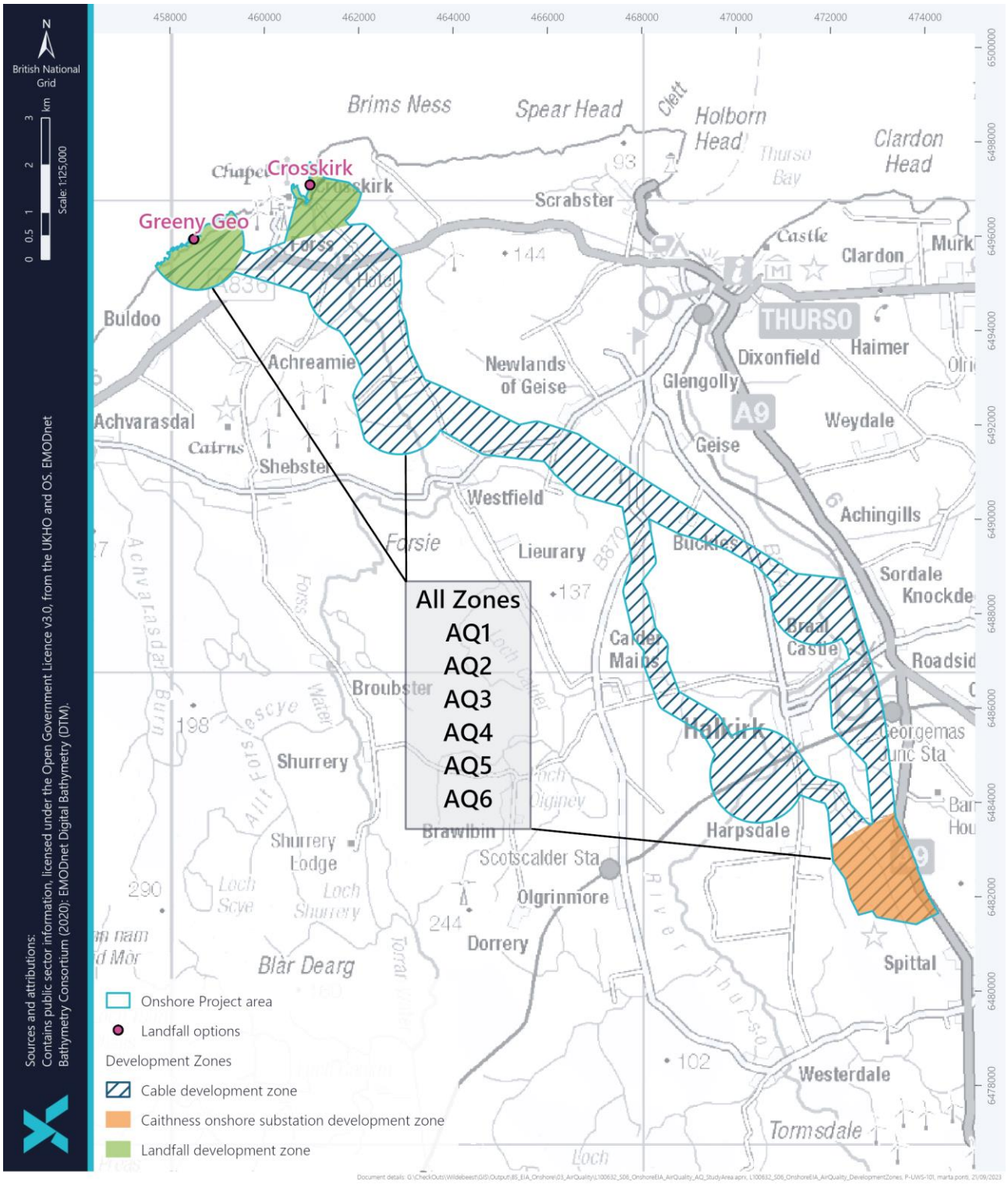

Figure 14-2 Development Zones for the onshore PPP Application

Table 14-11 Embedded mitigation measures relevant to air quality

ID	MITIGATION MEASURE	TYPE	DESCRIPTION	HOW MITIGATION WILL BE SECURED	DEVELOPMENT ZONE
AQ1	Avoidance of dust causing activities at sensitive locations	Primary	Appropriate site layouts will be developed so that machinery and dust causing activities are located away from receptors, as far as possible. Also ensure equipment is readily available on site to clean any dry spillages and ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out. Remove materials that have a potential to produce dust from site as soon as possible.	Established within design principles (secured through Construction Method Statements (CMSs). As per OMP 1: Outline CEMP, these measures will be established within a DAQMP which will be appended to the final CEMP. The CEMP will be secured through a condition attached to the PPP.	All zones.
AQ2	Adequate water supply	Primary	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Established within design principles (secured through CMSs). As per OMP1: Outline CEMP, these measures will be established within a DAQMP which will be appended to the final CEMP. The CEMP will be secured through a condition attached to the PPP.	All zones.
AQ3	CEMP	Tertiary	The CEMP will outline how the onshore Project will ensure the suitable implementation and control of the mitigation measures during construction. An outline CEMP (OMP 1: Outline CEMP) is provided alongside the Application for PPP.	As per OMP 1: Outline CEMP, the final CEMP will be provided at post-consent. The CEMP will be secured through a condition attached to the PPP.	All zones.

ID	MITIGATION MEASURE	TYPE	DESCRIPTION	HOW MITIGATION WILL BE SECURED	DEVELOPMENT ZONE
AQ4	CTMP	Tertiary	The management of construction traffic within the onshore Project area is provided within OMP 2: Outline CTMP, which is attached to the Application for PPP. The CTMP will be finalised post-consent once the design of the onshore Project is finalised. Best practice guidance 'Dust and Air Emissions Mitigation Measures' by the Institute of Air Quality Management will be utilised to control dust. In summary, the CTMP will ensure that: • Mechanical road sweeping will be undertaken as required to maintain clean routes; • Covering of loads where required during transportation by HGVs to minimise wind-blown materials from being deposited; • Dust suppression including water spraying to be used on internal and external access roads where necessary; and • Wheel washing to mitigate the amount of mud that could potentially be deposited on the local road network. Further details of the CTMP are provided in chapter 16: Access, traffic and transport.	As per OMP 2: Outline CTMP, these measures will be established within the final CTMP. The CTMP will be secured through a condition attached to the PPP.	All zones.

ID	MITIGATION MEASURE	TYPE	DESCRIPTION	HOW MITIGATION WILL BE SECURED	DEVELOPMENT ZONE
AQ5	Site inspections	Tertiary	Site inspections will be carried out by the Ecological Clerk of Works (ECoW(s)) to ensure the compliance with the CEMP. The frequency of these inspections should increase when activities with a high potential to produce dust are being carried out and during prolonged dry/windy conditions.	As per OMP 1: Outline CEMP, these measures will be established within a DAQMP which will be appended to the final CEMP. The CEMP will be secured through a condition attached to the PPP.	All zones.
AQ6	Decommissioning, Restoration and Aftercare Plan.	Tertiary	A Decommissioning, Restoration and Aftercare Plan will be prepared for the onshore Project and agreed with THC prior to decommissioning works being undertaken. The plan will include any measures required to protect dust sensitive features during decommissioning which are likely to be similar to those proposed within the CEMP.	Established within design principles (secured through CMSs). Also established within the Decommissioning, Restoration and Aftercare Plan which will be secured through a condition attached to the PPP.	All zones.

Table 14-12 Worst case scenario specific to air quality receptor impact assessment

POTENTIAL IMPACT	WORST CASE SCENARIO	JUSTIFICATION
Construction and decommissioning		
Dust emissions associated with the onshore Project works (onshore substation)	Preparation of working areas, excavation activities, use and storage of materials: – Onshore substation: ▪ Preparation of temporary work compound for substation 62,500 m^2 (including compound and welfare facilities); ▪ The full size of development area (including substation screening, bunding and Sustainable Urban Drainage Systems (SuDS)) is approximately 23.9 hectares (ha), with maximum excavated material 1,207,000 m^3; ▪ Potential for on-site batching of concrete; ▪ The estimation of concrete usage for the onshore substation foundations is 50,272 m^3; ▪ One permanent access road to the onshore substation of approximately 1,375 m^2; ▪ Preparatory and civil works for the onshore substation are anticipated to be undertaken over a 3 year period; and ▪ During decommissioning all concrete structures will be excavated and disposed of, and any pits backfilled. Cabling in the onshore substation site will be removed. Building structures will be demolished and access roads will be removed.	These activities/parameters are considered to represent the maximum worst case scenario with regard to potential dust emissions which could result in the impact to air quality receptors.

POTENTIAL IMPACT	WORST CASE SCENARIO	JUSTIFICATION
Dust emissions associated with mobile activity (onshore export cables laying)	• Preparation of working areas, excavation activities, use and storage of materials: – Onshore export cables: ▪ Construction and reinstatement of temporary laydown areas (estimated to be every 2 km along the route) and temporary access roads for underground onshore export cable installation works; ▪ Crossing methods will range from open trenching to a range of trenchless crossings (to be determined based on location specific requirements) and Horizontal Directional Drilling (HDD) operations at major crossings; ▪ Excavation of up to five trenches for the five onshore export cables and storage of excavated materials estimated to be 162,525 m^3 per trench. The total volume of excavated material to trench all the onshore export cables is estimated to be 975,150 m^3 (allowing for contingency) The working corridor is estimated to be 33 km long and 100 m wide; ▪ The number of Cable Joint Bays (CJBs) depends on the single (continuous) lengths of onshore export cables that can be installed. A maximum of 288 CJBs is anticipated; and ▪ During decommissioning, cables will be removed from the ducts utilising the joint bays and cables may be left *in situ* along the cable route area where removal methods will bring significant disturbance. Concrete structures will be dismantled, broken up and recycled. The pit will be backfilled. – Landfall: ▪ Preparation of the working area at the landfall site to accommodate six boreholes (five plus one contingency), HDD drilling equipment, utilities, and welfare facilities with an estimated area of 7,500 m^2; ▪ Storage of excavated materials from the boreholes estimated to be 1,630 m^3 per HDD bore prior to disposal off-site; and	These cable-laying methods are considered to represent the worst case scenarios that have the potential to directly result in the impact to air quality receptors.

POTENTIAL IMPACT	WORST CASE SCENARIO	JUSTIFICATION
	▪ Installation of up to five Transition Joint Bays (TJBs) at a worst case dimensions of 30 m long x 6m wide x 5 m deep. The concrete usage for the TJBs and CJBs is 20,682 m^3. ▪ Temporary access tracks (not including haul roads) up to 3,300 m in length at the landfall, the entry and exit points of the horizontal directional drilling (HDD) HDD points and the onshore substation. Lengths are indicative only; ▪ Where possible, local infrastructure including road networks, farmer tracks and utility access roads will be utilised to minimise the construction of new infrastructure. Temporary bridges/spanning structure will be considered for appropriate locations for haul roads; and ▪ HDD activities ongoing for up to 6 months. – Permanent access roads: ▪ Up to six permanent access tracks will be required for HDD sites along the onshore export cable corridor, subject to final design of the onshore Project. This consists of approximately 5 km in length of permanent access tracks. 24% (1.2 km) are existing tracks, 44% (2.21 km) are existing tracks that require improvements and 32% (1.67 km) will be newly installed tracks. • Onshore construction works are expected to take place over a period of four years.	

14.6 Assessment of potential effects

14.6.1 Potential effects during construction

A number of activities will be required for the construction of the onshore Project which could have potential effects on air quality. The details of the onshore Project are described within chapter 5: Project description, and proposed activities considered within this assessment are summarised in Table 14-12.

At this stage of the onshore Project, the details of the construction programme are high-level and not confirmed, therefore this assessment has assumed that construction will not be phased so as to assess the worst case scenario in terms of restoration. Post construction, the temporary works will be removed and the ground reinstated.

By convention, the assessment of construction dust is normally confined to a qualitative evaluation of the likelihood that emissions may give rise to some perceptible nuisance. This is often defined by the distance between construction works and sensitive receptors (e.g., residential properties). The worst case dust effects are generally experienced within 100 m of a source (depending on type). Table 14-13 outlines the receptor sensitivity and the reasoning for the decision. Ground works and the use of aggregates and cement on site has the potential to give rise to local dust issues. In addition, there is a potential for dust to be created during the decommissioning of the onshore substation/switch gear, especially if the floor is to be removed as it will need to be broken up.

The IAQM guidance (IAQM, 2014) provides a method to assess the significance of construction effects by considering the annoyance due to dust soiling as well as harm to ecological receptors and the risk of health effects due to any significant increases to PM_{10} or $PM_{2.5}$. Site activities are divided into four types (demolition, earthworks, construction and trackout) to reflect their different potential effects. The guidance is designed to inform the planning process and identify the significance of an air quality impact. It should be noted that three of the site activities are relevant to this project (earthworks, construction and decommissioning) and the sensitivity of each is provided in Table 14-14.

Table 14-13 Air quality receptor sensitivity

RECEPTOR	SPECIFIC RECEPTOR	JUSTIFICATION	SENSITIVITY
Hospitals, care homes and schools	• No receptors identified.	There are no hospitals, care homes and schools within 500 m of the source, therefore the sensitivity of the receptors are negligible.	Negligible
Residential properties	• Multiple residential properties are located within the Project area.	Based on Table 14-9, these receptors are considered to be of medium sensitivity, there are residential properties where people may be present for long periods of time and may have a very low capacity to recover or adapt.	Medium

RECEPTOR	SPECIFIC RECEPTOR	JUSTIFICATION	SENSITIVITY
Non–residential properties	• Forss Business & Energy Park; • Achscrabster Farm Cottage; and • Forss House Hotel.	Based on Table 14-9, these receptors are considered to be of medium sensitivity, as they are non-residential properties where people are present for long periods of time and may have a very low capacity to recover or adapt e.g. offices within 20 m.	Medium
Amenity areas	• NC500 route; • Lochan Buidhe; • Achanarras Quarry Nature Reserve; • St Mary's Chapel car park; • St Marys Chapel; • Sibster Forest; • Spittal woodland; and • Alder woodland on floodplains.	Based on Table 14-9, these receptors are considered to be low, due to the intervening distance from the source and transient nature of the receptor users.	Low
Designated sites	• Achanarras Quarry SSSI; • Ushat Head SSSI; and • Loch Lieurary SSSI.	Based on Table 14-9, Achanarras Quarry SSSI, Ushat Head SSSI and Loch Lieurary SSSI are considered to be of medium sensitivity, as although these designated sites are not considered to be particularly sensitive to air pollution (SNH, 2008; 2009; 2010), they have national designation status and it is considered they have very low capacity to accommodate potential effects.	Medium
	• River Thurso SAC.	Based on Table 14-9, the River Thurso SAC is considered to be of high sensitivity as it is a site of international importance which overlaps with the onshore Project area and is noted as being sensitive to surface water and airborne pollution impacts, which may include dust (Joint Nature Conservation Committee (JNCC), 2015). Atlantic salmon is a qualifying feature of this SAC and are an IUCN red listed species for which these are considered to be Vulnerable as detailed below.	High
Species listed in the IUCN Red List	• Atlantic salmon (V); • European Eel (CR); • Otter (NT); • Curlew (NT); • Lapwing (NT); • Eider (NT); • Oystercatcher (NT); • Rook (V); • Snipe (V); • Slavonian grebe (NT); and • Red-breasted merganser (NT).	These ICUN Red List species have been identified within 100 m of the onshore Project area through ecology surveys undertaken for the onshore Project. As per Table 14-9, they are considered to be of high sensitivity due to their status and due to sensitivities to impacts from air pollution which may include dust emissions.	High

Table 14-14 Sensitivity in terms of dust emissions (IAQM, 2014)

CATEGORIES	CHARACTERISTIC
Dust emission classes for earthworks activities	
High	• Total site area >10,000 m^2; • Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); • >10 heavy earth moving vehicles active at any one time; • Formation of bunds >8 m in height; and/or • Total material moved >100,000 tonnes (te).
Medium	• Total site area 2,500 to 10,000 m^2; • Moderately dusty soil type (e.g. silt); • 5 to 10 heavy earth moving vehicles active at any one time; • Formation of bunds 4 to 8 m in height; and/or • Total material moved 20,000 to 100,000 te.
Low	• Total site area <2,500 m^2; • Soil type with large grain size (e.g. sand); • <5 heavy earth moving vehicles active at any one time; • Formation of bunds <4 m in height; • Total material moved <10,000 te; and/or • Earthworks during wetter months.
Dust emissions classes for construction activities	
High	• Total building volume >100,000 m^3; • Piling; • On site concrete batching; and/or • Sandblasting.
Medium	• Total building volume 25,000 to 100,000 m^3; • Potentially dusty construction material (e.g. concrete); • Piling; and/or • On site concrete batching.
Low	• Total building volume <25,000 m^3; and/or • Construction material with low potential for dust release (e.g. metal cladding or timber).

14.6.1.1 Dust emissions associated with the onshore Project works (onshore substation)

The sensitivity of the receptors located within 500 m for human receptors and 100 m for ecological receptors are identified as **negligible, low, medium and high sensitivity** (see Table 14-13).

Concrete will be used throughout the construction stages of the onshore Project for the onshore substation foundations. The material is classified as a potentially dusty construction material therefore is classed as medium sensitivity for dust emissions. There may be concrete batching at the onshore substation and this activity is classed as a high dust emission magnitude as per the IAQM guidelines (IAQM, 2014) for dust emission classes.

The estimation of concrete usage for the onshore substation foundations is 50,272 m^3. This falls within the bracket considered medium in the guidelines and the embedded mitigation outlined in section 14.5.4 will ensure any impacts from dust are minimised. The maximum area for the onshore substation is estimated to be 239,200 m^2, while the maximum excavated volume is 1,207,000 m^3. This is categorised as high under the IAQM guidelines, however airborne pollution from site preparation and construction operations will be minimised by the embedded mitigation detailed within the CEMP, such as the DAQMP. The impact of dust emissions as a result of the construction works will therefore be localised and relatively short-term in nature.

Although an impact is likely to occur, it will occur at a low intensity and will be highly localised to the onshore substation search area where these construction works will occur. The embedded mitigation measures outlined in section 14.5.4 will work to further reduce the intensity of impacts experienced by receptors through minimising dust generation and migration from the onshore Project, ensuring dust pollution at receptors is minimal and ensuring the construction activities on site consider the potential dust generation. Following the construction period, dust generation activities will cease to continue, reinstation and full rapid recovery of the baseline environment is expected which will result in very slight or imperceptible changes to the baseline conditions. Therefore, the **magnitude of impact** is deemed to be **negligible** for all identified receptors.

Evaluation of significance

Taking the high to low sensitivity of receptors and the negligible magnitude of impact, the overall effect on receptors is considered to be **negligible** and **not significant** in EIA terms.

RECEPTOR	SENSITIVITY	MAGNITUDE OF IMPACT	CONSEQUENCE
Hospitals, care homes and schools	Negligible	Negligible	Negligible
Residential properties	Medium	Negligible	Negligible
Non – residential properties	Medium	Negligible	Negligible
Amenity areas	Low	Negligible	Negligible
Designated sites	High to medium	Negligible	Negligible
Species listed in the IUCN Red List	High	Negligible	Negligible
Impact significance - NOT SIGNIFICANT			

14.6.1.2 Dust emissions associated with mobile activity (onshore export cables laying)

The sensitivity of the receptors located within 500 m for human receptors and 100 m for ecological receptors are identified as **negligible, low, medium and high sensitivity** (see Table 14-13).

As detailed in chapter 5: Project description, although not fully defined, it is conservatively assumed that the installation of the onshore export cables will be undertaken over a four year period. It is expected that the installation works will progress in sections across multiple workfronts. Concrete will be used throughout the construction stages of the onshore Project for the TJBs and CJBs. The material is classified as a potentially dusty construction material therefore is classed as medium sensitivity for dust emissions. Additionally, during earth breaking works soils and bedrock may be disturbed. The dust potential from this disturbed soil/bedrock will depend on the final onshore export cable route, however as detailed in chapter 8: Geology and hydrology, the main soils encountered are likely to be gleys, peaty podzols and brown soils and sensitivity to dust generation will depend on the particle size of the soil or bedrock encountered at specific locations.

The total working corridor width for installation of the onshore export cables is approximately 100 m, which includes an area for cable trenches, haul roads, areas of stripped soil and storage, cable safety zones, and an allowance of tapering of the trenches. Temporary laydown compounds will also be required approximately every 2 km along the onshore export cable corridor. Due to the length of the onshore export cable route, the onshore export cables will require to be installed in a number of sections, resulting in connections at CJBs. The number of CJBs is dependent on the length of the onshore export cables but it is anticipated there will be a maximum of 288 CJBs will be required. The exact location, number and length of CJBs will be confirmed during detailed design post planning. The estimation of concrete usage for the TJBs and CJBs is 20,682 m^3. This falls within the bracket considered medium in the IAQM guidelines and the embedded mitigation outlined in section 14.5.4 will ensure impacts are minimised.

The total volume of excavated material to trench all the onshore export cables is estimated to be 975,150 m^3, which is categorised as high under the IAQM guidelines. However, this total volume will not all be excavated at the same time or at the same location, due to the linear nature of the cable installation activities, maximum length of a single cable is 33 km. The excavations will occur along the linear route of the cable and not localised to a single large site. This therefore reduces the amount of excavated material at any given time that has the potential to give rise to dust emissions. Therefore, although an impact is likely to occur, it will occur at a low intensity and will be highly localised where the small section of construction for the installation of the onshore cable is occurring. The embedded mitigation measures outlined in section 14.5.4 will work to further reduce the intensity of impacts experienced by receptors through minimising dust generation and migration from the onshore Project, ensuring dust pollution at receptors is minimal and ensuring the construction activities on site consider the potential dust generation. Following the construction period, full rapid recovery of the baseline environment is expected which will result in very slight or imperceptible changes to the baseline conditions. Therefore, the **magnitude of impact** is deemed to be **negligible** for all identified receptors.

Evaluation of significance

Taking the high to low sensitivity of receptors and the negligible magnitude of impact, the overall effect on receptors is considered to be **negligible** and **not significant** in EIA terms.

RECEPTOR	SENSITIVITY	MAGNITUDE OF IMPACT	CONSEQUENCE
Hospitals, care homes and schools	Negligible	Negligible	Negligible
Residential properties	Medium	Negligible	Negligible
Non – residential properties	Medium	Negligible	Negligible
Amenity areas	Low	Negligible	Negligible
Designated sites	High to medium	Negligible	Negligible
Species listed in the IUCN Red List	High	Negligible	Negligible

Impact significance - NOT SIGNIFICANT

14.6.2 Potential effects during decommissioning

In the absence of detailed information regarding decommissioning works, the impacts during the decommissioning of the onshore Project are considered analogous with, or likely less than, those of the construction stage.

Decommissioning operations will be based on strategies that minimise the environmental impact and maximise efforts to recycle materials where possible and will be developed in consultation with the local authorities. The preference will be to remove infrastructure where possible, however the impact of removal will be assessed against environmental impacts. Whilst the detail of the decommissioning strategy is yet to be established, this assessment is based on the decommissioning strategy proposed in Table 5-7 of chapter 5: Project description, which is as close to full removal as possible, whilst recognising that this is subject to assessments and consultation closer to the time of decommissioning. It is expected that decommissioning follows a reverse order of the installation activities with some infrastructure potentially left *in situ*, therefore lessening the impact on the land as there is no requirement for intrusive works. As the landscape bunds and proposed planting will be mature at the time of decommissioning, it is expected these will be retained.

For the onshore export cables, the impacts would be localised to the areas where cables are pulled and removed, and all aspects of the onshore substation would be dismantled and removed, both resulting in very localised impacts that are broadly comparable with those identified for the construction stage.

Throughout the operational and construction stages, new and forthcoming legislation and policies would be acknowledged and adhered to, supporting, and guiding the decommissioning process. A Decommissioning Restoration and Aftercare Plan will be prepared prior to decommissioning which will include a financial guarantee to secure decommissioning and site restoration. Decommissioning will be undertaken in accordance with applicable guidance at the relevant time. As per the embedded mitigation measures the Project will seek to maximise recycling where possible of components which are recovered to ensure sustainable decommissioning. As such, it would be expected that any potential impact would not be significant.

The overall impact on air quality during decommissioning is therefore considered to be, at worst, minor and not significant, in line with the impacts assessed for the construction stage.

14.6.3 Summary of potential effects

A summary of the outcomes of the assessment of potential effects from the construction and decommissioning of the onshore Project is provided in Table 14-15.

Table 14-15 Summary of potential effects

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Construction and decommissioning*						
Dust emissions associated with the onshore Project works (onshore substation)	Hospitals, care homes and schools	Negligible	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Residential properties	Medium	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Non-residential properties	Medium	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Amenity areas	Low	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Designated sites	High to medium	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Species listed in the IUCN Red List	High	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Dust emissions associated with mobile activity (onshore export cables laying)	Hospitals, care homes and schools	Negligible	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Residential properties	Medium	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Non-residential properties	Medium	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Amenity areas	Low	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Designated sites	High to medium	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Species listed in the IUCN Red List	High	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)

** In the absence of detailed information regarding decommissioning works, and unless otherwise stated, the impacts during the decommissioning of the onshore Project are considered comparable with, or likely less than, those of the construction stage.*

14.7 Assessment of cumulative effects

14.7.1 Introduction

Potential impacts from the onshore Project have the potential to interact with those from other developments, plans and activities, resulting in cumulative impacts on air quality receptors. The approach to the cumulative effects assessment is detailed in chapter 7: EIA methodology (see Figure 7-4), detailing the developments considered in relation to the onshore Project area. A summary of the approach is provided below.

The list of relevant developments for inclusion within the cumulative effects assessment is outlined in Table 14-16. This has been informed by a screening exercise, undertaken to identify relevant developments for consideration within the cumulative effects assessments for each topic-specific chapter, based on defined Zones of Influence (ZoI).

Developments which are located within 500 m of the onshore Project area have the potential to result in a cumulative effect for air quality receptors. Developments which are either operational or in the decommissioning stage are considered to be part of the baseline and are not considered within the assessment.

Table 14-16 List of developments considered for the air quality cumulative impact assessment

LOCATION	DEVELOPMENT TYPE	DEVELOPMENT NAME	DISTANCE FROM ONSHORE PROJECT AREA (KM)	DISTANCE FROM ONSHORE SUBSTATION SEARCH AREA (KM)	STATUS	CONFIDENCE[4]
Spittal, Caithness	Transmission infrastructure – substation plant	Electricity Supply Board (ESB) Asset Development Synchronous Compensator (20/05118/FUL)	0	0	Application	Low
Spittal, Caithness	Transmission infrastructure - cables	High Voltage Underground Spittal Synchronous Compensator Grid Connection (22/00016/FUL)	0	0.24	Consented	Medium

[4] *Confidence ratings have been applied to each cumulative development where: 'Low' = pre-application or application, 'Medium' = consented and 'High' = under construction or operational.*

LOCATION	DEVELOPMENT TYPE	DEVELOPMENT NAME	DISTANCE FROM ONSHORE PROJECT AREA (KM)	DISTANCE FROM ONSHORE SUBSTATION SEARCH AREA (KM)	STATUS	CONFIDENCE[4]
Forss, Caithness	Onshore Windfarm	Forss Windfarm Extension (20/04455/FUL)	0.51	18.21	Application	Low

The following impacts have been taken forward for the cumulative effects assessment for construction and decommissioning:

- Dust emissions associated with the onshore Project works (onshore substation) (Spittal, Caithness developments); and
- Dust emissions associated with mobile activity (onshore export cables laying) (Forss, Caithness development).

14.7.2 Cumulative construction effects

The developments listed in Table 14-16 may result in a cumulative impact to the construction of both the onshore substation construction and installation of the onshore export cables for the onshore Project.

At present, there is no available information on the construction timelines for the developments and the extent of material to be excavated. However, if a worst case is assumed that the programmes for the construction of all three developments overlapped with the onshore Project's construction stage, then there may be the potential to breach the high dust sensitivity category as per the IAQM guidance (2014). However, it is assumed that the cumulative developments will also submit and abide by a DAQMP within their CEMPs and CTMPs, as best practice. This will include best practice construction management measures including measures to manage risks associated with the production of pollution and the potential risks this may pose to waterbodies and human health. Therefore, potential impacts from dust would be mitigated by each development.

The onshore Project alone has assessed only negligible non-significant effects through the proposed activities with the implementation of embedded mitigation measures. It is also assumed each development will maintain a DAQMP as embedded mitigation as best practice. Cumulative impacts from construction dust is considered to have no change to the predicted magnitude of impact for construction and therefore will still result in a negligible magnitude of impact on receptors, which have a high to negligible sensitivity, as such the significance of effect is deemed as negligible and not significant in EIA terms.

14.7.3 Cumulative decommissioning effects

As there is limited information on the decommissioning of the onshore Project and that of other developments, at present, a thorough assessment of decommissioning cumulative effects has not been undertaken. Nonetheless, it is expected that the cumulative effects are likely to be less than or equal to the construction stage, given the decommissioning will be a largely a reverse process to that of construction. Furthermore, decommissioning of multiple other developments would not be expected to occur at the same time as the decommissioning stage of the onshore Project.

A Decommissioning Restoration and Aftercare Plan will be developed and approved pre-construction to address the principal decommissioning measures for the onshore Project and will be written in accordance with applicable guidance. The Decommissioning Restoration and Aftercare Plan will detail the environmental management, and schedule for decommissioning and will be reviewed and updated throughout the lifetime of the onshore Project to account for changing best practices.

14.7.4 Summary of cumulative effects

A summary of the outcomes of the assessment of cumulative effects for the construction and decommissioning stages of the onshore Project is provided in Table 14-17.

Table 14-17 Summary of assessment of cumulative effects

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Construction and decommissioning*						
Dust emissions associated with the onshore Project works (onshore substation)	Hospitals, care homes and schools	Negligible	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Residential properties	Medium	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Non-residential properties	Medium	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Amenity areas	Low	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Designated sites	High to medium	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**
	Species listed in the IUCN Red List	High	Negligible	**Negligible (not significant)**	None required above embedded mitigation measures.	**Negligible (not significant)**

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Dust emissions associated with mobile activity (onshore export cables laying)	Hospitals, care homes and schools	Negligible	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Residential properties	Medium	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Non-residential properties	Medium	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Amenity areas	Low	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Designated sites	High to medium	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)
	Species listed in the IUCN Red List	High	Negligible	Negligible (not significant)	None required above embedded mitigation measures.	Negligible (not significant)

**** In the absence of detailed information regarding decommissioning works, and unless otherwise stated, the impacts during the decommissioning of the onshore Project are considered comparable with, or likely less than, those of the construction stage.***

14.8 Inter-related effects

Inter-related effects are the potential effects of multiple impacts, affecting one receptor or a group of receptors. Inter-related effects include interactions between the impacts of the different stages of the onshore Project (i.e. interaction of impacts across construction, operation and maintenance and decommissioning), as well as the interaction between impacts on a receptor within an onshore Project stage. The potential inter-related effects for air quality receptors are described below.

14.8.1 Inter-related effects between onshore Project stages

There is not predicted to be any inter-related effects between onshore Project stages as impacts from the operation and maintenance stage of the Project were scoped out of the EIA, as detailed in section 14.5.2. Inter-related effects between the construction and the decommissioning of the Project are not predicted due to the time interval of tens of years between these stages of the onshore Project. There is therefore no potential for inter-related effects between any of the onshore Project stages.

14.8.2 Inter-related effects within an onshore Project stage

The magnitude of impact during construction of the Project in terms of dust emissions from onshore Project works are considered to be negligible for all the identified receptors due to very localised relatively short-term impacts which may cause a very slight change to baseline conditions and in line with the embedded mitigations. Similarly, dust emissions from onshore export cable laying activities are considered to be extremely localised along the onshore export cable corridor route. The dust emissions are considered to be the same in nature but will occur in different locations. There is therefore not predicted to be any inter-related effects within the construction stage of the onshore Project.

14.9 Whole Project assessment

The offshore Project is summarised in chapter 5: Project description and a summary of the effects of the offshore Project is provided in chapter 18: Offshore EIA summary. These offshore aspects of the Project have been considered in relation to the impacts assessed in section 14.6.

There is no potential for interaction between the effects of the onshore Project on receptors and any impacts in relation to the offshore Project. The potential impacts from the onshore Project are localised and are not expected to reach any receptors of the offshore Project.

14.10 Transboundary effects

There is no potential for transboundary impacts upon air quality receptors due to construction, operation and maintenance and decommissioning of the onshore Project. The potential impacts are localised and will not affect other European Economic Area (EEA) states. Therefore, transboundary effects for air quality receptors do not need to be considered further.

14.11 Summary of mitigation and monitoring

No secondary mitigation, over and above the embedded mitigation measures proposed in section 14.5.4, is either required or proposed in relation to the potential effects of the onshore Project on air quality as no adverse significant impacts are predicted.

Appointment of ECoW(s) to secure effective monitoring and compliance with environmental mitigation and management measures.

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14.13 Abbreviations

ACRONYM	ABBREVIATION
AQMA	Air Quality Management Area
AQP	Air Quality Plan
AQS	Air Quality Standard
CEMP	Construction Environmental Management Plan
CJB	Cable Joint Bay
CR	Critically Endangered
CMS	Construction Method Statement
CTMP	Construction Traffic Management Plan
DA	Detailed Assessment
DAQMP	Dust and Air Quality Management Plan
Defra	Department for Environment, Food and Rural Affairs
ECMWF	European Centre for Medium-Range Weather Forecasts
ECoW	Ecological Clerk of Works
EEA	European Economic Area
EIA	Environmental Impact Assessment
EN	Endangered
ERA5	ECMWF Reanalysis v5
ESB	Electricity Supply Board
GHG	Greenhouse Gas
Ha	Hectares
HDD	Horizontal Directional Drilling
HGV	Heavy Good Vehicle

ACRONYM	ABBREVIATION
HwLDP	Highland-wide Local Development Plan
IAQM	Institute of Air Quality Monitoring
IEMA	Institute of Environmental Management and Assessment
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
km	Kilometre
m /m^2 / m^3	Metre / Metre squared / Cubic metre
mm	Millimetre
MD-LOT	Marine Directorate - Licencing Operations Team
MS-LOT	Marine Scotland - Licencing Operations Team
NAQIA	National Air Quality Information Archive
NC500	North Coast 500
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
NT	Near Threatened
NVC	National Vegetation Classification
OIC	Orkney Islands Council
OMP	Outline Management Plan
OS	Ordnance Survey
$PM_{2.5}$	Particles < 2.5µm
PM_{10}	Particles < 10µm
PPG	Pollution Prevention Guidelines
PPP	Planning Permission in Principle

ACRONYM	ABBREVIATION
R&A	Review and Assessment
RCP	Representative Concentration Pathway
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SHET-L	Scottish Hydro Electric Transmission plc
SO_x	Sulphur Oxides
SS	Supporting Study
SSEN	Scottish and Southern Electricity Networks
SSSI	Site of Special Scientific Interest
te	Tonnes
THC	The Highland Council
TJB	Transition Joint Bay
UK	United Kingdom
UKCP 18	United Kingdom Climate Projections 18
USA	Updating and Screening Assessment
USB	Universal Serial Bus
V	Vulnerable
ZoI	Zones of Influence

14.14 Glossary

ACRONYM	ABBREVIATION
Air Quality	A measurement of how polluted the air is (i.e., the amount of pollutants within the air).
Friability	Able to be broken up easily.
Grain Size	The diameter of individual grains of sediment.
Greenhouse Gas	Gases such as carbon dioxide, methane, and nitrous oxide which are capable of absorbing and reflecting infrared radiation, resulting in increased surface temperatures.
Particle	A very small portion of matter.
Particulate Matter	A mixture of solid particles and liquid droplets found in the air (e.g., dust, smoke, etc.).
Pollutant	Solid particles, liquids or gases which in excess levels can result in the degradation of air quality. Pollutants can be hazardous and have negative effects on human health.
Trackout	Mud, soil, or other organic debris that gets carried out of a construction site, farm, or any other industrial area where the soil has been disturbed.