Environmental Impact Assessment

Greenside Extension

Client: Greenside Wind Energy Ltd.
Reference: C5865-655
Version 1

February 2024

Report Prepared for:
Greenside Wind Energy Ltd.

Author:
Green Cat Renewables

Checked by	Rachael Lyall	Date	13/02/2024
Approved by	Cameron Sutherland	Date	15/02/2024

Issue History	Date	Details
V1.0	12/01/2024	Client Issue
V2.0	15/01/2024	Final Submission

Table of Contents

Preface

This Environmental Impact Assessment Report assesses the environmental effects of a three-wind turbine extension at Greenside Wind Farm. Further details on the development are provided within this report. The proposal is being brought forward by Greenside Wind Energy Ltd., the Applicant.

This is an Environmental Impact Assessment Report for the purposes of the Planning EIA Regulations (the Environmental Impact Assessment (Scotland) Regulations 2017) covering the major environmental effects arising from this proposal. This EIA Report includes a description of the proposed development; a comprehensive study of potential environmental impacts during the construction, operational and decommissioning phases; and, where required, mitigation to minimise any potentially adverse impacts.

Green Cat Renewables Ltd (GCR) has been commissioned by Greenside Wind Energy Ltd..

A copy of the EIA Report can be viewed via the online 'Public Access' service on Aberdeenshire Council's website where representations can be made.

Hard copies of the Non-Technical Summary (NTS) are provided for £10 per copy upon request and the full Environmental Impact Assessment Report (EIAR) for £750 per hard copy, excluding Landscape Graphics and drawings. Electronic copies (CD-ROM) of the EIAR package can be purchased for £25. Please contact:

Green Cat Renewables Ltd, Address: Stobo House, Roslin, EH25 9RE

Email: info@greencatrenewables.co.uk

Tel: 0131 541 0060

1 Introduction

The development will be referred to as Greenside Extension ('the Proposed Development').

The Proposed Development seeks permission to install and operate three wind turbines as part of an extension to an existing farm of four wind turbines located at the site, in accordance with the Town and Country Planning (Scotland) Act 1997 as amended by the Planning etc. (Scotland) Act 2006. Depending on the turbine selected for the final design, the turbines could have a potential generating capacity of up to 2.35 MW, which would give a total capacity of up to 7.05 MW.

The EIA has been carried out to standards that comply with The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

Greenside Wind Farm (hereafter referred to as the 'consented development') was previous granted planning permission (APP/2011/1024) in 2012 for four 2.3MW wind turbines at the same site as the above Proposed Development. The previous consent was for four wind turbines (Enercon E70) up to 99.5m to blade tip. The consented development provides the background to, and is a material consideration in planning terms, for the Proposed Development.

1.1 Description of Development

The Applicant is seeking planning permission for the erection of three wind turbines up to 100m to tip and each turbine with up to 2.35MW generating capacity. Associated and ancillary infrastructure include a crane hardstanding area, upgrading of existing onsite access tracks, an electrical substation and buried cables, and temporary construction compound.

The proposed turbines will form an extension to the existing wind farm located at the site.

The planning application seeks planning permission on the basis that planning conditions relating to decommissioning could be used to ensure removal of structural elements if generation were to cease.

1.2 The Site

The Proposed Development at Greenside is located approximately 2-3km southeast of Crimond, Aberdeenshire.

The Site lies on existing farmland which does not carry any national planning designations.

The site connects with various other scattered farmhouses and surrounding farmland. The A90 Road passes from the north to the east of the Proposed Development.

1.3 The Applicant

The Applicant is Greenside Wind Energy Ltd. (GWEL), who are a renewable energy company focussed on small-scale onshore wind projects in the United Kingdom.

1.4 The Agent

Green Cat Renewables Ltd (GCR) has been commissioned to prepare this report and to manage all aspects of the planning submission.

GCR is an environmental and engineering consultancy focused on all aspects of development support, based in Scotland. The company's multi-disciplinary resource base spans all stages of project delivery from feasibility and concept development through to planning, engineering, project management and operational asset management.

GCR have also developed expertise in helping a range of businesses find sustainable energy solutions to aid economic viability in a climate where energy costs are forecast to continue to rise.

The GCR EIA team brings a diverse skill set that includes planning, environmental and technical expertise, and is comprised of Project Managers, planners, consultants, environmentalists, engineers, acousticians, CAD technicians, GIS technicians, hydrologists and resource analysts.

1.5 Content of the Planning Submission

In order to streamline the planning submission, prevent unnecessary duplication and aid in ease of access to specific topic chapters, the planning submission has been structured with individual topic chapters in the EIAR as independent documents.

- Environmental Impact Assessment Report (EIAR) comprises of 15 chapters submitted as separate documents as outlined in paragraph 1.4.1 below.
  - Planning Statement
  - Design and Access Statement
  - Appendices
  - Landscape and Visual Figures
  - Planning & Technical Drawings
  - Non-Technical Summary (NTS) summarises the key findings of the technical assessments in a non-technical style for ease of understanding.

Figures extracted from the planning application drawings have been inserted in the relevant EIA Report sections where appropriate.

1.5.1 Structure of the Environmental Impact Assessment Report

In line with the EIA Directive and the local planning policies, this Environmental Impact Assessment Report (EIA Report) covers a number of key environmental, technical and social issues associated with the proposed development.

The EIA Report forms the backbone of the planning application and comprises the following chapters:

1. Introduction
2. EIA methodology
3. Project Description
4. Planning Policy
5. LVIA
   - LVIA Figures
6. Cultural Heritage and Archaeology
7. Noise Impact Assessment
8. Hydrology and Hydrogeology
9. Traffic and transport
10. Carbon Balance
11. Shadow Flicker

12. Other issues (such as Socioeconomics and Recreation, Aviation, Telecommunications and Health & Safety)
13. Summary of Mitigation
14. Ecology
15. Ornithology

Within each of the above listed chapters, the information is structured in a consistent way, as far as practicable, as follows:

- Introduction: Identifies key objectives and issues.
- Guidance: Summarises the relevant policy and guidance documents used to inform the assessment.
- Methodology: Summarises the methods used in undertaking the assessment work.
- Baseline: Summarises the existing situation.
- Assessment of Predicted Impacts and Effects: Identification and assessment of the predicted effects (both positive and negative) associated with the construction, operation and decommissioning of the proposed development.
- Mitigation: A summary of measures envisaged to avoid, reduce or remedy predicted negative effects of the proposed development.
- Summary of Predicted Impacts and Effects: Summary of the impacts and effects predicted and proposed mitigation measures.
- Conclusion: Summary of the conclusions of the assessment.

1.5.2 Appendix Register

Table 1.1 below lists the appendices that accompany each Chapter.

Table 1.1 - List of Appendices

Appendix	Title	Location
Chapter 1 Introduction		
Appendix 1.1 Project Team	Project Team	Appended to chapter
Chapter 5 LVIA		
Appendix 5.1	LVIA Methodology	Appended to chapter
Appendix 5.2	Viewpoint Assessment	Appended to chapter
Chapter 7 Noise		
Appendix 7.1	Details of GWF 2018 Compliance Monitoring	Appended to chapter
Appendix 7.2	Sound Power Levels of Cumulative Developments	Appended to chapter
Chapter 14 Ecology		
Appendix 14.1	National Vegetation Classification Survey	Separate Document
Appendix 14.2	Protected Species Survey	Separate Document

Appendix	Title	Location
Appendix 14.3	Bat Survey	Separate Document

1.5.3 Drawing Register

Table 1.2 - Planning and Technical Drawings Register

Drawing Number	Drawing Title	Size	Issue/Revision
Planning Drawings			
C5865-GCR-WF-GA-DR-P-0004_P01	Site Location	A3	Planning Final
C5865-GCR-WF-GA-DR-P-0005_P01	Site Layout	A3	Planning Final
C5865-GCR-WF-EL-DR-P-0001_P01	Turbine Elevation	A3	Planning Final
C5865-GCR-WF-DT-DR-P-0001_P01	Cranepad and Laydown	A3	Planning Final
C5865-GCR-WF-SE-DR-P-0001_P01	Turbine and Gas Main Section	A3	Planning Final
C5865-GCR-WF-DT-DR-P-0002_P01	Track Details-Road details	A3	Planning Final
C5865-GCR-WF-GA-DR-P-0003_P01	Cable Layout	A3	Planning Final
C5865-GCR-SUB-GA-DR-P-0001_P01	Proposed Substation	A3	Planning Final
C5865-GCR-WF-GA-DR-P-0002_P01	Drainage Layout	A3	Planning Final
C5865-GCR-WF-DT-DR-P-0003_P01	Drainage Layout Sheet 1	A3	Planning Final
C5865-GCR-WF-DT-DR-P-0004_P01	Drainage Layout Sheet 2	A3	Planning Final

1.5.4 Figure Register

The following figures accompany the EIA Report.

Table 1.3 - Separate Figures Accompany the Noted Chapters.

Figure Number	Figure Title	Size	Issue/Revision
Constraints Plan for Chapter 2			
Figure 2.1	Site Constraints Plan	A3	Final

Figure 2.2	Site Constraints Plan with Layout	A3	Final
Landscape and Visual Impact Assessment Figures for Chapter 5			
Figure 5.1	Study Area	A3	Final
Figure 5.2	Cumulative Basemap	A3	Final
Figure 5.3	Regional Landscape Character	A3	Final
Figure 5.4	Local Landscape Character	A3	Final
Figure 5.5	Local Landscape Character with ZTV	A3	Final
Figure 5.6	Regional Landscape Designations	A3	Final
Figure 5.7	Local Landscape Designations with ZTV	A3	Final
Figure 5.8	Tip ZTV	A3	Final
Figure 5.9	Hub ZTV	A3	Final
Figure 5.10	Residential Amenity Assessment	A3	Final
Figure 5.11	Route Assessment	A3	Final
Figure 5.12	Viewpoint 01 – Longhill Farm	A3	Final
Figure 5.13	Viewpoint 02 – Overside Farm	A3	Final
Figure 5.14	Viewpoint 03 - Tillyduff	A3	Final
Figure 5.15	Viewpoint 04 - Crimond	A3	Final
Figure 5.16	Viewpoint 05 – Loch of Strathbeg	A3	Final
Figure 5.17	Viewpoint 06 – Kirkton of St Fergus	A3	Final
Figure 5.18	Viewpoint 07 – A90-A952 Junction	A3	Final
Figure 5.18c	Viewpoint 07 – A90-A952 Junction	A3	Final
Figure 5.19	Viewpoint 08 – Formartine and Buchan Way	A3	Final
Figure 5.20	Viewpoint 09 - Longside	A3	Final
Figure 5.21	Viewpoint 10 – Stirlinghall by Peterhead	A3	Final
Figure 5.22	Viewpoint 11 - Inverallochy	A3	Final
Figure 5.22a	Viewpoint 11 - Inverallochy	A3	Final
Figure 5.23	Viewpoint 12 – Mormond Hill	A3	Final
Figure 5.24	Viewpoint 13 – Culsh Monument	A3	Final
Cultural Heritage Figures for Chapter 6			
Figure 6.1	Cultural Heritage Features within the Site	A3	Final
Figure 6.2	Cultural Heritage Features within 10km	A3	Final
Noise Figure for Chapter 7			
Figure 7.1	Noise Study Area	A3	Final
Ecology Figure for Chapter 14			

Figure 15.1	Vantage Point Map	A3	Final

1.6 The EIA Team

GCR has been commissioned to prepare the EIA report. The report contains the results of the appropriate assessments undertaken to support the application.

The GCR EIA team brings a diverse skill set that includes planning, environmental and technical expertise. It is comprised of Project Managers, planners, consultants, environmentalists, engineers, acousticians, CAD technicians, GIS technicians, hydrologists and analysts.

GLM Ecology and IMTeco Ltd, were appointed by GCR to undertake the Ecological Impact Assessment. Their ecology assessments are within Chapter 14 Ecology and Chapter 15 Ornithology of the EIA Report.

The EIA has been carried out by GCR to standards that comply with The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

Details of members of the EIA team are provided in Appendix 1.1.

Appendix 1.1 – Project Team

In line with Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (a transposition of EU directive 2014/52/EU), which came into place on the 16th of May 2017, the EIA Report has been prepared by 'competent experts'. Regulation 5(5) states:

"(5) In order to ensure the completeness and quality of the EIA report—

(a) the developer must ensure that the EIA report is prepared by competent experts; and

(b) the EIA report must be accompanied by a statement from the developer outlining the relevant expertise or qualifications of such experts."

The following section provides details of the 'competent experts' involved in the preparation of the EIA Report. Full CVs available on request:

Gavin Catto – Director

Gavin established Green Cat Renewables in December 2004 and has over 25 years of experience in the renewables industry developing wind, small-scale hydro, solar and hybrid projects. From a background of electrical engineering, and with a PhD in wind turbine generator design, his broad base of expertise includes project feasibility assessment and optimisation, project management, construction management, commercial risk assessment, environmental assessment, resource assessment, grid connection negotiation and design. In his time at Green Cat, Gavin has overseen the delivery of over 800MW of renewables projects.

Cameron Sutherland – Technical Director

In his role as Technical Director, Cameron is responsible for Green Cat's wind, solar and hydro Due Diligence work for a variety of funders and investors and provides technical oversight across all our Environmental Assessment areas and Asset Management function. He has an MSc in Renewable Energy Systems Technology and 18 years of experience in the renewables industry. Cameron has a thorough and in-depth understanding of the technical, environmental and social issues associated with commercial renewable energy development, having managed more than 30 wind energy projects through the Scottish planning system and provided technical support for over 300 wind, solar and hydro projects at all stages of project development, from initial feasibility to post construction encompassing consenting, resource assessment, due diligence and operational asset management. Cameron also specialises in noise assessment of pre-planning and constructed sites and has acted as expert witness on noise in the UK and Alberta, Canada. His expert witness experience also extends to shadow flicker for wind farms and glare assessment for solar farms.

Rob Collin – Head of Planning and Environmental

Rob holds an MSc in in Urban and Regional Planning as well as a BEng in Energy and Environmental Engineering and has over 12 years of specialist experience in the renewables industry. Rob has managed all aspects of the consenting and project development process from initial feasibility assessments, constraints mapping and layout design, liaising with clients, community groups, sub-contractors and regulatory bodies, co-ordinating and inputting into environmental and technical assessments as well as the overseeing and managing of EIA's. Rob has a thorough understanding of the key environmental and technical constraints involved in the development of renewables projects.

Merlin Garnett – Principal Noise Consultant

Merlin is the Principal Noise Consultant at Green Cat and has been in post for almost 10 years. He has an MSc in Renewable Energy and a Diploma in Acoustics from the Institute of Acoustics. Responsibilities include the

management of noise equipment, planning and execution of noise measurement fieldwork, development of data validation and analysis tools, data analysis, author and reviewer of technical reports.

He has extensive experience in the production of noise impact and shadow flicker assessments for wind turbine and hybrid energy projects of all scales across the UK as well as in Alberta, Canada. Experience of the deployment and configuration of remote monitoring equipment in the UK and also Saskatchewan and Nova Scotia, Canada, using a variety of LiDAR and SoDAR platforms.

He has conducted more than seventy post-completion assessments for wind projects in the UK following the IoA Good Practice Guide. Has experience of several sound power and tonal analysis assessments following IEC 61400-11:2012 (Wind turbines – Part 11: Acoustic noise measurement techniques). Merlin also sits on the shadow sub-committee to MT 11, the British Standards Institute body that reviews amendments to, and discusses the development of, IEC 61400-11 and is an expert in the measurement and rating of amplitude modulation in turbine noise and a contributor to research in this field.

Merlin has a wide experience of industrial sound assessment following BS 4142:2014 for projects such as substations, solar parks, animal feed manufacturers, distillery & maltings, hydropower and energy storage projects.

Alasdair Warnock – Principal Landscape Architect

Alasdair is a qualified town planner and urban designer with over 10 years of experience in completing Townscape & Visual Impact Assessments and Landscape & Visual Impact Assessment, particularly specialising in wind energy developments. He has a wealth of experience in every aspect of wind energy LVIA, including site selection, viewpoint selection and photography, graphics and written assessment.

Within his years of experience, Alasdair has designed and undertaken assessments for a number of large-scale wind projects as well as small to medium scale commercial projects, throughout the UK. In addition, Alasdair has been involved in solar and hydro projects, designed landscape mitigation schemes and planting plans as well as landscape capacity work for local authorities. Alasdair also has experience in providing Landscape Clerk of Works services for construction sites during key phases and working to strict planning controls.

Rachael Lyall – Senior Environmental Consultant

Rachael has a BSc (Hons) in Construction Management and a MSc in Environmental Management and additionally has a HND in Architectural Technology. Rachael focused her university research on the life cycle of renewable technologies, public perception and the planning system. Rachael has previous experience from another consultancy and also as a local authority planning officer. With over 5 years' experience of handling planning applications and consulting on EIA project, Rachael has a strong understanding of both the Scottish and English planning systems and experience with a wide range of stakeholders and local authorities and has a thorough understanding of key constraints involved with renewable development projects.

Kirsten Henderson – Senior Environmental Consultant

Kirsten holds a MSc in Environmental Management with conservation specialisation and has a keen interest in groundwater, hydrological and ecological issues. Utilising strong GIS skills, and an expertise in ground conditions, habitat assessment and mapping, Kirsten is involved in all stages of project development from initial site identification and layout design, to conducting and assisting with environmental assessments and co-ordination, through to post-planning works and discharge of planning conditions. Kirsten is comfortable in liaising with stakeholders and community groups as well as the management of the project team across hydrology, ecology and ornithology disciplines. Kirsten has built a thorough understanding of the EIA and regulatory process within

the UK renewables sector, authoring and reviewing key chapters within the EIA, including hydrology and hydrogeology assessments, peat management plans, ecology and ornithology assessments and supplementary planning documents.

Isla Ferguson – Environmental Consultant

Isla is an Associate Member of IEMA (AIEMA) with a BSc. (Hons) in Environmental Geography and an MSc in Environmental Management, as well as an HND in Photography. During both degrees Isla's research focused on environmental impacts on cultural heritage assets. As an Environmental Consultant, Isla is involved in all aspects of project delivery including Site Constraints and Feasibility, Cultural Heritage Impact Assessments and Landscape and Visual Impact Assessments, as well as, Project Management and management of sub-contractors.

Isla also leads our GIS and Graphics team, coordinating and managing the production of all required photography, mapping, photomontages and figures for our clients, landscape studies and planning applications. Utilising a range of software packages such as QGIS, ReSoft Windfarm, the Adobe Creative Suite including Photoshop, Illustrator, Lightroom and InDesign and PTGui.

Iona Sutherland – Environmental Consultant

Iona has a Master of Arts Honours Degree in Urban Planning with a background in planning consultancy. Following obtaining experience in public consultation, and planning application and stakeholder management, Iona gained Chartered Town Planner status from the Royal Town Planning Institute. Iona will be responsible for undertaking report writing including chapters of the EIA, and planning statements.

Maria Morrison – Graduate Environmental Consultant

Maria holds a BSc. (Hons) in Environmental Geography from the University of Stirling and is currently an Associate member of IEMA and is working towards Practitioner. During her degree, she studied a wide range of subjects from geoarchaeology and ecology to water management and energy sustainability. As a graduate, Maria has experience in different stages of project delivery from site constraints for feasibility to scoping and EIA Hydrological and Carbon Balance assessments. She also aids in the production of graphics and visuals to accompany the Landscape and Visual Impact Assessment. Maria has a strong proficiency utilising a range of softwares to produce visualisations such as PT GUI, ReSoft WindFarm and the Adobe Creative suite. Additionally, Maria is highly skilled using QGIS for graphics and other mapping requirements for clients.

Glyn Morgan – Graduate Environmental Consultant

Glyn holds an MSc in Sustainability and Environmental Modelling and an MA (Hons) in Geography. This has provided him with a strong knowledge of energy sustainability and modelling with research into the UK wind energy industry, as well as a wider appreciation of environmental and sustainability challenges. As a Graduate Environmental Consultant, Glyn has experience in a range of project areas including the production of site constraints plans, landscape graphics and report writing. Glyn is confident in the use of a variety of software packages, including QGIS, ReSoft Windfarm and the Adobe Creative suite.

Alice Burberry – Graduate Environmental Consultant

Alice holds a Bsc (Hons) in Environmental Resource Management, in addition to a HND in the same subject. Throughout Alice's degree, she focussed on the energy industry with research into the state of nuclear power in Scotland. As a Graduate Environmental Consultant, Alice is involved in project delivery stages such as Landscape and Visual Impact Assessments, Telecommunications Assessments and Site Constraints for projects from feasibility

stages through to EIA. Alice is also an Associate Member of the Institute of Environmental Management and Assessment.

Alice is highly skilled in software such as QGIS, ReSoft WindFarm, Adobe Creative Suite and PTGui in addition to SNH standard landscape photography. Alice has authored LVIA chapters for small-scale repowering and wind farm extension projects, as well as telecommunications for a number of wind farm developments.

Garry Mortimer and Irene Tierney – Ecologists

GLM Ecology & IMTeco Ltd

GLM Ecology and IMTeco Ltd are experienced ecology consultancies with fifteen years' experience of ecological assessments at over 140 renewable energy sites in the UK. The findings of the field and desktop surveys are considered in regard to the legal obligations and guidance that currently exists for all protected species of flora and fauna when considering new proposals and developments.

2 EIA Methodology

2.1 Introduction

EIA is a statutory process governed by UK and European law. It is a means of drawing together in a systematic way, an assessment of the likely significant environmental effects arising from a Proposed Development. In Scotland, the relevant regulations are provided in The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

This section presents an overview of the methodology to be utilised for the production of the EIA. It outlines the methodology for the identification and evaluation of potential likely significant environmental effects and also presents the methodology for the identification and evaluation of potential cumulative and any inter-related impacts.

2.2 Assessment Methodology

The individual methodologies for assessing each EIA topic will be described in more detail in each of the individual chapters of the EIA Report. The following sections briefly outline the overarching assessment methodology to be undertaken.

2.2.1 Identification of Environmental Baseline

A review of the current environmental conditions will be undertaken in order to determine the appropriate baseline for assessment. In the majority of assessments, this will involve the following:

- Definition of an appropriate study area, based on guidance and best practice;
- A review of currently available information relating to the development study area;
- Identification of likely or potential impacts;
- Outline further data/survey/monitoring required to obtain relevant information if required to support assessment; and
- Review information to ensure sufficient data is available to provide a robust assessment.

2.2.2 Assessment of Impacts

The Applicant has appointed a competent team of EIA specialists who will undertake the required assessments using available data, new data (if required), professional and expert judgement.

The methods for predicting the nature and magnitude of any potential impacts vary dependent on the subject area. Quantitative methods of assessment can predict values that can be compared against published thresholds and indicative criteria in Government guidance and standards. Where it is not possible to use a quantitative method, a qualitative assessment method will be utilised, these assessments rely on the experience and professional judgement of the technical specialist.

The potential significant effects of the Proposed Development must be considered in relation to the characteristics of development and the location of development, with regard to the impact of the development on the factors specified in Regulation 3A(3), taking into account:

- The magnitude and special extent of the impact (for example geographical area and size of the population likely to be affected);
- The nature of the impact;
- The intensity and complexity of the impact;

- The probability of the impact;
- The expected onset, duration, frequency and reversibility of the impact;
- Cumulative impacts with the impact of other existing and/or approved development; and
- The possibility of effectively reducing the impact.

Table 2.1 illustrates how the criteria will be applied to ascertain the level of significance of a potential impact.

Table 2.1 – Significance of Effect Matrix

Sensitivity	Magnitude of Change			
	High	Medium	Low	Negligible
High	Major	Major/Moderate	Moderate	Moderate/Minor
Medium	Major/Moderate	Moderate	Moderate/Minor	Minor
Low	Moderate	Moderate/Minor	Minor	Minor
Key:		Significant in terms of the EIA Regulations		
		Not Significant		

2.3 Mitigation

The aim of the EIA is to identify, avoid, reduce and offset any significant adverse environmental effects arising from the Proposed Development.

Where possible, reasonable steps will be taken during the design process to avoid the creation of significant or adverse impacts. Where these cannot be avoided completely, appropriate mitigation will be proposed to avoid or reduce the impacts to acceptable levels.

3 Proposed Development

This chapter provides details of the proposed wind farm and ancillary infrastructure. The operational and decommissioning phases of the development are also discussed.

The Applicant is seeking planning permission for:

The erection of three wind turbines up to 100m to tip and up to 2.35MW generating capacity. Associated and ancillary infrastructure includes hard standing areas for each turbine location, on-site access tracks, an electrical substation and buried cables, borrow pit search area, temporary laydown areas and temporary construction compound.

Consent is sought for a temporary period of 40 years.

This chapter should be read in conjunction with the site constraints plan and the planning application drawings:

- Figure 2.1 Site Constraints Plan
- Figure 2.2 Site Constraints Plan with Layout
- C5865-GCR-WF-GA-DR-P-0004_P01 Site Location
- C5865-GCR-WF-GA-DR-P-0005_P01 Site Layout
- C5865-GCR-WF-EL-DR-P-0001_P01 Turbine Elevation
- C5865-GCR-WF-DT-DR-P-0001_P01 Cranepad and Laydown
- C5865-GCR-WF-SE-DR-P-0001_P01 Turbine and Gas Main Section
- C5865-GCR-WF-DT-DR-P-0002_P01 Track Details-Road details
- C5865-GCR-WF-GA-DR-P-0003_P01 Cable Layout
- C5865-GCR-SUB-GA-DR-P-0001_P01 Proposed Substation
- C5865-GCR-WF-GA-DR-P-0002_P01 Drainage Layout
- C5865-GCR-WF-DT-DR-P-0003_P01 Drainage Details Sheet 1
- C5865-GCR-WF-DT-DR-P-0004_P01 Drainage Details Sheet 2

3.1 Proposed Infrastructure

The Proposed Development consists of the following infrastructure elements:

- Three, three-bladed horizontal axis wind turbines measuring up to 100m tip height;
- Hardstanding areas for cranes at each turbine location;
- Turbine foundations;
- Site access tracks;
- Drainage works;
- An on-site electrical substation and control network of buried cables;
- Temporary laydown areas;
- Temporary construction compound, including parking, and welfare facilities; and
- Associated ancillary works.

Ordnance Survey National Grid References for the turbines are presented in Table 3.1 National grid references for turbines.

Table 3.1 – National Grid References for Turbines

Turbines	Grid Location
Turbine 1	E 405930.00 N 855290.00
Turbine 2	E 406280.00 N 855230.00
Turbine 3	E 406620.00 N 855170.00

The design process and layout evolution, outlined in the accompanying Design and Access Statement, brings together environmental, technical and economic requirements. The Site design has been optimised to account for all known constraints. The Applicant will nevertheless require some flexibility during construction as the complexity of the ground conditions will only be fully understood following detailed ground investigations.

A micrositing allowance from the proposed position of turbines, and the route of access tracks (up to 50m deviation from the indicative design) would assist in reducing environmental impacts during construction and it is anticipated that this will form a planning condition accompanying permission for the project. Any micrositing of project infrastructure would be used to reduce any predicted impacts highlighted within this EIA Report.

3.1.1 Wind Turbines

This application proposes three wind turbines up to 100m to blade tip height.

The exact model of wind turbine to be installed would be selected through a competitive procurement process, however for the purposes of the assessments, currently available wind turbine models are being considered which fit this height parameter. There are a number of potential wind turbine models which fit within the height parameter, but which differ in properties, such as noise emissions, in each instance a 'worst case' potential wind turbine has been used in the assessment as appropriate.

Each turbine will have a capacity of up to 2.35MW, giving a total capacity of up to 7.05MW.

The turbines will rotate in a clockwise direction. The computerised control system within the turbine continuously monitors the wind direction and instructs the turbine to turn (yaw) to face into the wind to maximise the amount of energy that is captured. The turbines will begin generating at a wind speed of 3-4 m/s and operate with a storm control feature that enables the turbine to continue to operate in very high wind speeds. This avoids the need for sudden shutdowns and the resulting energy yield losses.

In the event of extreme wind speeds, in excess of those that the turbines can operate at (typically 10minute averages of 25m/s or a gust of 34m/s), they would shut down until the wind speed has dropped to a level where they can safely start operating again.

3.1.2 Turbine Foundation

The foundations would typically have a diameter of approximately 18m, and a depth of 5.1m. When the foundations are excavated, a further metre around the foundation edge will be dug to allow working space during construction. A concrete blinding, 10cm thick, will be poured to provide a surface on which the foundation can be constructed.

The turbine foundations will be covered by consolidated backfill that will have a density of no less than 18kN/m³. It is anticipated that the excavated material will be used for this backfilling. A layer of topsoil is placed on top of the fill, with re-seeding undertaken when construction is complete. A plinth of approximately 7m in diameter is left, just above the surface level, upon which the turbine is bolted.

3.1.3 Crane Hardstanding

Crane hardstanding areas are required at each turbine location to facilitate the erection of the wind turbine. The indicative hardstanding design measures 44m x 21m. The hardstanding will be constructed using aggregate with a topping layer of type 1 aggregate or similar and will be designed to withstand a minimum surface pressure of 200kN/m².

3.1.4 Grid

Electrical cables will be laid in trenches, typically alongside the access tracks, and run to the onsite substation. Discussions are ongoing with Scottish Power Energy Networks, with regard to how the project would connect to the national electricity grid network. These plans would be finalised should the planning application gain consent.

3.1.5 Substation

The substation building plan and elevations is shown in drawing C5865-GCR-SUB-GA-DR-P-0001_P01 - Proposed Substation. This single storey building is approximately 13.7m by 5.9m and 3.2m in height. It will house the onsite usage transformer room; joint switch room; control and relay room and metering room.

3.1.6 Access Junction

The location of the access junction is at grid reference E406672 N854074 and is shown on C5865-GCR-WF-GA-DR-P-0005_P01 - Site Layout.

The Site access will be well signed with contractor information and public traffic warning signs as agreed with the Roads Department. This will be detailed within a Construction Method Statement produced for the discharge of planning conditions.

3.1.7 Access Tracks

Where possible, the on-site access track layout has been designed to minimise environmental disturbance and land take, utilising existing tracks where appropriate.

As shown in drawing C5865-GCR-WF-DT-DR-P-0002_P01 - Track Details-Road details, approximately 1,217m of new on-site track would be required to provide access to the wind turbines.

Tracks would be typically 4m wide with a 0.5m shoulder on each side which would consist of crushed stone to a depth dictated by ground conditions, generally between 300mm and 600mm.

On-site tracks and drainage have been designed in line with best practice guidance to minimise environmental impact, drainage and road design is further detailed in Chapter 8 - Hydrology & Hydrogeology and drawing C5865-GCR-WF-DT-DR-P-0003_P01 Drainage Details Sheet 1 and drawing C5865-GCR-WF-DT-DR-P-0004_P01 Drainage Details Sheet 2.

Typical access track sections are shown in C5865-GCR-WF-DT-DR-P-0002_P01 - Track Details-Road details.

3.2 Water Crossings

Details of how the Proposed Development will interact with the water environment are outlined in Chapter 8 - Hydrology and Hydrogeology.

3.3 Drainage

A preliminary drainage strategy plan has been produced to manage all surface water and foul drainage in line with the CIRIA C697 'The SuDS Manual'. This aspect is discussed further in **Chapter 8 - Hydrology & Hydrogeology** and shown on drawing **GCR-WF-DT-DR-P-0003_P01 Drainage Details Sheet 1** and drawing **C5865-GCR-WF-DT-DR-P-0004_P01 Drainage Details Sheet 2.**

3.4 Micrositing

A micrositing allowance for the proposed position of turbines and the routes of access tracks (up to 50m deviation from the indicative design) is requested via planning condition and will assist in reducing environmental impacts during construction. Micrositing of any of the turbines, track or associated infrastructure would be used to limit environmental impacts following a detailed site and ground investigation required as part of discharging the planning conditions and final locations of infrastructure would be agreed in writing with the planning authority prior to site commencement.

3.5 Reinstatement and Decommissioning

3.5.1 Reinstatement

Reinstatement will incorporate restoration and landscaping of track verges, cable runs, temporary construction compounds, temporary hardstandings (as required), temporary drainage controls and any other features which are not required as part of the permanent works.

Prompt completion of reinstatement works shall be undertaken where reasonably practicable. Early reinstatement reduces the temporary storage of materials, and the associated visual impact.

Excavated materials will be replaced in a sequence and to a depth similar to those recorded during excavation, or similar to the surrounding undisturbed ground at the point of reinstatement.

Any reinstatement and restoration proposals will consider, and mitigate against, all residual risks to environmental receptors.

3.5.2 Decommissioning

At the end of their operational life the turbines would be removed from the Site, and the foundations and hardstandings would be covered over with topsoil and re-seeded. The access tracks will remain in-situ to aid farming operations.

The electrical cables would be de-energised and left in place, with any cable marker signs removed. The electrical substation building would be demolished to ground level with the foundations covered with topsoil and re-seeded.

The decommissioning process would take between four to six months to complete. Decommissioning effects are not generally considered in detail at this stage. It is proposed that a decommissioning plan will be agreed with Aberdeenshire Council and relevant consultees prior to the end of life of the Proposed Development in line with planning conditions.

4 Regulatory and Policy Context

4.1 Introduction

Chapter 4 of the Environmental Impact Assessment (EIA) Report presents a review of the local and national policy context and legislative framework underpinning the Proposed Development. The EIA Report has been produced to detail the potentially significant environmental impacts identified during the EIA process under EIA Regulations. Further legislation and policies specific to each EIA topic are outlined in the relevant technical chapters of the EIA Report.

Chapter 4 does not assess the Proposed Development under the terms of the Town and Country Planning (Scotland) Act 1997[1] as a separate Planning Statement has been provided with an appraisal of whether the Proposed Development accords with the Development Plan, and whether other material considerations indicate otherwise, in line with Section 25 of the Planning Act 1997.

4.2 Requirement for Environmental Impact Assessment

The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations 2017)[2] sets out the selection criteria for a development to be considered an 'EIA development.' Under Regulation 6 of the EIA Regulations, a developer can request the Local Planning Authority (LPA) to provide a Screening Opinion to determine whether a development, of the types listed in Schedule 2 of the Regulations, is required to undergo an EIA prior to the submission of a planning application.

In this instance, no Screening Opinion has been requested as it is understood that the Proposed Development would be an EIA Development under the Regulations; as per Schedule 2, Paragraph 2, Section 3 (j) (i) and (ii) the Proposed Development involves the installation of more than 2 turbines which also exceed 15m in height and therefore the Proposed Development is considered and EIA development.

4.3 Climate Change and Energy

4.3.1 International Context

4.3.1.1 United Nations Framework Convention on Climate Change

The UK is a signatory to the Kyoto Protocol that is linked to the United Nations Framework Convention on Climate Change (UNFCCC) and provides commitments for the State parties to reduce Greenhouse Gas (GHG) emissions. The Kyoto Protocol was adopted in Kyoto, Japan on 11 December 1997 and entered into force on 16 February 2005. The Protocol was amended in Doha, Qatar on 8 December 2012 and entered into force on 31 December 2020. Its commitments are reflected in The Climate Change Act 2008 and The Climate Change (Scotland) Act 2009 which includes interim targets. (Chapter 4 Section 4.3.2.1 and Chapter 4 Section 4.3.3.1 respectively).

COP21 took place in December 2015 in Paris in which 195 countries, including the UK, adopted the Global Climate Deal (The Paris Agreement). The Paris Agreement sets out the global action plan of limiting global temperature increase to below 2°C, while pursuing efforts to limit the increase to 1.5°C above pre-industrial average temperature.

[1] Town and Country Planning (Scotland) Act 1997 – Accessed 08/12/2023.
[2] The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 – Accessed 08/12/2023.

COP26 took place in November 2021 in Glasgow where parties concluded that with current climate policies the world was not on track to meet the long-term temperature goal set out in the Paris Agreement, with a 2.7° C increase predicted.

COP 27 took place in November 2022 in Sharm el-Sheikh, where countries agreed to return each year to strengthen commitments on cutting GHG emissions to pursue efforts to keep the increase in temperature below 1.5°C.

COP 28 concluded on December 7th 2023 in the United Arab Emirates, where the first global stocktake took place. The stocktake concluded that we are not on track to limit global warming to 1.5° C. COP 28 also facilitated discussions around helping vulnerable communities deal with immediate climate impacts, accelerating both an energy and just transition, and closing the massive emissions gap between where global GHG emissions are heading and where science indicated emissions should be to limit warming to 1.5° C.

4.3.2 Wider UK Legislation and Policy

4.3.2.1 The Climate Change Act 2008

The Climate Change Act 2008[3] (as amended by The Climate Change Act 2008 (2050 Target Amendment) Order 2019) sets out the framework for the UK to transition to a low-carbon economy. It places a duty on the UK government to ensure their net carbon account and GHG emissions are reduced by 100% – by 2050 relative to 1990 levels (Net Zero) as legally underpinned by international agreements and commitments.

The Act includes a requirement for the Committee on Climate Change to report to the UK Parliament and each of the devolved administrations on:

- The progress that has been made towards meeting the carbon budgets that have been set under Part 1 and the target in Section 1 (the target for 2050).
- The further progress that is needed to meet those budgets and that target.
- Confirmation as to whether those budgets and that target are likely to be met.

4.3.2.2 The Energy Act 2023

The Energy Act 2023[4] received Royal Assent in October 2023 and is one of the largest pieces of energy legislation in a generation. The Act focuses on:

- The storage, transport, and capture of carbon.
- The storage, transport, and production of hydrogen.
- The establishment of a future systems operator which will have control over the electricity and gas systems.
- Granting power to the Secretary of State to establish regulations regarding heat networks.
- Competition within the electricity and gas markets to better serve the ultimate consumer.

The Act will help the government deliver net zero by 2050 in a pragmatic, proportionate, and realistic way.

4.3.2.3 Energy White Paper: Powering Our Net Zero Future

The White Paper[5] establishes the UK's goal of a decisive shift from fossil fuels to clean energy in power, buildings, and industry, while creating jobs and growing the economy.

[3] Climate Change (Scotland) Act 2009 – Accessed 08/12/2023.
[4] Search Legislation – Accessed 08/12/2023.
[5] Energy White Paper – Accessed 08/12/2023.

In order to achieve the aims of the White Paper, a series of commitments are identified against the 6 chapters: consumers, power, energy system, buildings, industrial energy, and oil and gas.

4.3.2.4 Net Zero Strategy: Build Back Greener

The Net Zero Strategy[6] from the UK Government is a strategy that sets out policies and proposals for decarbonising all sectors of the UK economy to meet the UK's Net Zero target by 2050.

The Net Zero Strategy promotes a green industrial revolution and a green economic recovery from the impact of COVID-19 with a focus on the position of the UK in the global green economy. It aims to keep the UK on track for the UK carbon budgets, the 2030 Nationally Determined Contribution, and Net Zero by 2050. It includes:

- Decarbonisation pathways to Net Zero by 2050, including illustrative scenarios.
- Policies and proposals to reduce emissions for each sector.
- Cross-cutting action to support the transition.

4.3.2.5 British Energy Security Strategy

The British Energy Security Strategy[7] was published in April 2022, and sets out how Britain will accelerate homegrown power for greater energy independence, in response to energy pressures and the cost-of-living crisis caused by the COVID-19 pandemic and Russia's invasion of Ukraine in 2022.

The British Energy Security Strategy seeks to accelerate the deployment of Wind, New Nuclear, Solar, and Hydrogen Power, whilst supporting the production of domestic Oil & Gas (O&G) in the short-term – which could see 95% of electricity by 2030 being low-carbon.

4.3.2.6 Powering-Up Britain: Energy Security Plan

The Powering Up Britain: Energy Security Plan[8] (March 2023) from the UK Government complements the earlier Powering Up Britain and sits alongside Powering Up Britain: Net Zero Growth Plan. The Energy Security Plan outlines the steps that the UK Government's Department for Energy Security and Net Zero is taking to ensure the UK is more energy independent, secure, and resilient.

4.3.3 National Context

4.3.3.1 The Climate Change (Scotland) Act 2009

The Climate Change (Scotland) Act 2009[9] (CC(S)A 2009) is legislation specifically implemented to reduce the GHG emissions in Scotland. The CC(S)A 2009 requires an interim reduction of GHG emissions by 42% and an 80%, relative to 1990 levels, for 2050. This also required that the Scottish Ministers set annual targets, in secondary legislation, from 2010–2050. To satisfy this requirement, the Climate Change (Annual Targets) (Scotland) Order 2010 outlined the first set of annual GHG emissions reduction targets for the period of 2010–2022. Following this period, The Climate Change (Annual Targets) (Scotland) Order 2011 outlines the targets for 2023–2027. The CC(S)A 2009 and The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 (Scottish Government, 2019) enact Scotland's legal commitments to reducing GHG emissions.

[6] Net Zero Strategy: Build Back Greener – Accessed 08/12/2023.
[7] British Energy Security Strategy – Accessed 08/12/2023.
[8] Powering Up Britain – Accessed 08/12/2023.
[9] Climate Change (Scotland) Act 2009 – Accessed 08/12/2023.

4.3.3.2 The Climate Change (Emissions Reductions Targets) (Scotland) Act 2019

The Scottish Government is committed to ensuring secure, reliable, and affordable energy supplies within the context of long-term decarbonisation of energy generation. Continued growth of the renewable energy sector in Scotland is an essential feature of the future clean energy system and a key driver of future economic growth. The Scottish Government has set a range of targets and ambitions to cut GHG emissions and to generate more energy from renewable sources. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019[10] commits the Scottish Government to reach Net Zero emissions of all GHGs by 2045. It also sets out interim targets to cut emissions by 75% by 2030, and 90% by 2040, against the 1990 baseline. Additionally, The Scottish Government has set a target to generate 50% of Scotland's overall energy consumption from renewable sources by 2030.

4.3.3.3 National Planning Framework 4 (NPF4)

The National Planning Framework 4[11] (NPF4) is discussed in detail in Section 4.4.2.1 below but in terms of Climate Change and energy, at the core of the framework are the twin global crises relating to climate and nature – Policy 1 Tackling the Climate and Nature Crises states *"When considering all development proposals significant weight will be given to the global climate and nature crises."* Policy 2 Climate Mitigation and Adaptation further develops this theme, and requires the minimisation of lifecycle GHG emissions, adaptation to the current and future risks from climate change, and proposals for retrofit measures to existing developments in order to reduce emissions or support adaptation to climate change. Policy 11 Energy encourages, promotes, and facilitates all forms of renewable energy development, including onshore wind.

4.3.3.4 The Electricity Generation Policy Statement 2013

The Electricity Generation Policy Statement 2013[12] (EGPS 2013) examines the way in which Scotland generates electricity and considers the changes which will be necessary to meet the targets that the Scottish Government has established. The Scottish Government's policy on electricity generation is that Scotland's generation mix should deliver:

- A secure source of electricity supply;
- At an affordable cost to consumers;
- That is largely decarbonised by 2030; and
- Achieves the greatest possible economic benefit and competitive advantage for Scotland, including opportunities for community ownership and community benefits.

4.3.3.5 Scotland's Energy Strategy

In 2017, the Scottish Government published Scotland's Energy Strategy: The Future of Energy in Scotland[13] that set a vision for how the energy system in Scotland would look in 2050. That vision was to see: "*A flourishing, competitive, local and national energy sector, delivering secure, affordable, clean energy for Scotland's households, communities and businesses.*"

Since the publication of the 2017 Strategy, the Scottish Government has committed to achieving ambitious targets of Net Zero GHG emissions by 2045, and a 75% reduction by 2030. The 2017 Strategy involves supplying 50% of Scotland's energy requirements from renewable sources and increasing energy productivity by 30% across the Scottish economy by 2030. The latest report by the Climate Change Committee[14] (CCC, 2023) identifies that GHG

[10] Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 – Accessed 08/12/2023.
[11] National Planning Framework 4 – Accessed 08/12/2023.
[12] Electricity Generation Policy Statement 2013 – Accessed 08/12/2023.
[13] Scottish Energy Strategy– Accessed 08/12/2023.
[14] Climate Change Committee Report 2023 – Accessed 21/12/2023.

emissions in 2022 were 46% below 1990 levels, this is an increase of 0.08% since 2021, but remains 9% below pre-pandemic (2019) levels.

4.3.3.6 Draft Energy Strategy and Just Transition Plan – Delivering a fair and secure zero carbon energy system for Scotland 2023

The Draft Energy Strategy and Just Transition Plan[15] was introduced in a ministerial statement in Parliament in January 2023. It brings together plans for a Just Transition and the existing Energy Strategy from 2017. It is anticipated that this plan will supersede the Scottish Energy Strategy once adopted.

The draft Plan sets out actions to ensure that:

- People have access to affordable clean energy.
- Communities and places can participate and benefit from the Net Zero energy transition.
- Scotland has a supportive policy environment, maximising the impact of government expenditure, and attracting private investment.
- Scotland is home to a multi-skilled energy workforce, boosting our domestic supply chain and manufacturing capabilities.
- Scotland's Net Zero energy system is continuously innovative and competitive in domestic and international markets.

The Proposed Development aims to support each of those goals.

4.3.3.7 Onshore Wind Policy Statement 2022

The Scottish Government published an updated version of the Onshore Wind Energy Statement[16] in December 2022; this document highlights that Scotland has approximately 8.4GW of installed capacity of onshore wind. The new target for 2030 is for 12GW of additional onshore wind deployment.

The Proposed Development would aid in the delivery of this target deployment.

4.4 Policy Context

4.4.1 Town and Country Planning (Scotland) Act 1997

The principal planning act, and the act under which this application will be determined, is the Town and Country Planning (Scotland) Act 1997[17] as amended.

Section 25 of the Planning Act 1997 requires that when: "*making any determination under the planning Acts, regard is to be had to the development plan, the determination is, unless material considerations indicate otherwise, to be made in accordance with that plan.*"

4.4.2 The Development Plan

The site is wholly within the Aberdeenshire Council area and therefore, the Development Plan relevant to the Proposed Development is the National Planning Framework 4 (NPF4), and the Aberdeenshire Council Local Development Plan[18]. The Development Plan was adopted prior to NPF4 therefore, where any contradictions exist between the two plans, NPF4 takes precedence as the latter document.

[15] Draft Energy Strategy and Just Transition Plan – Accessed 08/12/2023.
[16] Onshore Wind Policy Statement 2022 – Accessed 08/12/2023.
[17] Town and Country Planning (Scotland) Act 1997 – Accessed 08/12/2023.
[18] Aberdeenshire Local Development Plan 2023– Accessed 08/12/2023.

4.4.2.1 National Planning Framework 4

The fourth National Planning Framework (NPF4) was adopted by the Scottish Government on 13 February 2023; its adoption has superseded the National Planning Framework 3 and Scottish Planning Policy.

NPF4 brings together the long-term spatial strategy with national planning policies as part of the statutory Development Plan. NPF4 contains six overarching spatial principles, as below, that are key to achieving the goal of sustainable, liveable, and productive places:

- Just transition
- Conserving and recycling assets
- Local living
- Compact urban growth
- Rebalanced development
- Rural revitalisation

Policy 1 of NPF4 gives a clear direction by stating that significant weight should be given to tackling the climate and nature crises. This statement recognises the important role of NPF4 in achieving the ambitious targets for climate change and sets out the significant shifts in policies that are required to achieve net-zero emissions by 2045. This is further developed by Policy 2 which promotes climate mitigation and adaptation; polices 1, 2, and 3 (Biodiversity) are applicable to all development proposals.

NPF4 includes pertinent planning policies that should be taken into consideration as part of the assessment and determination processes. Subsequently, the below policies will be considered:

- Policy 1: Tackling the climate and nature crises
- Policy 2: Climate mitigation and adaptation
- Policy 3: Biodiversity
- Policy 4: Natural Places
- Policy 6: Forestry, woodland and trees
- Policy 7: Historic assets and places
- Policy 8: Green belts
- Policy 11: Energy
- Policy 22: Flood risk and water management
- Policy 23: Health and safety

4.4.2.2 Aberdeenshire Local Development Plan 2023

The Aberdeenshire Local Development Plan 2023, adopted in January 2023, has been developed to direct decision-making on all land-use planning matters and planning applications in Aberdeenshire; it sets out broad principles for development in the area. The spatial strategy within the plan highlights that Aberdeenshire is a diverse area that spans from the economically successful areas that provide homes and businesses around Aberdeen City, to areas of stunning character and natural beauty in the peripheral towns and countryside within Aberdeenshire.

The planning policies taken into consideration as part of the assessment process include:

- Policy R1 Development Proposals Elsewhere in the Countryside
- Policy P4: Hazardous and Potentially Polluting Developments and Contaminated Land

- Policy E1 Natural Heritage
- Policy E2 Landscape
- Policy E3 Forestry and Woodland
- Policy HE1 Protecting Listed Buildings, Scheduled Monuments and Archaeological Sites (including other historic buildings)
- Policy HE2 Protecting Historic, Cultural and Conservation Areas
- Policy PR1 Protecting Important Resources
- Policy C2 Renewable Energy
- Policy C4 Flooding

4.4.2.3 Aberdeenshire Council: Assessing Wind Energy Developments (AWED) – Planning Advice PA2023-21

Assessing Wind Energy Developments Planning Advice[19] accompanies the Aberdeenshire Local Development Plan and provides guidance on the principles that should be considered when locating, siting, and designing a wind energy development in the Aberdeenshire area. This guidance has been used to inform the EIA.

4.5 Conclusion

Planning Permission is sought from Aberdeenshire Council, as the determining authority, for the erection of 3 wind turbines as an extension of the existing Greenside Wind Farm under Section 28 of the Town and County Planning (Scotland) Act 1997, as amended.

This chapter has set out a summary of the Proposed Development in the context of the relevant regulatory and policy context. The supplementary Planning Statement provides a detailed assessment of the Development Plan and carries out an appraisal of whether the Proposed Development complies with the Development Plan and assesses other material considerations.

[19] Assessing Wind Energy Developments Planning Advice PA2023-21 – Accessed 08/12/2023.

5 Landscape and Visual Assessment

5.1 Introduction

The methodology for the Landscape and Visual Impact Assessment (LVIA) and the Cumulative Landscape and Visual Impact Assessment (CLVIA) has been undertaken in accordance with the methodology set out in Appendix 5.1 – LVIA Methodology and conforms with The Guidelines for the Landscape and Visual Impact Assessment, Third Edition (Landscape Institute and IEMA, 2013). The assessment process has encompassed the construction, operational and decommissioning phases of the wind turbine and has included the design, landscape and visual assessment (including cumulative) and assessment of residual effects.

The purpose of this assessment has been to determine the landscape and visual effects of the Proposed Development on the existing landscape visual resource. The following landscape and visual receptors have been assessed:

- Landscape Character, key characteristics and elements;
- Designated landscapes; and
- Views and visual amenity experience by residents, tourists, visitors and road users.

The Proposed Development is located low lying landscape directly south of Crimond in Aberdeenshire, as an extension to the already existing Greenside. The Proposed Development will comprise of three wind turbines, with a maximum tip height of 100m and 2.35MW generating capacity.

The extension would take the total number of turbines on site to seven. The assessment process has encompassed the construction, operation, and decommissioning of the Proposed Development and has included design parameters and further assessment of the residual effects. The process has sought to highest energy generation capacity for the site, whilst balancing this with environmental considerations and achieving an acceptable design in terms of landscape and visual effects.

This chapter is accompanied by:

- Appendix 5.1 – LVIA Methodology
- Appendix 5.2 – Viewpoint Assessment
- Landscape and Visual Impact Assessment Figures 5.1 to 5.11
    - Figure 5.1 – Study Area
    - Figure 5.2 – Cumulative Basemap
    - Figure 5.3 – Regional Landscape Character
    - Figure 5.4 – Local Landscape Character
    - Figure 5.5 - Local Landscape Character with 100m Tip ZTV
    - Figure 5.6 – Regional Landscape Designations
    - Figure 5.7 – Local Landscape Designations with 100m Tip ZTV
    - Figure 5.8 – 100m Tip ZTV
    - Figure 5.9 – 59m Hub ZTV
    - Figure 5.10 – Residential Amenity Basemap
    - Figure 5.11 – Route Assessment

- Landscape and Visual Impact Assessment Visualisation **Figures 5.12** to **5.24**

The aim of the design and assessment process is to promote the best "environmental fit" for the Proposed Development through consideration of the existing landscape resource, the potential landscape and visual effects and design alternatives. The assessment process will refer to landscape value, and in particular, landscape designations and related planning policy, as well as landscape character and capacity for an additional turbine development at this site.

5.2 Legislation, Policy and Guidance

5.2.1 Legislation

National legislation relating to landscape and visual includes:

- *Climate Change Act (Scotland)*, Scottish Government, 2009; and
- *The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations*, Scottish Government, 2017.

5.2.2 Policy

National and local policy relating to landscape and visual includes:

- *Policy Statement No. 05/01 – Landscape Policy Framework*, Scottish Natural Heritage, December 2005;
- *Policy E2 – Landscape*, Aberdeenshire Local Development Plan, Aberdeenshire Council, 2017; and
- *Policy C2 – Renewable Energy*, Aberdeenshire Local Development Plan, Aberdeenshire Council, 2017.

5.2.3 Guidance

National and local guidance relating to landscape and visual includes:

- *Landscape Character Assessment: Guidance for England and Scotland* (Countryside Agency and Scottish Natural Heritage publication, produced by the University of Sheffield and Landuse Consultants), 2002;
- *Landscape Character Assessment: Banff and Buchan*, Cobham Resource Consultants, 1997;
- *South and Central Aberdeenshire: Landscape Character Assessment,* Scottish Natural Heritage, 1998;
- *Landscape Character Assessment Topic Paper 6 - Techniques and Criteria for Judging Capacity and Sensitivity*, Countryside Agency and Scottish Natural Heritage, 2015;
- *Siting and Designing Wind Farms in the Landscape*, Scottish Natural Heritage, Version 3a, August 2017;
- *Visual Representation of Wind Farms,* Scottish Natural Heritage, February 2017;
- *Visual Representation of Wind Farms Good Practice Guidance,* prepared by Horner + Maclennan and Envision for Scottish Natural Heritage, The Scottish Renewables Forum and the Scottish Society of Directors of Planning, March 2006;
- *Photography and Photomontage in Landscape and Visual Assessment*, Landscape Institute Advice Note 01/2011, 2011;
- *Guidance: Cumulative Impacts of Onshore Wind Developments*, Scottish Natural Heritage Advisory Service, Version 3, March 2012;
- *Assessing the Cumulative Impacts of Onshore Wind Energy Developments*, Scottish Natural Heritage, Version 3, March 2012;
- *Aberdeenshire Local Landscape Designation Review,* LUC and Aberdeenshire Council, March 2016;

- *Aberdeenshire Special Landscape Areas,* Aberdeenshire Local Development Plan Supplementary Guidance, Aberdeenshire Council, April 2017; and
- *Strategic Landscape Assessment for Wind Energy in Aberdeenshire,* Ironside Farrar, March 2014.
- Residential Visual Amenity Assessment (RVAA) Technical Guidance Note, Landscape Institute, 2019.

5.3 Scope of Assessment

The scope of the assessment has been established on the basis of professional judgement and is set out in **Table 5.1**

Table 5.1 - Scope of the Landscape and Visual Impact Assessment

Landscape Issues	Description
Landscape Character	The effects of the Proposed Development on the landscape character and quality of the site area, as defined by the Aberdeenshire Landscape Character Assessment and site survey.
Landscape Elements	Direct or physical effects on any landscape elements which characterise the area.
Landscape Designations	Views from any designated landscape including National Scenic Areas (NSA), Special Landscape Areas (SLA), or Gardens and Designed Landscapes (GDL). Views from other areas of landscape character as perceived by people.
Visual Issues	**Description**
Local Community	Views from the local rural community, particularly from residential properties near the site and from local settlements which lie within the ZTV. Views from roads and popular tourist/walker destinations and hilltops will also be taken into consideration.
Tourist Destinations	Views from popular outdoor tourist destinations which entail an appreciation of the landscape, and the setting of features and visitor experience.
Major Transport Routes	Transport routes including the A90 as well as any popular walking routes in the area.
Cumulative Issues	**Description**
Cumulative Assessment	The cumulative assessment includes viewpoint assessment within the study area where simultaneous and/or successive views of more than one wind energy development may be achieved, and sequential cumulative assessment, where more than one wind energy development may be viewed along transport routes (simultaneous or successive).

5.3.1 Viewpoint Selection

The final list was borne out of professional experience. Table 5.2 below provides a summary of the viewpoint locations and rationale for their selection. The selected viewpoints offer views from near, middle and distant locations as well as views from the north, south, east and west. Ten locations in total have been photographed and photomontages have been produced across the study area. These locations represent a number of different receptors, viewing directions and distances. As far as possible, viewpoints have been selected to represent the Proposed Development at its most visible.

Viewpoint	Reason for Initial Selection	Distance
1. Longhill Farm	The view represents users of the road to Longhill Farm.	0.8km
2. Overside Farm	The view represents the residents of Overside Farm.	0.9km
3. Tillyduff	The view represents the residents of Tillyduff and Greenwellheads.	0.3km
4. Crimond	The view represents the residents of Crimond.	1.3km
5. Loch of Strathbeg	The view represents the vistors to the Loch of Strathbeg nature reserve and visitor centre.	2.7km
6. Kirkton of St Fergus	The view represents the residents of Kirkton of St Fergus.	4.0km
7. A90-A952 Junction	The view represents the users of the A90 and A952 southbound.	6.8km
8. Formartine and Buchan Way	The view represents the users of the Formartine and Buchan Way.	5.8km
9. Longside	The view represents the residents of Londside.	8.3km
10. Stirlinghill by Peterhead	The view represents the recreational users of Stirlinghill at Peterhead.	15.1km
11. Inverallochy	The view represents the residents of Inverallochy and users of the B9107.	9.7km
12. Mormond Hill	The view represents the recreational users of Mormond Hill.	7.8km
13. Culsh Monument	The view represents visitors to the Culsh Monument.	19.1km

5.3.2 LVIA Study Area

An overall study area of 30km radius from the Proposed Development has been established following NatureScot Guidance. This study area is illustrated in **Figure 5.1.** In addition to this, a 30km study area for the cumulative assessment was initially investigated. The focus of the assessment will be on all schemes within 15km of the Proposed Development.

5.3.3 Cumulative Assessment

Drawing from NatureScot guidance, a cumulative baseline of all operational and consented wind energy developments and other planning applications for wind energy developments within a 30km study area has been created. All turbines above 50m within 15km of the development site are included. Wind farms over 15km away are unlikely to give rise to significant cumulative effects. In accordance with the NatureScot guidance, projects at or up to the scoping stage have not been included. All other wind energy developments included in the assessment are listed and illustrated in **Figure 5.2.**

The most relevant wind energy developments to the CLVIA include those sites within 15km of the Proposed Development. These developments will be included on any wirelines.

5.4 Landscape Design Considerations

5.4.1 Project Description

The Proposed Development would include the construction of three turbines in the Eastern Coastal Agricultural Plain Landscape Character Area (LCA) within the Coastal Agricultural Plain Landscape Character Type (LCT). According to the *'Strategic Landscape Capacity Assessment for Wind Energy Aberdeenshire'* 2014, the landscape is described as being:

> *"This area is characterised by its gently undulating landform, relatively large scale, extensive mosses and the influence of development including transmission masts, electricity transmission lines, the A90 & A953, the gas terminal at St Fergus. It is the backdrop to the larger coastal towns of Peterhead and Fraserburgh, although large areas of these towns do not have clear views of this LCA as they face out towards the North Sea. It is visually sensitive due to its proximity to roads. Mormond Hill is a distinctive local landmark hill."*

According to the '*Strategic Landscape Capacity Assessment for Wind Enery in Aberdeenshire'* 2014, the area has a medium capacity for large wind turbines due to its scale, landform, broad extent, simple pattern and open character. The guidance however does state that "*The areas around Mormond Hill and St Fergus Moss are already Wind Turbine Landscapes and over their underlying capacity."*

There are currently four turbines that make up the existing Greenside Wind Farm, with a maximum tip height of 100m. These turbines fit into the existing character and scale. The Proposed Development would be situated approximately 470m north of the existing Greenside Wind Farm at its closest point.

5.4.2 Design Objectives

NatureScots' guidance '*Siting and Designing Wind Farms in the Landscape'* has been used to inform the layout and design of the scheme and the final development will be in accordance with its key principles.

Scale – Turbine size and location has been chosen at a maximum of 100m to be in scale with the existing turbines at this location. Adding the additional turbines would likely impact the horizontal scale due to increasing the spread of turbines from some locations. The vertical scale will be unchanged due to the similar blade tip height however Greenside Extension may appear taller when viewed from the north and in close proximity.

Skylines – The design is such that the proposed turbine would affect the same section of the skyline already characterised the existing Greenside wind turbines. The linear design means that the skyline is not dominated by these additional turbines.

Aesthetics – The additional turbines would slightly alter the aesthetics of the current four turbine scheme. However, design and positioning means less chance of overlapping and less visual clutter on the skyline.

5.4.3 Layout Design

The proposed location has been chosen as it is considered to represent the best compromise between technical and environmental considerations within the land ownership boundary. The design, in terms of turbine position and height, was developed to limit the development's visibility over the local receptors including residents and appear in scale with the surrounding landscape and existing turbine development. A number of different layouts and turbine numbers were considered. The layout has been designed to fit into the landscape without causing visual confusion.

5.4.4 Turbine Selection

The LVIA has been assessed on the basis of a maximum tip height of 100m. Other design considerations include the following:

- A modern turbine will be used that has a simple and balanced appearance with the three blades and a tapered, non-lattice tower: and
- The turbine will be semi-matt and pale grey in colour to reduce its contrast with the background sky under most weather conditions.

5.4.5 Construction Activities

Temporary landscape and visual effects would occur during the construction period, and would result from the visibility of construction activity, use of laydown areas, and site compound. The landscape and visual effects would be of a low and negligible magnitude of change and not significant. The lay down areas and compound would be located adjacent to the proposed turbine locations. During the construction period the landscape and visual effects would be significant for a small number of receptors in the local areas. This is due to the movement and contrast of workers and machinery in this area. These effects would be temporary and fully restored upon completion.

All disturbed areas resulting from construction (around turbine base and temporary onsite compound) will be restored upon completion of the construction period. Specific mitigation measures necessary during construction would include:

- Land clearance and occupation will be limited to the minimum necessary for the works;
- Vegetation removal will be minimised as far as possible; and
- Valued features, such as historic features and field boundaries will be protected. Temporary fencing will be used to define such areas to avoid accidental damage.

5.5 Assessment of Landscape Effects

The methodology for the Landscape Assessment has been undertaken in accordance with the methodology set out in **Appendix 5.1** and conforms with *The Guidelines for Landscape and Visual Impact Assessment,* Third Edition (Landscape Institute and IEMA, 2013).

5.5.1 Landscape Baseline

Information on the existing landscape and visual resource has been collected by reference to Local Plans, OS maps and relevant literature, including the Aberdeenshire Landscape Character Assessment as well as information gathered from field surveys.

5.5.2 Broad Landscape Context

The Study Area (**Figure 5.1**) for the Proposed Development comprises of Aberdeenshire Banff and Buchan Landscape Character Assessment and Aberdeen South and Central Landscape Character Assessment areas.

The Aberdeenshire Banff and Buchan Landscape Character Assessment area covers the landscapes of the Banff and Buchan area of Aberdeenshire from the Bay of Cruden in the south to the coastline in the north and from the Moray council border in the west to the coast in the east. The majority of this landscape is low-lying coastal and agricultural land with scatter small settlements. It is characterised by expansive views and impressive coastline.

The Aberdeenshire South and Central area covers the landscapes of the central and southern areas of the Aberdeenshire council area, covering the area surrounding the City of Aberdeen and down to the Angus council border. The majority of this landscape is agricultural in nature with some areas of settlement and industry and more natural and upland landscape to the west.

5.5.3 Regional Landscape

The Proposed Development is situated within the Banff and Buchan Regional Landscape Area as identified by NatureScot in their 'Landscapes of Scotland' document. A brief description is offerd by NatureScot:

> *"An area of low-lying and rolling coastline and farmland with a strong sense of exposure and openness to the changing sky. There are wide views to distant hills and mountains. Mormond Hill, with its telecom masts and the White Horse, is an important local landmark. There are few trees,*

although clusters of mature woodland on small knolls punctuate the open landscape. Drystone dykes edge the fields. Prehistoric settlement and funerary monuments are visible throughout. Small villages are located near rivers, and large farmsteads are widespread. Several fishing villages huddle at the foot of cliffs, the houses set gable ends to the sea. The ports of Peterhead and Fraserburgh are larger and more formal. Remains of the Rattray Line along the coast bear witness to the area's strategic importance during WWII."

5.5.4 Key Landscape Character Types/Areas within the Study Area

While the Banff and Buchan landscape is a wider regional area, locally, the Proposed Development site is located within the Eastern Coastal Agricultural Plain LCA, which covers an area of Aberdeenshire from the southern boundary of Fraserburgh in the north, to Cruden Bay in the south, the western boundary of Peterhead to the east, and Mintlaw and Mormond Hill to the west.

In addition to this landscape there are also a number of other LCAs that are included within the study area **(Figure 5.1). Table 5.2** summarises the landscape character areas that are situated within the study area and have potential visibility. Those landscapes beyond 15km and those without visibility of the Proposed Development have been scoped out of the assessment as the turbines are unlikely to cause significant effects on their character.

Table 5.2 - Key Characteristics of Landscape Character Types/Areas

Name	Key Characteristics
Aberdeenshire Banff and Buchan Landscape Character Assessment	
Eastern Coastal Agricultural Plain	Low-lying and very gently undulating landform, with a pattern of subtle ridges and valleys in the north-east. Mormond Hill is a prominent feature in the western edge of the area, which features the only White Horse and White Stag quartz hillside figures in Scotland. Broad shallow valleys often feature water courses, with coniferous forest in the south. Limited broadleaf woodland, forming rare shelterbelts and small groups around farms. The area features mainly arable farming comprising of large, open, geometric fields, with fairly extensive areas of moss and wetland. Consistent views of high coastal dunes and sea, giving a strong coastal context.
Cliffs of the North and South-east Coasts	This is an area of high headlands, sheer cliffs, occasional narrow inlets and sheltered bays along this rocky coastline. Small distinctive coastal settlements such as Pennan and Crovie are huddled at the base of cliffs, together with the larger settlements of Peterhead and Fraserburgh. The farmland stretches to the edges of the cliffs with a very simple pattern of fields. Field boundaries are limited to low gorse hedges and there are few trees, the areas being open and windswept. This part of the Coast is more elevated and exposed than the dune areas with expansive views from the north across the Moray Firth and mountains beyond.
Dunes and Beaches from Fraserburgh to Peterhead	The extensive dunes have wide beaches, dynamic dune systems, open views and the absence of tree cover. It forms one of the longest stretches of beach in Europe. The farmland inland merges into coastal grasslands and sandy shorelines. They alternate with stretches low cliffs and with coastal settlements. The RSPB reserve at the Loch of Strathbeg is the largest dune lake in Britain. With few vertical features the chimneys of the massive St Fergus Gas Terminal, act as foci and are visible for miles along this stretch of coast.
Agricultural Heartland	This LCA is characterised by a gently rolling landform, but with steeper ground in some places mainly along river valleys, it forms a broad plain with open views. It has large arable fields, with post and wire fences and scattered broadleaved shelterbelts running along ridges and around farms. Moorland occurs in pockets around New Pitsligo and large conifer plantations in the north of the area. There are no large towns but there are a number of villages such as New Deer, Cuminestown and Strichen.

North-east Coastal Farmland	A transition area between the higher sandstone ridges of Troup and *the Eastern Coastal Agricultural Plain* it forms the backdrop to Fraserburgh although the settlement itself is orientated towards the sea. Close to the coast are large arable fields but this gives way on higher ground to poorer quality moorland where blocks of coniferous woodland have eroded the character.
Wooded Estates around New Deer	The river valley of the South Ugie Water lies at its centre but the river is not more than a stream and is visually insignificant. Woodland is unusually for this part of the district the dominant feature. The old policy woodlands around the estates of Aden and Pitfour create an enclosed sheltered character, with coniferous and broadleaves woodland well laid out along ridge lines, valley bottoms and slopes. It is a well-settled area with a number of planned villages such as Mintlaw, numerous farmsteads and Manses. Well managed it has high integrity in places and provides a setting for Deer Abbey and a Country Park.

5.5.5 Land Use and Land Use Change

This local area of this section of the Eastern Coastal Agricultural Plain is mainly flat with large arable fields separated by post-and-wire fences. The site is located on the northern edge of St Fergus Moss. There are several working farms surrounding the site and therefore there are several vehicles using the tracks surrounding, creating a sense of busyness and movement.

5.5.6 Coastal Agricultural Plain Landscape Character Type

The site is located within the Coastal Agricultural Plain Landscape Character Type. The LCT is described by NatureScot as:

> *"The Coastal Agricultural Plain is an extensive Landscape Character Type comprising a lowlying and often very open sweep of exposed farmland in eastern Aberdeenshire where the influence of the sea is particularly strong. It is characterised by its gently undulating landform, relatively large scale, extensive mosses and the influence of development including transmission masts, electricity transmission lines, the A90 and A953, and the gas terminal at St Fergus on its eastern edge. The transition between the Beaches Dunes and Links Landscape Character Type in the east and the hinterland formed by this landscape is very gradual."*

5.5.7 Landscape Planning Designations

The study area for the Proposed Development covers an area of the Aberdeenshire Council Area. The local development plan contains policies which seek to protect landscape resources, and although there are no designations on the site itself, there are designated landscapes within the study area that are relevant to this assessment. The key landscape planning designations are illustrated in Figure 5.6.

Landscape planning designations and policies are considered in the determination of the sensitivity of landscape and visual receptors as they provide an indication of value ascribed to the landscape or visual resource.

The assessment will consider those designated landscapes located within 15km of the Proposed Development. Those designated landscapes that overlap the ZTV (and may have potential views of the Proposed Development) have been considered as part of this assessment and are listed in Table 5.3. Planning policies and designated landscapes outwith the ZTV have been scoped out of the assessment.

Table 5.3 - Landscape Planning Designations

Designation	Description
Aberdeenshire Special Landscape Area (SLA)	North East Aberdeenshire Coast SLA is located to the east, north and south of the Proposed Development. The designation covers the area from Fraserburgh, along the coast to the south past

	Rattray Head to Peterhead. The designation is located 0.8km from the Proposed Development at the nearest point. The designation is covered under **Policy E2** in the Aberdeenshire Local Development Plan.
Gardens and Designed Landscapes (GDL)	There are two GDLs within 15km of the Proposed Development. Both have predicted theoretical visibility. These are covered by **Policy HE2** of the Aberdeenshire Local Development Plan. It is unlikely any GDLs beyond 15km will be affected and have been scoped out. Those included in the assessment are: **Crimonmogate;** located 2.9km north-west of the Proposed Development. **Cairness;** located 5.3km north-west of the Proposed Development.

5.5.8 Assessment of Predicted Landscape Effects

Landscape effects are determined by the Landscape Institute as "Change in the elements, characteristic, charact, and qualities of the landscape as a result of development." These effects are assessed by considering the landscape sensitivity against the magnitude of change. A matric is used to guide the evaluation or level of effect as illustrated in **Appendix 5.1** – LVIA Methodology**.** The type of effect may also be described as temporary or long-term/permanent, direct of indirect, cumulative and negative, neutral or negative.

5.5.9 Potential Operational Effects on Local Landscape Fabric

Changes to landscape fabric can occur where there would be direct or indirect physical changes to the landscape. In this instance, direct changes to the landscape fabric would only occur within the development boundary.

The landscape has been assessed to be of **medium** sensitivity.

Magnitude of Change

During operation, the proposed Greenside Extension would occupy and directly effect a minor extent of the local landscape character. This would result in the loss of an area of an area of agricultural land and some commercial forestry.

The local landscape is medium to large in scale with a landcover shared by agricultural use, commercial forestry and mosses. The area is simple, and generally open in character, with the slopes of Mormond Hill rising up from the low-lying landscape to the west of the site. The landscape has numerous roads and farmsteads such as the A952 to the west and the A90 that runs east of the site in a north/south direction. The proposed extension turbines would fit well into this landscape as it maintains a similar scale to the existing operational turbines and will be positioned within a similar section of the landscape. The addition of these turbines would have little impact on the local landscape given that the current character is influenced by the eight operational turbines in the immediate area. The addition of three turbines to the area would not cause changes in the perceived landscape, nor would it overwhelm the character to the point where turbines dominate the landscape due to the scale, form and landcover being large and simple enough to accommodate the extension turbines.

The magnitude of change is considered to be low, resulting in in a **moderate/minor** level of effect that is not significant.

5.5.10 Potential Operational Effects on the Eastern Coastal Agricultural Plain Landscape Character Area

This area of the landscape occupies a larger area inland, west of Peterhead in Aberdeenshire. Much of the landscape is occupied by rolling fields and extensive mosses in a gently undulating landform, with signs of development throughout. The condition/quality of the landscape is generally medium.

In terms of landscape value within the study area, a small area of the LCA is situated within the North East Aberdeenshire Coast Special Landscape Area. This area is minute in comparison to the size of the LCA, and the

Strategic Landscape Assessment for Wind Energy in Aberdeenshire, 2014 states that the area is considered to be medium/low.

The overall sensitivity of the landscape unit is considered to **medium**, which is in line with the value assigned by the *Strategic Landscape Capacity Assessment for Wind Energy in Aberdeenshire*, 2014.

Magnitude of Change

During operation, the Proposed Development would occupy and directly affect a minor area of the LCA, however it may be visible from across the character area indirectly affecting its character. When viewed from within the area or from the immediate surrounding area, the turbines would be a notable feature, however these impacts would be mitigated by the presence of the existing Greenside turbines. **Viewpoints 2** and **3** illustrate the impacts of the Proposed Development from the east looking west, with the sensitive St Fergus Moss and Mormond Hill behind the turbines. The proposed turbines fit well into the existing pattern of turbines by maintaining a linear layout and being of similar scale. There is minimal increase in spread across the landscape from the southeast and northwest directions. These factors mitigate the impacts on the LCA, allowing the turbine to be accommodated in the landscape with minimal fuss. Its addition does not create any sense of clutter in the landscape and the combined scale of the Proposed Development when seen along with the operational turbines does not overwhelm the landscape.

The ZTV indicates that there would be visibility across much of the LCA. This is due to the low rolling topography across the area with only a few areas of elevated landscape preventing views.

The magnitude of change on the Eastern Coastal Agricultural Plain would be low, resulting in a **moderate/minor** level of effect.

5.5.11 Indirect Effects on Neighbouring Landscape Character Areas

Neighbouring areas of landscape character are formed by beaches, dunes and links, cliffs and rocky coast, coastal farmland with ridges and valleys, undulating agricultural heartland and farmland and wooded policies.

None of these areas would be directly affected by the Proposed Development and there would be no direct effects on the key physical characteristics that form the areas landscape character or their quality and integrity. However, parts of the Proposed Development may be visible from these areas and as such, could indirectly affect the landscape character where particular views or scenic qualities are noted as a key characteristic of the landscape. Alternatively, the Proposed Development could be frequently visible and particularly prominent in the landscape such that the addition of these new features affects the character of the area.

Owing to the likelihood of effects on landscape character areas dramatically diminishing beyond 15km, those LCTs lying beyond 15km of the Proposed Development have been scoped out of the final assessment due to lack of visibility and distance. An assessment of those inside 15km with visibility predicted are assessed in **Table 5.4** below.

Table 5.4 - Aberdeenshire Banff and Buchan Landscape Character Area Assessment

Aberdeenshire Banff and Buchan Landscape Character Area Assessment	
Dunes and Beaches from Fraserburgh to Peterhead LCA	This LCA follows the coast from Fraserburgh south to Peterhead. Much of this area is covered by the North East Aberdeenshire Coast SLA due to its high scenic qualities. The ZTV shows visibility across much of the LCA, however this gradually diminishes toward the built-up areas of Fraserburgh and Peterhead. This area of coastline has few areas of woodland, and therefore is an exposed landscape, with man-made features present throughout, particularly St Fergus Gas Terminal. **Viewpoint 11** has been selected to represent views from within this character type. When the turbines are seen, they appear on the horizon beyond farmland and agriculture alongside the existing Greenside turbines. While these views look over the Eastern Coastal Agricultural Plain, the impact would not be sufficient

	to have detrimental impacts on the character, setting or scale of the landscape, or its important relationship with the coast, as the Proposed Development would be inland from the LCA. The landscape character is considered to be of medium/high sensitivity. Overall, the magnitude of change would be low, and the overall level of effect would be **moderate**.
Cliffs of the North and South-East Coasts LCA	This LCA is a small strip of coastline running south from Peterhead to the village of Whinnyfold. This LCA also appears to the north of Aberdeenshire. A small area of this LCA is within 15km of the Proposed Development, and occupies the area around Boddam and Stirling Hill. **Viewpoint 10** has been selected to represent this LCA and the recreational users of Stirling Hill. The turbines would appear as minor features in the landscape amongst the existing Greenside turbines and would be indistinct from these. When seen in conjunction with views over the Eastern Coastal Agricultural Plain, the presence of the turbines in the distance would not have detrimental impacts over the character of either that LCA or the Cliffs of the North and South-East Coasts LCA, whose association to the coast is unaffected. The landscape character is considered to be of high sensitivity. Overall, the magnitude of change would be negligible, resulting in a **minor** level of effect.
Wooded Estates around Old Deer LCA	This LCA occupies a large area to the south-west of the Proposed Development. The ZTV indicates visibility is intermittent here, as the river valley of the South Ugie Water passes through, and the terrain provides some screening. It is likely that from this LCA, visibility would be further screened due to abundance of tree cover. When viewed from this LCA, it is likely that the turbines would be visible at a distance and amongst the existing Greenside turbines which they are indistinguishable. The landscape character is considered to be of medium/high sensitivity. Overall, the magnitude of change would be low, resulting a **moderate** level of effect.
Agricultural Heartland LCA	This LCA occupies a large section of the study area approximately to the west, with intermittent visibility across the areas of higher ground. Given its undulating form, visibility is not consistent and is often partially screened by topography. When visible, the turbines would be seen on the open landscape of the Eastern Coastal Agricultural Plain amongst the existing Greenside turbines, and have only a limited impact given the baseline views and the scale and quality of the LCA The landscape character is considered to be of a medium sensitivity. Overall, the magnitude of change would be low, and the overall level of effect would be **moderate/minor**.
North-East Coastal Farmland LCA	The LCA is situated to the north-east, with visibility focused in the north of the section of the study area. Visibility diminishes when the topography drops away within valleys for rivers and burns e.g. Burn of Marno. Patches of conifer and mixed woodland may further diminish views within this LCA. The landscape character is considered to be of medium low sensitivity. Overall, the magnitude of change would be low, resulting in a **moderate/minor** level of effect.
The LCTs that have either no, or highly limited visibility predicted by the ZTV or located beyond 15km distance have been scoped out of the final assessment.	

5.5.12 Effects on Landscape Designations

The site itself is not designated and as such, there would be no direct effects on designated landscape areas. Any landscape effects therefore would be limited to indirect effects on the views and visual character experienced from within these areas, whilst viewing towards the wind turbines. The assessment below considers if these effects on the views would lead to an indirect effect on either the landscape character or valued features and characteristics for which these areas are designated. The assessment of the overall indirect effects experienced by people viewing the wind turbine from designated landscape and the development's impact on the setting and

character of any designated landscape areas is provided in **Table 5.5.** The sensitivity of all designated landscapes considered as part of this assessment has been considered as high.

Table 5.5 - Aberdeenshire Landscape Designation Assessment

Aberdeenshire Landscape Designations	
North East Aberdeenshire Coast SLA	The North East Aberdeenshire Coast SLA is situated on the coast between Fraserburgh and Peterhead. The ZTV indicates visibility throughout the designation, with only small patches with no visibility as the topography dips away. **Viewpoints 5** and **11** represent views from within the SLA. When the turbines are seen from **Viewpoints 5**, the turbines are visible amongst the operational Greenside turbines, and while they appear to increase the horizontal spread, they are well screened by intervening woodland, which would be a common experience when viewing inland from the SLA, with shelterbelts and plantations positioned along the western boundary of the SLA. The scale of the development is not enough to overwhelm the landscape within the SLA, as the view is directed inland and not along the scenic coastline or out to sea. Viewpoint 11 has screened views of the Proposed Development due to vegetation and distance and the turbines are indistinct from the existing Greenside turbines. Due to the designation recognising the rugged scenery, coastal cliffs and raised beach features, it is likely that the viewer would be facing the eastern direction toward the coast, and rarely inland to experience these features. As such, the Proposed Development has little impact on their appreciation. The landscape designation is considered to be of high sensitivity. Overall, the magnitude of change would be low, and the overall level of effect would be **moderate.**
Crimonmogate GDL	Crimonmogate GDL is situated to the north-west of the Proposed Development. The ZTV indicates near complete visibility from within the GDL, however the area is also heavily wooded, so real world visibility is likely to be considerably less. The views both from and of Crimonmogate House are unlikely to experience any visual impacts as a result of the Proposed Development due to this vegetation screening. The landscape designation is considered to be of high sensitivity. Overall, the magnitude of change would be negligible, and the overall level of effect would be **moderate/minor.**
Cairness GDL	Cairness GDL is situated to the north-west of the Proposed Development and is where Cairness House is located. The ZTV indicates strong visibility within the GDL, however heavy vegetation to the south and east of the site mean that views will be difficult to achieve. This impact would be minor and have little impact on Cairness House and its scenic value. The landscape designation is considered to be of a high sensitivity. Overall, the magnitude of change would be negligible, and the overall level of effect would be **moderate/minor**.
The Landscape Designations that have either no, or highly limited visibility predicted by the ZTV or located beyond 15km distance have been scoped out of the final assessment.	

5.6 Assessment of Visual Impacts

Visual effects are recognised by the Landscape Institute as a subset of landscape effects and are concerned wholly with the effect of the Proposed Development on views, and the general visual amenity. The methodology for the Visual Assessment has been undertaken in accordance with the methodology set out in **Appendix 5.1** – LVIA Methodologyand conforms with *The Guidelines for Landscape and Visual Impact Assessment,* Third Edition (Landscape Institute and IEMA, 2013).

5.6.1 Visual Baseline and Receptors

Visual receptors would include anyone who may have visibility of the turbines, such as people who may work in the area, residents or tourists. Table 5.6 below identifies all visual receptors that were considered as part of the assessment.

Table 5.6 - Key Visual Receptors

Designation	Description
Settlements	Settlements within the ZTV that will be assessed include Crimond, St Fergus and Inverallochy. Photomontages have been produced for a number of these settlements. Settlements outwith 15km are unlikely to experience major visual effects.
Road Users	The visual impact of road users in the area will be considered.
Recreational	Recreational receptors in the area mostly refer to visitors to historical sites and those partaking in outdoor pursuits such as walking, cycling and horse riding,

5.6.2 Broad Visual Context

The overall visual character of the landscape is largely agricultural in nature due to the patchwork of fields and scattering of farmsteads which occupies the majority of the surrounding landscape. There are a few areas of plantation forestry, however the area is dominated by fields separated by stone walls or post-and-wire fencing and St Fergus Moss to the south. The A90 and the A952 are the only major roads in the area, with most others being B roads or unclassified. The existing Greenside turbines along with other turbines in the local area add to the man-made features that have influence over the existing views from the area and characterise the landscape across this part of Aberdeenshire.

5.6.3 Weather Conditions

Changing weather patterns and local climatic conditions will influence the visibility of the wind turbines in terms of the extent of the view, the colour and the contrast of the turbines as well as the visibility and thus the perceived visual impact. There will be periods of low visibility (fog, low cloud, and bright sunny conditions that are accompanied by haze generated by temperature inversions) as well as periods of high visibility in clear weather. In some instances, and from some locations the wind turbines may be 'back-lit' (e.g. appearing darker in colour during sunset/sunrise and periods or pale or white blanket cloud) and in other circumstances may appear to be 'up-lit' (e.g. during stormy periods that combine dark clouds and bright sunshine). The assessment has been conducted for periods of fine weather and assumes good visibility and limited seasonal leaf cover.

5.6.4 Visual Effects During Operation

Post construction and during operation, the appearance of the Proposed Development would recover a calmer visual character with negligible levels of maintenance activity visible on site from the visual receptors, and no significant visual effects likely. Visibility of the turbines would extend over the study area affecting a range of visual receptors including residents, road users, tourists, and people undertaking recreational activity. The visual effects of the proposed wind turbines on views and visual amenity during operation are assessed in the following sections.

5.6.5 ZTV and Visual Receptors

Blade tip and hub height ZTVs are illustrated in Figure 5.8 and 5.9 and indicates the maximum potential visibility of the proposed wind turbines, assuming there are no trees, woodland or buildings in the area (i.e. a bare Earth scenario). It is likely that this visibility would be reduced further by the screening effect of trees, woodland buildings on the ground, particularly in relation to settlements. The key visual effects to be addressed include the following:

- Visual effects on the views experienced by local communities;
- Visual effects on the views experienced by users of footpaths and general recreational areas/tourist destinations; and
- Visual effects on the views experienced by road users in the area.

5.6.6 Viewpoint Analysis

An analysis has been undertaken for each of the viewpoints. The viewpoints are contained in the **Landscape & Visual Assessment Figures – Figures 5.12** to **5.24** and the analysis is summarised in **Table 5.7** below and detailed in **Appendix 5.2** – Viewpoint Assessment

Table 5.7 - Viewpoint Analysis

Viewpoint	Sensitivity	Magnitude	Overall Impact	Distance from Development
1. Longhill Farm	Medium	Medium	Moderate	0.8km
2. Overside Farm	Medium	Medium	Moderate	0.8km
3. Tillyduff	High	Medium	Major/Moderate	0.3km
4. Crimond	High	Low	Moderate	1.3km
5. Loch of Strathbeg	High	Low	Moderate	2.7km
6. Kirkton of St Fergus	High	Low	Moderate	4.0km
7. A90-A952 Junction	Medium	Low	Moderate	6.8km
8. Formartine and Buchan Way	High	Low	Moderate	5.8km
9. Longside	High	Negligible	Moderate/Minor	8.3km
10. Stirlinghill by Peterhead	High	Negligible	Moderate/Minor	15.1km
11. Inverallochy	High	Low	Moderate	9.7km
12. Mormond Hill	High	Low	Moderate	9.8km
13. Culsh Monument	High	Negligible	Moderate/Minor	19.1km

5.6.7 Residential Amenity Assessment

The guidance provided in the *Residential Visual Amenity Assessment (RVAA) Technical Guidance Note*, Landscape Institute, 2019, was also used to form the basis of the residential amenity assessment. The assessment covers properties within 2km of the Proposed Development in **Figure 5.10** and **Table 5.8** below:

Table 5.8 - Residential Amenity Assessment

Residential Property	Distance from Turbine	Description
Tophead	672m	Tophead is a two-storey property situated to the east of the Proposed Development and is accessed by a minor road from the A90. There are several large farm buildings located to the north and east of the dwelling. **Distance:** The Proposed Development would be situated 672m from the Proposed Development.

Residential Property	Distance from Turbine	Description
		Type: The existing view towards the development site looks across a scene of gently rolling agricultural land of a uniform character and large scale. It is occupied by the four existing Greenside turbines, which are notable features of the view. **Direction:** The primary views from this property are to the south, with some secondary views to the west toward the Proposed Development. The primary views are over a small garden space with trees. The secondary views are over an unrestricted area of flat ground, with views leading to the fields. **Extent:** Theoretically the Proposed Development would occupy a moderate extent of the horizontal view and a major extent of the vertical view. Although the Greenside Extension being seen in conjunction with the existing Greenside turbines, the Proposed Development will add to the horizontal extent of the wind farm. **Scale of Change:** The Proposed Development would appear prominent in the landscape at this location. Due to the open views to the west from the dwelling, the turbines would be visible in their entirety. These impacts will also be felt on the access to the property from the track which joins the A90. **Degree of Contrast:** Current views are heavily characterised by the existing turbines which spread across the landscape. As such, there would be little contrast to the baseline. **Mitigation:** There is no mitigation in place currently. The properties are considered to be of high sensitivity. Overall, the magnitude of change would be high, and the overall level of effect would be **major**, direct, negative, reversible. Despite being major, the presence of the Proposed Development would not breach any visual amenity thresholds.
Tillyduff	744m	Tillyduff consists of two properties to the north of the Proposed Development and is accessed by a minor road from the A90. **Distance:** The closest property to the Proposed Development would be situated 744m from the turbines. The second and farthest property would be 797m from the Proposed Development. **Type:** The existing view in the direction of the proposed development site is heavily restricted from both properties by mature woodland on the southern side of each. Beyond this woodland, the topography rises up to create a small rounded ridge which partially screens views of the existing turbines, although all turbines would visible to some extent if not for the woodland. **Direction:** The two properties are located one behind the other when looking north from the Proposed Development. The property closest to the Proposed Development has primary views to the south and west. Views to the south appear to be partially screened by hedge vegetation. Views to the west are to a large garden area. The second property appears to have views in all directions however is screened by large trees and other vegetations aside from to the east, where the road passes. **Extent:** Theoretically the Proposed Development would occupy a major extent of the horizontal view and a major extent of the vertical view. Although the Greenside Extension is seen in conjunction with the existing Greenside turbines, the Proposed Development will add to the horizontal extent of the wind farm. **Scale of Change:** The Proposed Development would appear prominent in the landscape at this location. Views to the south of the dwellings may be partially screened by vegetation, however the proximity to the Proposed Development may result in views above the vegetation. These impacts will also be felt on the access to the property from the track which joins the A90. **Degree of Contrast:** Current views are heavily characterised by the existing turbines which spread across the landscape. As such, there would be little contrast to the baseline. **Mitigation:** Some mitigation is provided by the mature woodland on the southern edges of the properties.

Residential Property	Distance from Turbine	Description
		The properties are considered to be of high sensitivity. Overall, the magnitude of change would be low, and the overall level of effect would be **moderate**, direct, negative, reversible.
Keyhead	756m	Keyhead is a group of nine properties north-east of the Proposed Development. The properties are accessed either via the A90 itself or on minor roads leading from the A90. **Distance:** The closest property is situated 756m from the Proposed Development. The furthest property is positioned 997m from Greenside Extension. **Type:** Current views in the direction of the Proposed Development looks across open flat agricultural land, with sections of mature commercial forestry on the horizon and the operation Greenside turbines notable features. **Direction:** All but two properties have south facing windows onto the Proposed Development. Four of the properties with south will have some screening by trees or other properties in front. The remaining two properties have windows facing in a south-east and north-west direction and therefore will unlikely experience any views of the Proposed Development from the dwellings. **Extent:** Theoretically the Proposed Development would occupy a moderate extent of the horizontal view and a moderate extent of the vertical view. Although the Greenside Extension is seen in conjunction with the existing Greenside turbines, the Proposed Development will add to the horizontal extent of the wind farm, by one turbine, with the other two fully within the existing visual envelope of Greenside. **Scale of Change:** The Proposed Development would appear slightly more prominent in the landscape than the existing turbines from these properties, when seen. Views to the south of the dwellings may be partially screened by vegetation, however the proximity to the Proposed Development may result in views above the vegetation or seasonally during the winter months when the trees lose their leaves. These impacts will also be experienced by the access to the properties from the track which joins the A90 and the A90 itself. **Degree of Contrast:** Current views are heavily characterised by the existing turbines which spread across the landscape. As such, there would be little contrast to the baseline. **Mitigation:** Some mitigation is provided by vegetation and screening by buildings. The properties are considered to be of high sensitivity. Overall, the magnitude of change would be range from low to high, and the overall level of effect would range from **moderate** to **major**, direct, negative, reversible. Despite three of the properties (Northessie Cottage, Skypleton and the modern dwelling south of Skypleton) experiencing major effects being significant, the presence of the Proposed Development would not breach any visual amenity thresholds.
Bylands Croft	788m	Bylands Croft is a group of three properties situated to the south-east of the Proposed Development. The dwellings can be accessed via a minor road off the A90. **Distance:** The closest property to the Proposed Development would be situated 788m from the turbines. The second and farthest property would be 873m from the Proposed Development. **Type:** Due to a band of mature trees along the western edge, views (particularly those of the eastern dwellings) in this direction are well screened. Any views through gaps in the trees or from the minor road adjacent have views of the existing Greenside turbines, rolling agricultural land and commercial forestry. **Direction:** The properties are located in an east/west linear pattern. Main viewing windows within the properties are oriented to the north and south and therefore not in the direction of the Proposed Development. Each property has some smaller windows facing west, however would either have views screened, or see some of the existing Greenside turbines.

Residential Property	Distance from Turbine	Description
		Extent: Theoretically the Proposed Development would occupy a moderate extent of the horizontal view and a moderate extent of the vertical view. Although the Greenside Extension is seen in conjunction with the existing Greenside turbines, the Proposed Development will add to the horizontal extent of the wind farm. However, these views would likely be experienced from smaller, west facing windows and/or the westernmost dwellings garden. This would however be partially screened by trees and in the cases of the eastern dwellings completely screened by a combination of vegetation and the other dwellings. **Scale of Change:** The Proposed Development would appear prominent in the landscape at this location however not from the dwelling. The changes would be seen when in the westernmost property's garden to the west. These views may also be partially screened by trees and vegetation. **Degree of Contrast:** Current views from the access road are heavily characterised by the existing turbines which spread across the landscape. As such, there would be little contrast to the baseline. **Mitigation:** Some mitigation is provided by vegetation and other properties along the street. The properties are considered to be of high sensitivity. Overall, the magnitude of change would be low (negligible in the case of the eastern most dwelling), and the overall level of effect would be **moderate**, direct, negative, reversible.
Highfield Howe	875m	Highfield How consists of two properties to the south-east of the Proposed Development. The dwelling can be accessed by two minor roads both leaving the A90. **Distance:** The closest property is located 875m from the Proposed Development. The second dwelling is located 916m from the Proposed Development. **Type:** The existing view in the direction of the Proposed Development looks across a gently rolling moorland and agricultural landscape with a uniform character, where the existing Greenside turbines are notable features. **Direction:** The property closest to the Proposed Development has large, west facing windows. The main windows at the property however face north and south. The property furthest away is oriented to main windows to the front of the dwelling face west across two storeys. There is a small farm shed however that is likely to screen views from the windows on the northern side of the dwelling. **Extent:** Theoretically the Proposed Development would occupy a moderate extent of the horizontal view and a moderate extent of the vertical view. Although the Greenside Extension is seen in conjunction with the existing Greenside turbines, the Proposed Development will add to the horizontal extent of the wind farm by double. With the distance to the Proposed Development being further from the operational Greenside turbines, they will appear at a smaller scale and therefore not increase the vertical extent. **Scale of Change:** The Proposed Development would appear prominent in the landscape from the windows of the western dwelling and the garden area on this side, while the views from the eastern dwelling will be most constrained. Despite Greenside being visible at this location, the horizontal spread is minimal. Greenside Extension will appear as an increased spread across the horizon. Unlike Greenside, the Proposed Development will not appear as overlapping. **Degree of Contrast:** Current views from the access road are heavily characterised by the existing turbines which spread across the landscape. As such, there would be little contrast to the baseline. **Mitigation:** There is no mitigation in place currently for the property closest to the Proposed Development. The second dwelling has some mitigation due to screening from buildings. The properties are considered to be of high sensitivity. Overall, the magnitude of change would be medium (low for the eastern dwelling), and the overall level of effect would be **major/moderate**, direct, negative, reversible and significant. Despite being

Residential Property	Distance from Turbine	Description
		major/moderate, the presence of the Proposed Development would not breach any visual amenity thresholds.
Bylands	895m	Bylands is situated east of the Proposed Development. The dwelling can be accessed by two minor roads both leaving the A90. **Distance:** The property is located 895m east of the Proposed Development. **Type:** Existing views look across flat agricultural land and into a mature shelterbelt. The existing turbines can be seen rising above these trees, however the tree block any long range vistas. **Direction:** The property is orientated so that main viewing windows are facing either north or south. A large barn will likely screen and potential minor views to the east toward the Proposed Development. A large area of trees to the north will further screen any potential views of Proposed Development. **Extent:** Theoretically the Proposed Development would occupy a major extent of the horizontal view and a major extent of the vertical view. Although the Greenside Extension is seen in conjunction with the existing Greenside turbines, the Proposed Development will add to the horizontal extent of the wind farm. However, these views would likely be experienced from the property's garden, not the dwelling itself. **Scale of Change:** The Proposed Development would appear prominent in the landscape at this location however not from the dwelling. The changes would be seen when in the property's garden to the north. These views may also be partially screened by trees and vegetation. **Degree of Contrast:** Current views from the access road are heavily characterised by the existing turbines which spread across the landscape. As such, there would be little contrast to the baseline. **Mitigation:** Some mitigation is provided by vegetation and the large barn building situated within the courtyard screening views to the east. The properties are considered to be of high sensitivity. Overall, the magnitude of change would be medium, and the overall level of effect would be **major/moderate**, direct, negative, reversible. Despite being major/moerate, the presence of the Proposed Development would not breach any visual amenity thresholds.
Three Acres	897m	Three Acres is a two-storey dwelling located to the west of the Proposed Development and is accessed by a minor road from the A90. **Distance:** The property is located 897m west of the Proposed Development. **Type:** The existing view towards the development site is partially blocked by mature vegetation along the property's north-eastern edge, however the existing turbines can be seen rising above this. **Direction:** The properties main windows are positioned to the north-west and south-east directions, with minor windows to the north-east and south-west. Due to this orientation, it is unlikely that views of Greenside Extension would be visible from the dwelling. There may be some views experienced from smaller windows facing toward the north-east and the garden areas, however these views are likely to be partially screened by trees. **Extent:** Theoretically the Proposed Development would occupy a moderate extent of the horizontal view and a minor extent of the vertical view when facing the direction in which it is positioned. Due to the Greenside Extension being seen in conjunction with the existing Greenside turbines positioned behind, the Proposed Development adds to both the horizontal extent but not the vertical extents. **Scale of Change:** The Proposed Development would appear rising above the vegetation at this location when viewed from the garden of the dwelling. The towers would be partially screened by trees to the east of the property, with the hub in view above the treeline. Views from the main windows to the south-east would be unchanged however, due to the Proposed Development nor Greenside being visible from here.

Residential Property	Distance from Turbine	Description
		Degree of Contrast: Current views from the access road are heavily characterised by the existing turbines which spread across the landscape. As such, there would be little contrast to the baseline. **Mitigation:** Some mitigation is provided by vegetation and screening by buildings. The properties are considered to be of high sensitivity. Overall, the magnitude of change would be low, and the overall level of effect would be **moderate**, direct, negative, reversible and significant.
North Mosstown	967m	North Mosstown is a two-storey dwelling situated to the north of the Proposed Development. The property is accessed from the A90 on a minor road. **Distance:** The property is situated 967m north of the Proposed Development. **Type:** Existing views in the direction of the Proposed Development are well screened by an area of woodland on the property's southern side. **Direction:** It appears that main views from the property would be to the south, toward the Proposed Development. The property has a garden space to the south, which these main windows are likely to look out over. The garden boundary is surrounded by trees, which may partially screen turbines viewed from this location. **Extent:** Theoretically the Proposed Development would occupy a major extent of the horizontal view and a moderate extent of the vertical view. Due to the Greenside Extension being seen in conjunction with the existing Greenside turbines, the Proposed Development adds to the horizontal and vertical extents, however this would only be by one turbine, with the other two within the existing visual envelope. **Scale of Change:** The Proposed Development would appear notable in the landscape at this location. Views to the south of the dwellings are well screened by vegetation, however the proximity to the Proposed Development may result in views of blade tips above the vegetation. These impacts would be greater on the access to the property from the track which joins the A90, where the full exist of the proposal would be seen. **Degree of Contrast:** Current views from the access road are heavily characterised by the existing turbines which spread across the landscape. As such, there would be little contrast to the baseline. **Mitigation:** Strong mitigation is provided by vegetation. The properties are considered to be of high sensitivity. Overall, the magnitude of change would be low, and the overall level of effect would be **moderate**, direct, negative, reversible.

5.6.8 Settlement Assessment

The following assessment considers the views from settlements, and the likely visual effects that could be experienced from the main living rooms and garden areas of residential properties but excludes rooftops and upper windows. The illustrated viewpoints have been selected to represent views from where the wind turbine would be most visible within the towns or villages or along the edges of towns or villages. All settlements and residential properties have been judged to be of high sensitivity.

Due to the topography, there are a number of settlements that will experience theoretical visibility of the Proposed Development. This visibility is limited in the west however, where the low-lying landscape increases in altitude, with the rolling hills masking the turbines in some areas. Table 5.9 below provides assessment on these settlements.

Table 5.9 - Visual Effect on Settlements within the ZTV

Settlement	Distance	Visual Assessment
Settlement <5km from Greenside Extension Wind Turbines		
Crimond	1.6km	The residents of Crimond are likely to have visibility of the Proposed Development. **Viewpoint 4** is representative of the residents of Crimond to the south and south-east, in addition to users of the A90 southbound. Those with dwellings on the southern edge of the village such as Leys Drive and The Corse would likely have significant visibility of the turbines. Due to the existing turbines however, it is unlikely any the additional turbines would cause any significant change in the landscape and views. The magnitude of change would be medium, resulting in a **moderate** level of effect.
St Fergus and Kirktown	4.0km	St Fergus and Kirktown residents are likely to experience views of the Proposed Development. **Viewpoint 6** is representative of the residents on the western edge of the village, with windows facing north-west. From here, the turbines are well screened by a combination of topography and vegetation, although will still be partially visible in the same part of the view as the existing turbines. The magnitude of change is considered to be low, resulting in a **moderate** level of effect.
Settlement between 5-10km from Greenside Extension Wind Turbines		
Longside	8.1km	Longside residents are likely to have visibility throughout the village. Due to tree cover masking real word views, **Viewpoint 9** has been selected as where the likely views by residents of Longside would be experienced to the north. From this location however, trees mask the turbine views. The magnitude of change would be negligible, resulting in a **moderate/minor** level of effect.
Mintlaw	8.9km	Mintlaw lies to the south-west of the Proposed Development and has some areas with theoretical visibility within the town. It is likely from this distance and with tree cover, the Proposed Development will be masked at this location. The magnitude of change is therefore negligible resulting in a **moderate/minor** level of effect.
Peterhead	9.3km	Much of Peterhead has theoretical visibility in a bare-earth scenario. However, due to the built environment, tree cover to the western and northern edges and distance from the Proposed Development, it is unlikely to experience views of the Proposed Development in the real world scenario.
Inverallochy	9.5km	Inverallochy is situated to the north of the Proposed Development and has theoretical visibility to the south and west of the town. **Viewpoint 11** is representative of the residents of Inverallochy, and users of the B9107 southbound leaving the town. Due to the distance from the Proposed Development, the rolling hill topography masks views of the turbines. The magnitude of change is negligible resulting in a **moderate/minor** level of effect
Settlement between 10-15km from Greenside Extension Wind Turbines		
Strichen	10.8km	There are no views predicted from within Strichen.
Fraserburgh	11.8km	Much of Fraserburgh has theoretical visibility of the Proposed Development. Similar to Peterhead, views from within Fraserburgh will be screened due to buildings. From the southern edge of Fraserburgh, any potential views are likely to be screened by areas of forestry and woodland to the south.

Settlement	Distance	Visual Assessment
Boddam	14.0km	The town of Boddam has theoretical visibility to the west. Due to buildings and distance, it is unlikely that the town will experience any real-world visibility. **Viewpoint 10** on Stilrling Hill is likely to be most representative of residents, as Stirling Hill is used recreationally. The magnitude of change is negligible, resulting in a **moderate/minor** level of effect.
Settlements beyond 15km are unlikely to experience any significant effects		

5.6.9 Assessment of Major Transport Routes

The assessment of potential for visual effects on major transport routes in the area has been undertaken. These routes are shown in **Figure 5.11** and include:

- The A90 between Fraserburgh and Peterhead.

The impact on all other routes in the area were deemed minimal and the addition of the extension turbines to the operational four turbines are unlikely to have any notable effects.

5.6.9.1 *A90 between Fraserburgh and Peterhead*

This is a popular route which connects Perth and Fraserburgh. Much of the route from Stonehenge follows the coast. North of Peterburgh, the route deviates inland and has an increased agricultural character. The route passes through some urban areas such as Dundee and Aberdeen, but for the majority of the route has smaller towns and villages lining its duration. The section assessed runs for 23km and is 800m from the Proposed Development at its closest point. The route is considered to be of medium sensitivity as it is typically a commuter route which passes through agricultural landscapes.

Much of the route within 5km of the Proposed Development has visibility of all three turbines to blade tip. As the A90 passes the village of St Fergus, there is a 500m stretch where theoretically only one turbine would be visible. Approximately 2.8km north of the Proposed Development, there is a 160m stretch of the A90 where one turbine is theoretically visible. Much of the large areas with visibility is down the low lying, flat agricultural landscape of the Eastern Aberdeenshire Agricultural Plain LCT. Visibility reduces 7.3km north of the Proposed Development, as the land slopes into a shallow valley, through which the Water of Philorth flows. Visibility resumes on the northern side of the river as the A90 approaches Fraserburgh. These views would only be experienced if the user was travelling southbound.

When travelling north from Peterhead, 1.2km of the A90 directly out of the town experiences no visibility of the Proposed Development due to its low-lying position in the landscape. Views theoretically return for 800m however are likely to be screened due the area of woodland and the direction of travel facing the North Sea. Approximately 3km north of Peterhead, views return however are likely to be partially screened by the small pockets of woodland that line the fields across the area.

Overall, the magnitude of change on road users travelling the route would be low, resulting in a **moderate/minor** level of effect.

5.7 Assessment of Predicted Cumulative Visual Impacts and Effects

5.7.1 Cumulative Baseline

There are a number of operational projects within the study area in addition to one consented scheme and two that are in planning stages. All operational, consented and in planning schemes within 30km of the project are detailed on **Figure 5.2.** For LVIA purposes, the area assessed for cumulative impacts has been scoped down to 15km.

5.7.2 Cumulative Landscape Assessment

The Proposed Development will be an extension of the four already existing Greenside Wind Farm. North Lothian, St Fergus Moss, St Fergus and Ednie Farms also exist within 5km and all within the Eastern Coastal Agricultural Plain LCA. Greenside Extension has been positioned to minimise any cumulative effects by locating the turbine on the same section of landscape already characterised by these turbines and maintaining the linear pattern which they create. This keeps turbine development to the same section of landscape and by virtue of being a relatively modest extension, it does not exacerbate any existing landscape effects. The addition of these turbines does little to add to the cumulative effects that occur between Greenside Wind Farm and the turbines at North Lothian and St Fergus Moss. In addition to this, the LCA would not cross any thresholds which would alter the character of this LCA by virtue of cumulative impacts. The magnitude of change is considered to be low, which results in a **moderate/minor** level of effect.

5.7.3 Cumulative Viewpoint Analysis

Each viewpoint assessed as part of the viewpoint assessment has also been considered cumulatively with any existing, consented and planned turbines. The location of the cumulative developments included within the assessment are mapped and shown in **Figure 5.2.** This aspect is considered in more detail as part of the viewpoint assessment in **Appendix 5.2** – Viewpoint Assessment.

A summary of potential cumulative visibility assessment from each of the viewpoints is provided in **Table 5.10**

Table 5.10 - Summary of Cumulative Viewpoint Analysis

Viewpoint No.	Sensitivity	Magnitude	Level of Effect
Viewpoint 1: Longhill Farm			
Greenside Extension and Operational Development	Medium	Low	Moderate/Minor
Greenside Extension and Operational, Consented Development		Low	Moderate/Minor
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate/Minor
Viewpoint 2: Overside Farm			
Greenside Extension and Operational Development	Medium	Low	Moderate/Minor
Greenside Extension and Operational, Consented Development		Low	Moderate/Minor
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate/Minor
Viewpoint 3: Tillyduff			
Greenside Extension and Operational Development	High	Medium	Major/Moderate
Greenside Extension and Operational, Consented Development		Medium	Major/Moderate
Greenside Extension and Operational, Consented, Planned Development		Medium	Major/Moderate
Viewpoint 4: Crimond			
Greenside Extension and Operational Development	High	Low	Moderate/Minor
Greenside Extension and Operational, Consented Development		Low	Moderate/Minor

Viewpoint No.	Sensitivity	Magnitude	Level of Effect
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate/Minor
Viewpoint 5: Loch of Strathbeg			
Greenside Extension and Operational Development	High	Low	Moderate
Greenside Extension and Operational, Consented Development		Low	Moderate
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate
Viewpoint 6: Kirkton of St Fergus			
Greenside Extension and Operational Development	High	Low	Moderate
Greenside Extension and Operational, Consented Development		Low	Moderate
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate
Viewpoint 7: A90 – A952 Junction			
Greenside Extension and Operational Development	Medium	Low	Moderate/Minor
Greenside Extension and Operational, Consented Development		Low	Moderate/Minor
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate/Minor
Viewpoint 8: Formartine and Buchan Way			
Greenside Extension and Operational Development	High	Low	Moderate
Greenside Extension and Operational, Consented Development		Low	Moderate
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate
Viewpoint 9: Longside			
Greenside Extension and Operational Development	High	Low	Moderate
Greenside Extension and Operational, Consented Development		Low	Moderate
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate
Viewpoint 10: Stirlinghill by Peterhead			
Greenside Extension and Operational Development	High	Low	Moderate
Greenside Extension and Operational, Consented Development		Low	Moderate
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate
Viewpoint 11: Inverallochy			
Greenside Extension and Operational Development	High	Low	Moderate
Greenside Extension and Operational, Consented Development		Low	Moderate

Viewpoint No.	Sensitivity	Magnitude	Level of Effect
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate
Viewpoint 12: Mormond Hill			
Greenside Extension and Operational Development	High	Negligible	Moderate/Minor
Greenside Extension and Operational, Consented Development		Low	Moderate
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate
Viewpoint 13: Culsh Monument			
Greenside Extension and Operational Development	High	Negligible	Moderate/Minor
Greenside Extension and Operational, Consented Development		Negligible	Moderate/Minor
Greenside Extension and Operational, Consented, Planned Development		Low	Moderate

5.8 Summary of Predicted Impacts

5.8.1 Landscape Design

The Proposed Development would comprise of three turbines with a hub height of 59m and a maximum turbine height of 100m to blade tip. The turbine size and positions have been carefully chosen to minimise the overall impact of the Proposed Development on the landscape and when visible, allow the Proposed Development to be read as a logical extension to the existing development at Greenside. This was done by selecting an appropriately scaled turbine and keeping a consistent spacing between the Proposed Development and the operational turbines. This, along with maintaining the linear pattern will keep a continuity with the operational turbines and minimise visual confusion. The Proposed Development would be located within the Eastern Coastal Agricultural Plain LCA, which according to the *Strategic Landscape Assessment for Wind Energy in Aberdeenshire*, 2014 states "*This area is capable of accommodating wind energy due to its medium to large scale, landform, broad extent, simple pattern of very large geometric fields and a generally open character. It could accommodate small clusters of either small/medium, medium, medium/large or large turbines. However preference should be given to larger sized turbines where this complies with the detailed guidance."* It should be noted that the assessment also states that the *areas around Mormond Hill and St Fergus Moss are already Wind Turbine Landscapes and over their underlying capacity*." However, there is preference given to extensions of existing development in the area over new applications.

5.8.2 Landscape Assessment

The Proposed Development is located within the Eastern Coastal Agricultural Plain LCA, within the Banff and Buchan Landscape Character Assessment and would affect a proportion of this area. This section of the LCA is described as agricultural with the influence of development, with 13 turbines within 5km of the Proposed Development, along with the presence of transmission masts, lines, the A90 and A953 and the gas terminal at St Fergus. Due to the medium to large scale of the landscape, it is accommodating for wind energy. The area in which the Proposed Development is situated may be considered more sensitive due to its proximity to St Fergus Moss.

Considering the wider area, the assessment has concluded that there will be no notable indirect effects from any of the other landscape character types or within the study area. Generally, the surrounding landscapes have been modified with roads, settlement pattern, pylons and wind turbines, and the Proposed Development would fit into

this pattern. In addition to this, the turbines will always appear alongside the operational turbines at Greenside which mitigates the impact somewhat, as these turbines are already present in views from the same parts of these landscapes.

5.8.3 Effects on Designated Landscapes

The Proposed Development is not situated within a nationally or locally designated landscape and as such would have no direct impacts on any designated landscapes. It would have some minor indirect impacts on the North East Aberdeenshire Coast SLA however due to the designations notable features being in the eastern direction, the Proposed Development would be rarely seen in conjunction with these. The Proposed Development would also have some minor indirect impacts on the Cairness GDL and the Crimonmogate GDL, however these would be screened by woodland and would only create an impact upon the removal of this woodland.

5.8.4 Visual Assessment

5.8.4.1 Visual Effects: Construction Period

There will be no significant visual effects resulting from the construction period and visibility of the ground-based activity. Views of the concentrated areas of construction could however lead to a temporary and negative effect that in some cases may appear more disruptive than the finished Proposed Development. Post construction, the appearance of the site would recover a calmer visual character with negligible levels of activity visible on site from the nearest receptors.

5.8.4.2 Visual Effects: Operational Period

The assessment shows that while some visual effects may occur in the immediate area surrounding the Proposed Development; these quickly diminish over the wider area. The majority of the main settlements in the area such as Crimond and St Fergus and Kirkton have views of the Proposed Development. As these views are already occupied by the existing Greenside turbines, the additional turbines may significantly alter the views experienced, but also may blend into the existing visible infrastructure.

5.8.4.3 Cumulative Landscape and Visual Effects

Cumulative views were found to be limited, this was primarily as the turbines appear in a section of the horizon already characterised by the eight operational turbines and the addition of three further turbines does not notably increase the horizontal spread, nor does it cause clutter due to its design. In all instances it was found that the cumulative relationship the operational turbines already had with other schemes in the area was the same, even with the addition of the extension turbines.

5.9 Conclusion

The assessment has found that Greenside Extension can be accommodated in the landscape but may have impacts that are moderate when viewing in close proximity. The capacity study indicates that there is medium capacity for large-scale wind turbines within the Eastern Coastal Agricultural Plain LCA, however the areas around Mormond Hill and St Fergus Moss are already beyond capacity.

The design is a simple and logical extension, maintaining spacing and scale wile also continuing the linear character of the wind farm. This avoids any visual clutter or visual confusion and would not overwhelm the character of the landscape, affecting a small section of the landscape already characterised by the Greenside turbines. The Proposed Development is expected to have only moderate/minor level of effect on the North East Aberdeenshire Coast SLA and the Crimonmogate and Cairness GDLs.

It is concluded that, while there may be some major visual effects experienced by the closest visual receptors within ~2km due to the introduction of three, of up to 100m high turbines, wider impacts a limited and dimmish quickly, with the turbines being indistinct from the existing turbines. Only moderate/minor level of effect would be experienced on the A90 between Fraserburgh and Peterhead and impacts from surrounding settlements beyond Crimmond would be limited. The turbines will feature in an area of landscape which is already characterised by wind turbines and therefore only slightly increases the existing visual influence.

Appendix 5.1 – LVIA Methodology

1. Defining the Study Area

An overall Study Area of 30km radius from the site centre has been established based on SNH guidance. The study area was further defined for each part of the assessment process as follows:

Landscape and Visual Impact Assessment (LVIA) – the study area was restricted to the application site, access routes, and the potential Zone of Theoretical Visibility (ZTV) from where there may be a view of the Proposed Development at up to 25km distance from the turbine. Based on professional experience of similar scaled projects, the main focus of the assessment with respect of landscape and visual receptors would be 15km which would be the distance most likely to experience significant effects as a result of the Proposed Development. Although effects may occur out to 30km it is unlikely that these will be significant and is informed with reference to the findings of field survey and viewpoint analysis, as well as professional experience from previous assessments.

Cumulative Landscape and Visual Impact Assessment (CLVIA) - considered existing wind energy development proposals that have permissions, and those that are currently the subject of undetermined applications within a Search Area of 30km radius of the site centre. An initial assessment of the cumulative visibility of these wind farms within the Cumulative Search Area was then undertaken in order to determine which wind farms have the potential to contribute to a significant cumulative effect following addition of the Proposed Development. Many of these developments were scoped out of the assessment at this stage due to the lack of combined visibility or long distance from the proposed site such that they would not contribute to significant cumulative effects. The detailed assessment, therefore, focuses on those sites with potential for significant cumulative effects, in combination with the Proposed Development.

A Zone of Theoretical Visibility (ZTV) was calculated using the ReSoft © WindFarm computer software to produce areas of potential visibility of any part of the proposed wind turbine calculated to blade tip and hub-height. The ZTV however, does not take account of built development and vegetation, which can significantly reduce the area and extent of actual visibility in the field and as such provides the limits of the visual assessment study area.

LVIA Figure 5.8 illustrates the ZTV for blade tip height of 100m at 1:100,000 at A1 scale, LVIA Figure 5.9 illustrates the ZTV to a 59m hub height at the same scale.

2. Baseline Landscape and Visual Resource

This part of the LVIA refers to the existing landscape character, quality or condition and value of the landscape and landscape elements on the site and within the surrounding area, as well as general trends in landscape change across the study area. A brief description of the existing landscape character and land use of the area which includes reference to settlements, transport routes, vegetation cover, as well as landscape planning designations, local landmarks, and tourist destinations.

3. Assessing Landscape Effects

Landscape Effects are defined by the Landscape Institute as "*changes to landscape elements, characteristics, character, and qualities of the landscape as a result of development*". The potential landscape effects, occurring during the construction and operation period, may include, but are not restricted to, the following:

- Changes to landscape elements: the addition of new elements or the removal of trees, vegetation, and buildings and other characteristic elements of the landscape character type;
- Changes to landscape quality: degradation or erosion of landscape elements and patterns, particularly those that form characteristic elements of landscape character types;

- Changes to landscape character: landscape character may be affected through the incremental effect on characteristic elements, landscape patterns and qualities and the cumulative addition of new features, the magnitude of which is sufficient to alter the overall landscape character type of a particular area; and
- Cumulative landscape effects: where more than one wind farm may lead to a potential landscape effect.

The Proposed Development may have a direct (physical) effect on the landscape as well as an indirect effect or effect perceived from outwith the landscape character area. Landscape effects are assessed by considering the sensitivity of the landscape against the degree of change posed by the Proposed Development. The sensitivity of the landscape to a particular development is based on factors such as its quality and value and is defined as high, medium or low. Examples of landscape sensitivity and criteria are described below:

High Sensitivity – This would primarily be rare landscapes, or landscapes which have been afforded either a national or local designation such as National Parks, National Scenic Areas or Areas of Great Landscape Value. These landscapes can be fairly dramatic in terms of scale and may feature a number of attractive landscape features, including mature woodland, intricate gorges and river valleys, prominent summits and features of cultural heritage. Man-made features or modifications to the landscape will be minimal and the landscape may have a wild or remote feeling to it.

Medium Sensitivity – This would include landscapes which are still relatively attractive and generally rural but do contain some man-made elements. It may be landscapes which have been modified to accommodate farming practices and landscapes which include more prominent settlement pattern and road networks. These landscapes may also contain woodland including plantation forestry and shelterbelts.

Low Sensitivity – This would only be reserved for landscapes which may be deemed unattractive due to heavy modification and prominent man-made features, such as industrial units.

The magnitude or degree of change considers the scale and extent of the Proposed Development, which may include the loss or addition of particular features, and changes to landscape quality, and character. Magnitude can be defined as high, medium, low or negligible, examples of magnitude are shown below:

High Magnitude – This would be a major change to baseline conditions, where the character of the landscape may be altered from its existing state into a landscape with wind farms;

Medium Magnitude – This would be a noticeable change in the baseline condition but not necessarily one which would be enough to alter the character of the landscape and will generally diminish with distance;

Low Magnitude – This would be a minor change to the baseline conditions where the development would be readily missed by a casual viewer and any character of the landscape would remain intact; and

Negligible Magnitude – This would be a change which would be difficult to notice and the baseline conditions are likely to remain almost as they were.

The level of effect is determined by the combination of sensitivity and magnitude of change as shown in Appendix 5.1 Table 1.

Appendix 5.1 Table 1 - Magnitude and sensitivity matrix for assessing overall level of effect

Sensitivity	Magnitude of Change			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major/Moderate	Moderate	Moderate/Minor
Medium	Major/Moderate	Moderate	Moderate/Minor	Minor
Low	Moderate	Moderate/Minor	Minor	Minor

The impact of any identified landscape or visual effect has been assessed in terms of Major, Major/Moderate, Moderate, Moderate/Minor, Minor or Minor/Negligible. These categories are based on the juxtaposition of receptor sensitivity with the predicted magnitude of change. The matrices should not be used as a prescriptive tool but must allow for the exercise of professional judgement.

4. Assessing Visual Effects

Visual effects are recognised by the Landscape Institute as a subset of landscape effects and are concerned wholly with the effect of the development on views, and the general visual amenity. The visual effects are identified for different receptors (people) who will experience the view at their places of residence, during recreational activities, at work, or when travelling through the area. These may include:

- Visual effect: a change to an existing view, views or wider visual amenity as a result of development or the loss of particular landscape elements or features already present in the view; and
- Cumulative visual effects: the cumulative or incremental visibility of similar types of development may combine to have a cumulative visual effect. Either:
    - Simultaneously - where a number of developments may be viewed from a single fixed viewpoint simultaneously within the viewer's field of view without moving;
    - Successively - where a number of developments may be viewed from a single viewpoint successively by turning around at a viewpoint, to view in other directions; and
    - Sequentially - where a number of developments may be viewed sequentially or repeatedly from a range of locations when travelling along a route.

The general principles adopted for the assessment of visual effects were taken from *The Guidelines for Landscape and Visual Impact Assessment* Third Edition, produced by the Landscape Institute, 2013. This guidance outlines the approach to define a 'sensitivity' for a given view and a 'magnitude of change' that would be caused by the development in question over its lifetime. A matrix in the Guidance is then used to assess the overall 'level of effect'. This matrix is the same format as used to understand landscape effects and can be seen in Table 1. Examples of visual sensitivity are highlighted below:

High Sensitivity – These include residential receptors, such as views from individual properties or views from within settlements. Views from both recreational locations, such as hill summits, long distance footpaths, cycle paths and tourist locations such as castles and visitor centres are also considered to be of high sensitivity;

Medium Sensitivity – This would include most other visual receptors such as views from roads, other areas of landscape which would not be classed as recreational areas and views from areas within settlements which would not be considered residential; and

Low Sensitivity – This would cover views experienced by people at work and views where the existing view is already dominated by significant man-made features.

In the context of this project, the effects during operation are always direct and long-term (reversible upon decommissioning). Effects may also be non-cumulative or cumulative. None of the visual effects relating to this project have been considered positive in order to present a worst case view of any effects, although it should be noted that surveys have consistently shown that the majority of people are positively disposed to wind farm development once it is built.

5. Viewpoint Analysis Method

Viewpoint analysis is used to assist the LVIA from selected viewpoints within the study area. The purpose of this is to assess both the level of visual impact for particular receptors and to help guide the assessment of the overall effect on visual amenity and landscape character. The assessment involves visiting the viewpoint location in good weather and viewing wireframes and photomontages prepared for each viewpoint location. Illustrated turbines always face the viewer to give a worst case impression of the development under consideration.

- A balance of viewpoints to the north, south, east and west;
- A range of near middle and distance views of the development;
- A proportion representing areas known locally where people use the landscape, such as prominent hill tops or footpaths; and
- A proportion representing designated areas.

6. Methodology for Production of Visualisations

With the viewpoints selected, the locations were confirmed and then taken with a full frame digital Single Lens Reflex (SLR) camera set to produce photographs equivalent to that of a manual 35 mm SLR camera with a fixed 50 mm focal length lens.

SNH Visualisation Standards

In accordance with the SNH guidance *Visual Representation of Wind Farms,* panoramic images were produced from these photographs to record a 53.5° angle of view. This illustrates the typical extent of view that would be experienced by the viewer at the viewpoint when facing in one direction and also includes a 90° angle of view which provides an indication of the visual context of the Proposed Development and any cumulative projects. In addition to these single frame photomontages have been produced at 75mm (extracted from the original 50mm photographs).

The wider 360° of each view were also taken into account when assessing each viewpoint and full 360° photography included where relevant.

Each view was illustrated using a panoramic photograph, a wireline and, in some cases, a photomontage. Wirelines and photomontages were produced using Resoft© WindFarm software using 50m² Ordnance Survey Digital Terrain Mapping (DTM) height data covering the study area.

7. Visual Assessment of Settlements and Residential Properties

All settlements within the study area will be assessed with regards to the level of visual impact the development will have on them. The sensitivity for each of the settlements is considered to be high in accordance with Guidelines for Landscape and Visual Impact Assessment, 2013. The assessments are from public roads and footpaths within the settlements and the assessment represents a 'best estimate' of the likely visual effects, this was typically done from the public area immediately adjacent to the front gardens, parks, roads and properties which had open views towards the development site. In line with the guidance from the Landscape Institute, the views from upper floor windows are considered as of lesser importance, but the garden and public areas are included as well as the visual context in which views are experienced. The guidance provided in the *Residential*

Visual Amenity Assessment (RVAA) Technical Guidance Note, Landscape Institute, 2019, was also used to form the basis of the residential amenity assessment.

8. Visual Assessment of Main Transport Routes

A route assessment has been undertaken which explores the visual impact of the development on views experienced by road users along major transport routes in the area and assumes that the viewer would be travelling at typical speed for the road conditions. It also includes assessment of any National Cycle Routes, Long Distance Footpaths and locally valued footpaths which fall within the study area. Where relevant, railroads and ferry routes will also be included within the study. This part of the assessment has also been considered cumulatively along with all other wind energy development within the study area.

9. Cumulative Landscape and Visual Assessment

In addition to the Landscape Institute methodology for LVIA, the cumulative landscape and visual assessment (CLVIA) has considered the guidance from Scottish Natural Heritage's *Assessing the Cumulative Impact of Onshore Wind Energy Developments,* Scottish Natural Heritage, March 2012. The CLVIA is however, not a substitute for individual wind farm landscape and visual impact assessment.

Predicting Cumulative Landscape Effects

The assessment considers the extent to which the Proposed Development, in combination with others, may change landscape character through either incremental effect on characteristic elements, landscape patterns and quality, or by the overall cumulative addition of new features. Identified cumulative landscape effects are described in relation to each individual Landscape Character Area and for any designated landscape areas that exist within the study area.

Predicting Cumulative Visual Effects

The assessment of cumulative visual effects involves reference to the cumulative visibility ZTV maps and the cumulative viewpoint analysis. Cumulative visibility maps are analysed to identify the residential and recreational locations and travel routes where cumulative visual effects on receptors (people) may occur as a result of the Proposed Development.

With potential receptor locations identified, cumulative effects on individual receptor groups are then explored through viewpoint analysis, which involves site visits informed by wireline illustrations that include other wind cluster developments. Travel routes are driven to assess the visibility of different wind cluster developments and inform the assessment of sequential cumulative effects that may occur along a route or journey.

Cumulative Viewpoint Analysis

Each viewpoint will be assessed cumulatively in order to understand whether or not the Proposed Development introduces a cumulative impact on the view from that location. All visible operational, consented and undetermined planning application wind energy projects are considered along with the Proposed Development and a level of cumulative magnitude is assigned. The level and significance of cumulative visual effects is determined in the same manner as the main LVIA, using the previous matrix shown in Appendix 5.1 Table 1.

Appendix 5.2 – Viewpoint Assessment

Viewpoint 1 – Longhill Farm

Figure 5.12	**Viewpoint 1: Longhill Farm**	
Description	This viewpoint is located at **E405112 N855342** on a minor road south of Crimond. Situated 0.8km from the Proposed Development to the west, it faces an easterly direction. The view is open in character, with the flat landscape apparent. The foreground shows a field of cattle grazing, with the field boundary outlined with post-and-wire fencing. Beyond this field, and additional field of sheep is visible, characteristic of this agricultural landscape. From the left of the view to the center in the midground, a large solar farm is under construction. These solar panels and the existing Greenside turbines add a further sense of man-made infrastructure to the area. There is a strong presence of conifer forestry at this viewpoint, as the background is occupied near to exclusively by a small plantation, from which the existing Greenside turbines rise up behind.	
Sensitivity	The view represents users of the road to Longhill Farm and is of **medium** sensitivity.	
Magnitude of Change	The proposed turbines would appear to the left of the existing Greenside turbines. The turbines would appear as an extension to the existing wind farm, increasing the horizontal extent. The design is as such, that once constructed it would appear as a logical extension to the existing turbines, with consistent spacing. Turbine dimensions are similar to Greenside, and the development is positioned in a similar section of landscape in terms of landcover. The magnitude of change is considered to be **medium**, resulting in a **moderate** level of effect.	
Cumulative Impact	<u>Operational</u> The Proposed Development would appear as a natural extension to the Greenside Wind Farm due to the consistent spacing that has been maintained in addition to similar dimensions. This reduces any sense of imbalance or confusion. The proposal would increase the horizontal spread, and this would slightly increase any existing cumulative impacts. Ednie Farms is theoretically visible from this location, however is screened by the conifer plantation. The single North Lothian turbine is visible to the rear of the viewer at this location which increases the cumulative impact again but would not be able to be seen in conjunction with the Proposed Development in the same view from this location. The cumulative magnitude of change would be low. <u>Operational, Consented</u> St Fergus is a consented development that would be theoretically visible amongst the existing Greenside turbines. When built, it is likely that these would be partially screened by forestry with the hubs visible above the trees. The cumulative magnitude of change would be low. <u>Operational, Consented, Planning</u> There are no planned developments visible from this location and the cumulative magnitude of change would remain low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*Medium*
	Magnitude:	*Medium*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate*

Viewpoint 2 - Overside Farm

Figure 5.13	Viewpoint 2: Overside Farm	
Description	This viewpoint is located at **E406947 N854298** on a minor road between Overside and Howe Farms and is located 0.8km south-east of the Proposed Development, facing north-west. The eye of the viewer is immediately drawn to the existing Greenside turbines spanning from the left background to centre mid-ground. The landscape in which they are situated is typical of the agricultural landscape, with gently undulating slopes and fields separated by hedgerow and post-and-wire fencing. Greenwellheads is visible in the mid-ground to the right of the existing Greenside turbine that is closest to the viewer. From the left extent of the view to the centre in the background, the horizon is lined with conifer forestry. The left of the view features the summit of Mormond Hill with the telecommunication infrastructure that is positioned here also visible, adding to the man-made features visible. To the right of the view, two masts can be seen rising into the sky.	
Sensitivity	The view represents the residents of Overside Farm and is of **medium** sensitivity.	
Magnitude of Change	T1 of the Proposed Development would appear within turbines three and fourth Greenside turbines and T2 and T3 would be expanding the horizontal extent to the right. The vertical extent would remain unchanged however, as the distance between the viewer and the turbines means that the Proposed Development does not appear taller than what already exists. The magnitude of change is considered to be **medium**, resulting in a **moderate** level of effect.	
Cumulative Impact	Operational The proposal would be visible amongst the Greenside and North Lothian turbines. Appearing as a logical extension to the Greenside turbines, the Proposed Development will add to the cumulative nature of the viewpoint. The cumulative magnitude of change would therefore be low. Operational, Consented There are no consented developments visible from this location and the cumulative magnitude of change would remain low. Operational, Consented, Planning There are no planned developments visible from this location and the cumulative magnitude of change would remain low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*Medium*
	Magnitude:	*Medium*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate*

Viewpoint 3 - Tillyduff

Figure 5.14	Viewpoint 3: Tillyduff	
Description	This viewpoint is located at **E406652 N855515** on the a minor road off the A90 at Tillyduff. The view is 0.3km north of the Proposed Development facing south. The view is open in character, and typical of the rolling agricultural landscape. The field in the foreground, used for cattle grazing, is separated by post-and-wire fencing. The perimeters of the fields across the view also sometimes feature vegetation lining the boundaries. The mid-ground and background have pockets of intermittent woodland; mixed and conifer. Man-made features are common within the view including electricity pylons, communication lines, and turbines. Overside Farm is partially visible in the centre of the view behind a rolling slope.	
Sensitivity	The view represents the residents of Tillyduff and Greenwellheads and is of **high** sensitivity.	
Magnitude of Change	Due to the positioning of the viewer, the Proposed Development would increase both the horizontal and vertical extent of the view. The view is heavily characterized by turbines, with Greenside, Middleton of Rora and St Fergus Moss visible. The spread of the Proposed Development at this location however means the viewer would not see all three extension turbines within the same field of view. The magnitude of change is considered to be **medium**, resulting in a **major/moderate** level of effect.	
Cumulative Impact	Operational The proposed turbines add to the linear developments situated in this area, such as Greenside, St Fergus Moss and Ednie Farms. The turbines do add to the cumulative spread of turbines in this area due to their proximity to the viewer. The cumulative impact would therefore be medium. Operational, Consented St Fergus is a consented development that would be theoretically visible from this location. When built, these turbines would not be visible within the same view as Greenside Extension. The cumulative impact would therefore remain medium. Operational, Consented, Planning There are no planned developments visible from this location and the cumulative magnitude of change would remain medium.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*High*
	Magnitude:	*Medium*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Major/Moderate*

Viewpoint 4 - Crimond

Figure 5.15	Viewpoint 4: Crimond
Description	This viewpoint is located at **E405697 N856614** on the A90 on the western limits of Crimond. The view is 1.3km north of the Proposed Development, facing south. Similar to previous viewpoints, the area seen is expansive and flat. Field boundaries are easily identified, with vegetation lining the perimeters. Farm buildings from North Mosstown are visible on to the left of the view behind the gently rolling slope.

	Telecommunication lines and turbines are visible across the view, giving the landscape a sense of the presence of man-made infrastructure amongst the agricultural activity. The right extent of the view has a large area of mixed woodland.	
Sensitivity	This viewpoint is representative of the residents of Crimond and is of **high** sensitivity.	
Magnitude of Change	The Greenside Extension turbines will be seen in front of the existing Greenside turbines, however will appear as part of the same development. The horizontal extent increases with the addition of the Proposed Development at T1 is positioned further to the left than T1 of Greenside. Due to the positioning of the viewer, the Greenside Extension turbines appear taller, thus increasing the vertical extent. This increase in height however does not create a sense of overwhelming the landscape, as the turbines are still of a similar scale. The magnitude of change is considered to be **low**, with a **moderate** level of effect.	
Cumulative Impact	<u>Operational</u> Turbines are a familiar feature on this landscape, with Greenside, St Fergus Moss, North Lothian and Ednie Farms theoretically visible from this location. There are no further operational turbines within 5km of the Proposed Development. Any turbines beyond this distance in any direction will be unlikely to be seen. The cumulative magnitude of change would be low. <u>Operational, Consented</u> St Fergus would be theoretically visible from this location, with the tower screened by topography and hub and blade tip visible above this. These turbines however would be positioned directly behind the Greenwellheads Farm buildings and therefore the real-world scenario my be screening the turbines in their entirety. The cumulative magnitude of change would therefore remain low. <u>Operational, Consented, Planning</u> There are no planned developments visible from this location and the cumulative magnitude of change would remain low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*High*
	Magnitude:	*Low*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate*

Viewpoint 5 – Loch of Strathbeg

Figure 5.16	**Viewpoint 5: Loch of Strathbeg**
Description	This viewpoint is located at **E405717 N858025** at the Starnafin Visitor Center at the RSPB Loch of Strathbeg. The view is 2.7km north of the Proposed Development, facing south. This viewpoint has a more varied character than previous, with the foreground showing a large area of rough, wild grasses. The left of the view features a small broadleaf woodland in the foreground. This woodland continues across the view in the background, acting as a shelterbelt between the fields and the A90. Signs of industry are still present here, with industrial estate visible through a break in the woodland to the left of the view. Farm buildings are also visible in the mid-ground with fields of cattle, indicating a transition from the reserve to the agricultural landscape. The center mid-ground of the view to toward the right shows small areas of mixed woodland also acting as shelterbelts to the agricultural fields. The right of the view shows a break in the woodland, with the northern edge of Crimond visible amongst the fields and trees.
Sensitivity	The view represents the visitors to the Loch of Strathbeg nature reserve and visitor centre and is of **high** sensitivity.

Magnitude of Change	The Proposed Development will increase the horizontal extent of the view as all three turbines are visible along side T1 of Greenside which is the only existing turbine visible being the woodland. T2 and T3 of the Proposed Development only have blades visible, with T1 visible with the hub and a small section of the tower. Due to this screening, and the scale of the Proposed Development compared to the visible Greenside turbine, the vertical extent increases only slightly, and not enough to dominate the skyline. The magnitude of change would be **low**, with a **moderate** level of effect.	
Cumulative Impact	**Operational** Greenside, St Fergus Moss and North Lothian are theoretically visible from this viewpoint, however the woodland buffer between the viewer and the A90 screens St Fergus Moss and T2, T3 and T4 of Greenside. The cumulative magnitude of change will be low. **Operational, Consented** St Fergus is the only consented development that is theoretically visible from this viewpoint. Here, only turbine blade tips would be visible, however are likely to be screened by vegetation. The cumulative magnitude of change will therefore remain low. **Operational, Consented, Planning** There are no planned developments visible from this location and the cumulative magnitude of change would remain low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*High*
	Magnitude:	*Low*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate*

Viewpoint 6 – Kirkton of St Fergus

Figure 5.17	**Viewpoint 6: Kirkton of St Fergus**
Description	This viewpoint is located at **E409174 N852091** within the village of Kirkton and St Fergus. Located 4.0km to the south-east, it faces north-west toward the Proposed Development. The landscape is typical of that of the agricultural landscape. Expansive rolling fields dominate the view, separated by post-and-wire fencing and in the midground vegetation also line the perimeters of the fields. The left of the view shows large trees that make up the boundary between these fields and the residents of Kirkton. The left of the centre shows Mormond Hill in the distance as the highest point in the view, with the telecommunication masts are visible at the summit. Other man-made infrastructure is present across the view with electricity pylons, telecommunication lines, turbines and farm buildings scattered within the landscape. There is also a conifer plantation on the rolling fields, indicating additional land uses.
Sensitivity	The view represents the residents of Kirkton of St Fergus and is of **high** sensitivity.
Magnitude of Change	Greenside extension would appear alongside the Greenside turbines, extending the horizontal extent of the linear appearance. Due to this, the Proposed Development appears as a logical extension to the existing turbines. Due to Greenside Extensions positioning in the landscape, from this location, only blade tips are visible, with the hubs screened by the landscape. The magnitude of change is considered to be **low**, resulting in a **moderate** level of effect.
Cumulative Impact	**Operational** When facing the Proposed Development, Greenside and St Fergus Moss are partially visible, however are extensively screened by vegetation. Ednie Farms turbines are situated 0.8km south-west but

	would not be seen within the same view of the Proposed Development. The cumulative magnitude of change would be low. Operational, Consented St Fergus is situated 1.0km north of the viewpoint. There is potential for St Fergus and the Proposed Development to be seen within the same view at this location, however they developments would never be seen in conjunction with one another. The cumulative magnitude of change would therefore remain low. Operational, Consented, Planning There are no planned developments visible from this location and the cumulative magnitude of change would remain low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	Sensitivity:	*High*
	Magnitude:	*Low*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate*

Viewpoint 7 – A90 – A952 Junction

Figure 5.18	Viewpoint 7: A90-A952 Junction
Description	This viewpoint is located at E400498 N859371 where the A952 merges onto the A90 as it goes north. The view is situated 6.8km north-west of the Proposed Development, facing south-east. The left half of the view features rolling agricultural landscape, with Cortibrae visible amongst a small group of trees. The visible fields are separated by post-and-wire fencing and vegetation, that slope from the left of the view down to the centre where it meets the A90. The road is screened toward the viewer by a bank of vegetation, likely acting as a sound buffer. On the southern side of the of the A90 is closer in feel, with large trees lining the roadside as it travels south-east. The Lakeview Garden Centre is visible to the right extent of the view in the foreground. Other man-made infrastructure is visible across the view with telecommunication lines, electricity pylons, road signs, and turbines all within sight at this location.
Sensitivity	The view represents the users of the A90 and A952 southbound and is of **medium** sensitivity.
Magnitude of Change	The Proposed development would be located to the left of the existing Greenside and North Lothian turbines, that are visible through the trees to the centre-right of the view. Due to the tree cover on the southern edge of the A90, two of the three proposed turbines of Greenside Extension would be screened at this location. The blade tip of T3 would be visible above the trees at this location. These views may change seasonally. The vertical extent of the view is unchanged, with the horizontal extent only increasing slightly. The magnitude of change is considered to be **low**, resulting in a **moderate/minor** level of effect.
Cumulative Impact	Operational This viewpoint has a number of operational developments theoretically visible including Greenside, North Lothian, Ednie Farms, St Fergus Moss, Middleton of Rora and Auchmore within the view. All but Greenside and North Lothian are screened by trees. Hallmoss, Gowanfold, House O Hill, Cortes Gardens, Cockmuir and North Redbog are also theoretically vsibile from this location, however would not be seen in conjunction with the Proposed Development. The cumulative magnitude of change would therefore be low. Operational, Consented St Fergus would theoretically be seen between T2 and T3 of the Proposed Development. Due to the distance beyond the Proposed Development that St Fergus is located, the turbine appears lower on

	the horizon and is therefore likely to be screened. The cumulative magnitude of change would therefore be low. Operational, Consented, Planning There are no planned developments visible from this location and the cumulative magnitude of change would remain low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	Sensitivity:	*Medium*
	Magnitude:	*Low*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate/Minor*

Viewpoint 8 - Formartine and Buchan Way

Figure 5.19	Viewpoint 8: Formartine and Buchan Way
Description	This viewpoint is located at **E400930 N858278** on the Formartine and Buchan way, just as the route crosses the A952. Located 5.8km north-west of the Proposed Development, the view faces south-east. The view is characteristic of the agricultural landscape. The area is flat, with very few signs of undulation within the surroundings. The foreground is dominated by a large field used for arable farming. The boundary of this field stretches across the midground, which is post-and-wire fencing lined with low-lying vegetation. Beyond this field, there are additional fields with a similar appearance. The left mid-ground of the view features a small area of broadleaf woodland, likely implemented as a shelterbelt. These patches of woodland appear across the view at varying distances, made up of conifer and broadleaf species likely for shelterbelt purpose also. The view features scattered residential properties and farm buildings, which add to the agricultural character of the area. Additional man-made infrastructure is common here, such as electricity pylons, telecommunication lines and turbines.
Sensitivity	The view represents the users of the Formartine and Buchan Way and is therefore of **high** sensitivity
Magnitude of Change	The Proposed Development would appear to the left of the existing Greenside turbines, appearing as a logical, linear extension to this. This would increase the horizontal extent of the view at this location. Due to the flat landscape, the turbines appear at their similar scale to the existing Greenside turbines. The magnitude of change is considered to be **low**, resulting in a **moderate** level of effect.
Cumulative Impact	Operational Greenside and North Lothian are seen in conjunction with one another in the centre of the view at this location. St Fergus Moss is also visible from behind one of the shelterbelt woodland areas. The blade tips of the Ednie Farms turbines are also theoretically visible between the Greenside and St Fergus Moss, however these are screened by conifer woodland. Auchmore and Cortes Gardens are also situated within 1km of the viewpoint location, however it is only Auchmore is likely to be the only development that may be visible within the same view as the Proposed Development from this location. The cumulative magnitude of change is low. Operational, Consented St Fergus is the only consented development within the study area. When constructed, this would be seen between the Proposed Development and the existing Greenside Turbines. It is likely however due to the woodland at the Greenside turbines, the St Fergus development may be screened from view. The cumulative magnitude of change would therefore remain low. Operational, Consented, Planning

	Howford would potentially be visible from this location, however it would not be seen within the same view as the Proposed Development and would be screened by topography. Cumulative magnitude of change would therefore be low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*High*
	Magnitude:	*Low*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate*

Viewpoint 9 - Longside

Figure 5.20	Viewpoint 9: Longside	
Description	This viewpoint is located at **E404762 N847055** on a minor road off the A950 to the east of the town of Longside. The view is 8.3km south of the Proposed Development, facing north. The landscape at this viewpoint shows a gently undulating agricultural landscape. The minor road o which the view is located is situated between two fields heading north, with the sides of the road separating from the fields with post-and-wire fencing and low-lying vegetation. There are two residential dwellings that line this road, with one nestles within a small patch of woodland. Man-made infrastructure is common within this view, with telecommunication lines and turbines present throughout. In the distance to the left of the view, Mormond Hill can be seen with its telecommunication masts rising against the backdrop of the sky.	
Sensitivity	The view represents the residents of Longside and is of **high** sensitivity.	
Magnitude of Change	The Proposed Development would appear within the agricultural landscape to the west of the minor road on which the viewpoint is situated. Due to the positioning, the horizontal extent remains unchanged due to the Proposed Development appearing within the existing Greenside turbines. The Greenside Extension turbines would also be of a similar scale to the existing turbines, and the vertical extent would also remain unchanged. The magnitude of change is considered to be **negligible**, resulting in a **moderate/minor** level of effect.	
Cumulative Impact	<u>Operational</u> In addition to being situated within Greenside, St Fergus Moss and North Lothian turbines are situated directly west and would be seen in the same view. North Lothian is subject to increased screening by trees at this location and may not be visible. Middleton of Rora is theoretically visible to the right of the view however is screened by topography. Redbog, North Redbog, Cortes Garden and Cockmuir are visible to the left of the view against the backdrop of Mormond Hill. The cumulative magnitude of change is low. <u>Operational, Consented</u> St Fergus is theoretically visible when constructed at this location to the right of the view. This is however going to be a single blade tip in the bare-earth scenario. The cumulative magnitude of change would therefore remain low. <u>Operational, Consented, Planning</u> There are no planned developments visible from this location and the cumulative magnitude of change would remain low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*High*
	Magnitude:	*Negligible*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate/Minor*

Viewpoint 10 – Stirlinghill by Peterhead

Figure 5.21	Viewpoint 10: Stirling Hill by Peterhead
Description	This viewpoint is located at **E414206 N841181** on Stirling Hill to the south of Peterhead. Situated 15.1km south-east of the Proposed Development, the view faces a north-west direction. From its elevated position, a variety of land uses can be seen from this viewpoint. In the immediate foreground, the landscape is scarred by a granite quarry directly to the north. To the left of the view,

	the land is sloping and covered with agricultural land with a patchwork of woodland areas, likely acting as shelterbelts due to the proximity to the coast. The visible fields are separated with post-and-wire fencing lined with vegetation. Throughout the agricultural landscape, there is a scattering of individual residential properties, telecommunication lines and electricity pylons. Toward the right side of the view, the landscape begins to transition from agricultural to industrial. Electricity pylons begin to localise at a substation, with the Peterhead Power Station and its two chimney stacks rising up against the skyline. Beyond this, the town of Peterhead is visible next to the coastline. In land from Peterhead in the background of the view, the St Fergus Gas terminal is visible. This industrial landscape is also influenced by the turbines in the area.	
Sensitivity	The view represents the recreational users of Stirlinghill and is therefore of **high** sensitivity.	
Magnitude of Change	The Proposed Development would appear nestled amongst a number of existing developments such as Greenside, Gowanfold, and Ednie Farms. Due to this, the horizontal extent would appear unchanged, however the density of turbines visible here will increase. Due to the Proposed Development using turbines that are of similar scale to the existing Greenside turbines and the distance between the Proposed Development and the viewer, the vertical extent would also remain unchanged. The flat landscape will mean that the Proposed Development is backdropped by the sky. The magnitude of change is considered to be **low**, resulting in a **moderate** level of effect.	
Cumulative Impact	<u>Operational</u> Due to the direction of the viewpoint, most of the opposing direction from the Proposed Development is out to the North Sea. Facing inland however, there are a number of developments that are visible from this elevated position. Fourteen developments are within theoretical view here, including Greenside, St Fergus Moss and Ednie Farms. Mormond Hill provides a backdrop to the turbines positioned to the left of the view such as Redbog, North Redbog and Cockmuir. For those toward the centre and right of the view, the backdrop becomes the sky as the land flattens toward the coast. The cumulative magnitude of change would be low. <u>Operational, Consented</u> St Fergus when constructed would be visible adjacent to the St Fergus Gas Works to the left side of the view. Here, the turbines would be situated within infrastructure such as pylons and towers within the gas works. The turbines would appear taller than these, however the character of the landscape would not be altered. The cumulative magnitude of change would therefore remain low. <u>Operational, Consented, Planning</u> There is one development that is currently in planning theoretically visible from this location. Howford would be positioned behind the rolling hills to the right extent of the operational turbines, however would only appear as a blade tip and therefore is likely to be screened by vegetation.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*High*
	Magnitude:	*Low*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate*

Viewpoint 11 - Inverallochy

Figure 5.22	Viewpoint 11: Inverallochy	
Description	This viewpoint is located at **E403532 N864684** on the B9107 at the south-western limit of the town of Inverallochy approximately 9.7km north of the Proposed Development, facing south. The view immediately has a close feel, as the viewer is positioned below a field that is gently sloping upward. The left of the view shows some residential properties at the south-western edge of Inverallochy. There is a brick wall separating the field from the houses. As the view spans to the right, the field opens out and spans the remainder of what is visible in this direction, some areas further screened by vegetation visible from the roadside on the north-western edge of the field. There is some infrastructure visible above the rolling slope in the form of a telecommunication mast and two high frequency transmitter masts which are located at the RNAS Rattray base, currently operated by Babcock International on behalf of the Ministry of Defence. To the right extent of the view, the Gowanfold turbines are visible on within the field.	
Sensitivity	The view represents the residents of Inverallochy and users of the B9107 and is of **high** sensitivity.	
Magnitude of Change	The Proposed Development is theoretically visible from the on the ridgeline between Ednie Farms and North Lothian/St Fergus Moss. The existing Greenside turbines would be visible behind the Proposed Development. Due to this, the horizontal extent would appear unchanged, however the density of turbines visible will increase due to the positioning of Greenside Extension from this location. Due to the Proposed Development using turbines that are of similar scale to the existing Greenside turbines and the distance between the Proposed Development and the viewer, the vertical extent would also remain unchanged. The flat landscape will mean that the Proposed Development is backdropped by the sky. The magnitude of change is considered to be **low**, resulting in a **moderate** level of effect.	
Cumulative Impact	<u>Operational</u> Within this viewpoint, two Gowanfold turbines catch the eye of the viewer due to their size and scale in the foreground to the right of what is visible. In addition to this, the Hallmoss turbine is also noticeable to the left of the view in the midground. The center of the view features Ednie Farms, Greenside, North Lothian and St Fergus Moss are theoretically visible beyond the field boundaries in the background. Due to the presence of turbines in the fore and midgrounds, and other tall structures in the area, these turbines blend into the horizon. The cumulative magnitude of change would be low. <u>Operational, Consented</u> The turbines at St Fergus are the only consented turbines that would have theoretical visibility at this viewpoint. Here, the turbines would be situated within infrastructure such as pylons and masts. The three masts situated around where the turbines are proposed would likely draw the attention of the viewer. The cumulative magnitude of change would therefore remain low. <u>Operational, Consented, Planning</u> There are no planned developments visible from this location and the cumulative magnitude of change would remain low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*High*
	Magnitude:	*Low*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate*

Viewpoint 12 – Mormond Hill

Figure 5.23	Viewpoint 12: Mormond Hill	
Description	This viewpoint is located at **E398333 N856849** on Mormond Hill. Situated 9.8km to the north-west of the Proposed Development, the view faces south-east. The view is open and expansive from its position on the slopes of Mormond Hill. The foreground and midground landscape is a patchwork of large agricultural fields, most of irregular shape. The field boundaries are outlined by vegetation, with scattering of shelterbelt woodland of mixed species. Amongst this landscape, turbines are a common feature, along with electricity pylons and large farm buildings. To the left of the view, the Loch of Strathbeg can be seen before the landscape reaches the coastline. The small village of Crimond is also in view to the right of the loch. The background of the view shows views of the North Sea, and the infrastructure that lines the coast such as St Fergus Gas Works and Peterhead Power Station. To the left of the power station, the town of Peterhead is visible in the distance.	
Sensitivity	The view represents the recreational users of Mormond Hill and is of **high** sensitivity.	
Magnitude of Change	The Proposed Development would be situated to the left of the existing Greenside turbines, extending the horizontal spread of the Greenside development when fully constructed. Due to the design of the Proposed Development, from this view, the turbines would appear closely packed together, minimising their spread. Vertically, the Proposed Development will appear as the same height at Greenside, and will have the backdrop of other towers at the Peterhead Gas Works. The magnitude of change is considered to be **low**, resulting in a **moderate** level of effect.	
Cumulative Impact	<u>Operational</u> There are seven operational developments within the view, with the addition of other turbines that are under 50m to tip height. Most developments are scattered across the landscape and are of a similar scale to the Proposed Development. The cumulative magnitude of change would therefore be negligible. <u>Operational, Consented</u> The St Fergus turbines would be visible to the right of the Proposed Development, with a backdrop of the North Sea directly behind. These turbines would be of an existing scale to those surrounding, so vertical extent would remain unchanged. However, the horizontal spread of turbines would increase. The distance of this development does minimise their impact on the surrounding landscape. The cumulative magnitude of change would therefore increase to low. <u>Operational, Consented, Planning</u> There are no planned developments visible from this location and the cumulative magnitude of change would remain low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*High*
	Magnitude:	*Low*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate*

Viewpoint 13 – Culsh Monument

Figure 5.24	Viewpoint 13: Culsh Monument
Description	This viewpoint is located at **E388127 N848317** at the Culsh Monument in Aberdeenshire. This location is 19.1km south-west of the Proposed Development, facing north-east.

	The view from the Culsh Monument overlooks a rolling agricultural landscape with agricultural fields of varying sizes across the area. The fields are separated with post-and-wire fencing and vegetation and are used for both pastoral and arable means. These field perimeters are intermittently also lined with small areas of shelterbelt mixed woodland. Farm buildings are also intermittently scattered within the landscape. To the left of the view in the midground, a castle ruin is visible. Mormond Hill is the highest elevation in the area at the left of the view, with three telecommunications masts visible at the summit. A couple of single turbines are also visible at this location, adding to the infrastructure. In the background to the right extent of the view, one of the cooling towers at Peterhead Power Station is visible in the distance toward the North Sea.	
Sensitivity	The view represents visitors to the Culsh Monument and is of **high** sensitivity.	
Magnitude of Change	The Proposed Development would be screened by the landscape so that only the very tip of the blades are theoretically visible above the ridgeline. Due to the trees that appear at the top of this ridge, these blade tips would be screened for as long as the trees remain at this location. Therefore, it is likely the Proposed Development would not be visible at this viewpoint. The horizontal and vertical extents would be unchanged. The magnitude of change is considered to be **negligible**, resulting in a **moderate/minor** level of effect.	
Cumulative Impact	**Operational** There are a number of developments at this viewpoint, scattered across the ridgeline. Most that are screened by the trees on the ridgeline, like the Proposed Development. White Cow Wood and Clayfords are visible on the viewers side of the ridge, with Clayfords having Mormond Hill as its backdrop. The cumulative magnitude of change is therefore negligible. **Operational, Consented** St Fergus, like the Proposed Development, would have visible blade tips behind the ridge. Due to this, it is likely that upon construction these blade tips would be screened by trees and therefore not be seen by the viewer. The cumulative magnitude of change would remain negligible. **Operational, Consented, Planning** Howford when constructed would be situated to the right of Clayfords, sharing the backdrop of Mormond Hill. This turbine would be smaller in scale to Clayfords, and therefore would appear within the trees at the foot of Mormond Hill. Due to the addition of this turbine in the landscape, the cumulative magnitude of change would be low.	
Type of Effect	On completion of the development the visual effect from this viewpoint would be permanent (reversible) and direct. The development would lead to a medium magnitude of change and despite the careful design of the project a manmade vertical structure in this area would always lead to a negative effect.	
Assessment of Visual Effects	**Sensitivity:**	*High*
	Magnitude:	*Negligible*
	Type of Effect:	*Permanent, direct and negative*
	Level of Effect:	*Moderate/Minor*

6 Cultural Heritage and Archaeology

6.1 Introduction

Cultural heritage is represented by a wide range of features, both above and below ground, which result from past human use of the landscape. These include standing buildings, many of which are still in use; sub-surface archaeological remains and artefact scatters; industrial remains; earthwork monuments and landscape features such as field boundaries. The aim of this study is to identify elements of cultural heritage value that may be impacted upon by the Proposed Development.

6.2 Legislation, Policy and Guidance

Statutory, general, national and local guidance for assessing the potential impact of renewable energy developments on heritage assets is given in:

6.2.1 Legislation

National legislation relating to the planning and protection of cultural heritage assets includes:

- *The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017;*
- *Historic Environment Scotland Act 2014;*
- *Ancient Monuments and Archaeological Areas Act 1979; and*
- *Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997.*

6.2.2 Policy

National and local planning policy relating to the Proposed Development Site includes:

- *National Planning Framework for Scotland 4 (NPF4),* Scottish Government, 2023;
- *Historic Environment Policy for Scotland,* Historic Environment Scotland, May 2019;
- *Planning Advice Note (PAN) 2/2011 – Planning and Archaeology, Scottish Government,* 2011;
- *Policy HE1 Protecting Listed Buildings, Scheduled Monuments and Archaeological Sites (including other historic buildings)*, Aberdeenshire Local Development Plan, Aberdeenshire Council, 2023; and
- *Policy HE2 Protecting Historic, Cultural and Conservation Areas*, Aberdeenshire Local Development Plan, Aberdeenshire Council, 2023.

6.2.3 Guidance

In addition to the above legislation and policy, a number of guidance documents have been produced relating to assessment and protection of cultural heritage assets.

- *Environmental Impact Assessment Handbook,* NatureScot and Historic Environment Scotland, 2018;
- *Historic Environment Circular 1,* Historic Environment Scotland, June 2016;
- *Managing Change in the Historic Environment: Setting,* Historic Environment Scotland, June 2016 (updated
- 2020); and
- *Designation Policy and Selection Guidance,* Historic Environment Scotland, April 2019 (updated 2020).
- *Supplementary Guidance Historic Environments 1 - Listed Buildings*, Aberdeenshire Council, April 2017;

- *Supplementary Guidance Historic Environments 2 – Conservation Areas*, Aberdeenshire Council, April 2017;
- *Supplementary Guidance Historic Environments 3 – Historic Gardens and Designed Landscapes*, Aberdeenshire Council, April 2017; and
- *Supplementary Guidance Historic Environment 4: Archaeological sites and monuments,* Aberdeenshire Council, 2017.

6.3 Assessment Methodology

In the preparation of this assessment, a range of historical and technical data was collected and analysed. This includes a review of all potential features that fall under the umbrella term of cultural heritage, such as historic buildings and landscapes. The following sources were used to locate features and collect the information required for the assessments within this chapter:

- Aberdeenshire Local Historic Environment Record (HER)[20];
- The National Record of the Historic Environment (NRHE)[21];
- National Collection of Aerial Photography (NCAP) held by Historic Environment Scotland (HES)[22];
- National Library of Scotland (Map Library)[23]; and
- HES's database of; Listed Buildings (LBs), Scheduled Monuments (SMs), Gardens and Designed Landscapes (GDLs), Conservation Areas, Inventory Battlefields, World Heritage Sites and monuments proposed for scheduling[24].

6.3.1 Assessment Approach

6.3.1.1 Physical Impacts and Effects

The area most at risk of physical impact was assessed to be land 50m either side of proposed access tracks and infrastructure and within 200m of the proposed turbine locations. These elements are mapped and shown on Figure 6.1.

6.3.1.2 Setting Impacts and Effects

The impacts on setting and character of known heritage assets have been considered within this assessment. Nationally significant features such as SMs, Category 'A' LBs, GDLs and Inventory Battlefields are considered within 10km of the Proposed Development. Heritage assets such as Conservation Areas and Category 'B' LBs are considered within 2km of the Proposed Development and are shown in Figure 6.2.

This assessment will consider the potential for impacts upon the setting of designated assets, including views both to and from the assets and any impacts to sense of place, sense of remoteness, cultural identity, evocation of historical past and associated spiritual responses.

6.3.2 Figures and Visual Aids

The assessment has made use of the following visual aids:

[20] https://online.aberdeenshire.gov.uk/smrpub/master/default.aspx?Authority=Aberdeenshire – Accessed 12/01/2024
[21] https://canmore.org.uk/– Accessed 12/01/2024
[22] https://ncap.org.uk/– Accessed 12/01/2024
[23] https://maps.nls.uk/index.html– Accessed 12/01/2024
[24] http://portal.historicenvironment.scot/– Accessed 12/01/2024

- Zone of Theoretical Visibility (ZTV), map areas where the wind turbine is theoretically visible. This is a 'bare earth' representation which does not account for local screening from the natural and built environment.
- Wirelines representing the inherent topography of the surrounding area produced using the ReSoft WindFarm software.

Visual representations have been produced where it was considered to be helpful in visualising the potential visual impact of the development.

The figures included in this assessment are as follows:

- Figure 6.1 – Heritage Assets within the Site;
- Figure 6.2 – Heritage Assets within 10km of the Site.

6.3.3 Limitation of Scope

Data on designated assets was downloaded from Historic Environment Scotland Download Portal in November 2023. The Aberdeenshire Historic Environment Record was reviewed in November 2023. The assessment does not include any assets that have been added to these data sets or records beyond these dates.

6.3.4 Assessment Criteria

The following general criteria outlined in Table 6.1 and Table 6.2 have been used in the assessment of level of effect of any direct or indirect impact on all sites of cultural heritage importance within the study radius.

Table 6.1 - Sensitivity of Heritage Assets

Sensitivity	Definition
High	Category A Listed Buildings Scheduled Monuments Gardens and Designed Landscapes World Heritage Sites Inventory Battlefields Non-designated heritage assets likely to be of national importance
Medium	Category B Listed Buildings Category C Listed Buildings Conservation Areas Non-designated assets likely to be of regional importance
Low	Non-designated heritage assets likely to be of local importance Non-Inventory Gardens and Designed Landscapes

Table 6.2 - Magnitude of change

Magnitude	Definition
High	Any number of wind turbines and/or ancillary development that would result in: • the removal or partial removal of key features, areas, or evidence important to the historic character and integrity of the heritage asset, which could result in the substantial loss of physical integrity; and/or • a substantial obstruction or addition to the setting where it significantly alters the quality, setting or the visual amenity of the feature in views both to and from.
Medium	Any number of wind turbines and/or ancillary development that would result in:

Magnitude	Definition
	• the removal of one or more key features, parts of the heritage asset, or evidence at the secondary or peripheral level, but are not features fundamental to its historic character and integrity; and/or • a partial obstruction or addition to the setting where it alters the quality, setting or the visual amenity of the heritage asset in views both to and from.
Low	Any number of wind turbines or ancillary developments that may result in: • a partial removal/minor loss, and/or alteration to one or more peripheral and/or secondary elements/features, but not significantly affecting the historic integrity of the heritage asset or affect the key features of the heritage asset; and/or • an introduction of elements that could alter to a small degree the quality of the setting or visual amenity of the heritage assets in views both to and from.
Negligible	Any number of wind turbines or ancillary developments that may result in: • a relatively small removal, and/or alteration to small, peripheral and/or unimportant elements/features, but not affect the historic integrity of the heritage assets or the quality of the surviving evidence; and/or • an introduction of elements that could be visible but not intrusive, and the overall quality of the setting or visual amenity of the heritage assets would not be affected in views both to and from.
No Change	There would be no change to the baseline.

The level of effects that the proposed wind turbines may have on the surrounding features of historical significance is determined by the combination of the sensitivity and magnitude of change. The following matrix is used to determine the overall level of effect.

Table 6.3 - Significance of Effects Matrix

Sensitivity	Magnitude of Change				
	High	Medium	Low	Negligible	No Change
High	Major	Major/Moderate	Moderate	Moderate/Minor	None
Medium	Major/Moderate	Moderate	Moderate/Minor	Minor	None
Low	Moderate	Moderate/Minor	Minor	Minor/Negligible	None
Key:		Significant in terms of the EIA regulations			
		Not Significant			

6.4 Baseline

6.4.1 Physical Impacts

There is potential for features of historical significance within 200m of the proposed turbine locations and 50m of any proposed infrastructure, to be physically affected by the Proposed Development. Table 6.1 below lists the features which fall within this study area, and they can be seen on Figure 6.1.

Table 6.4 - Heritage Assets within 200m of turbines and 50m of all other Proposed Development components

Ref	Type	Monument ID	Name	Feature	Distance to closest component
HER01	Locally Designated Heritage Site and NRHE	Primary Reference: NK05SE0033	Greenwellheads	Site of a farmstead (Destroyed)	5.6m (Track)

		Canmore ID: 275825			
HER02	NRHE	Canmore ID: 275825	Greenwellheads	Farmhouse/ farmstead (Period Unassigned)	68.7m (Track)

The closest feature has been found to be within 0m of the compound and would be within the area of ground-breaking. An assessment of the physical impact on the features listed in Table 6.4 has been carried out.

6.4.2 Setting Impacts

Figure 6.2 show the theoretical visibility of the Proposed Development in relation to all designated heritage assets within their relevant study areas; they illustrate nationally significant features out to 10km such as 'A' LBs SMs, GDLs and Inventory Battlefields and heritage assets such as Category B LBs and Conservation Areas out to 2km.

Table 6.5 below lists the heritage assets found within the wider 10km study radius.

The assessment will focus on heritage assets within the ZTV, those with an outward setting and any other of the key features which may have the potential to be significantly affected by the Proposed Development. Those features taken forward are highlighted green.

Table 6.5 - Heritage Assets within 10km of the Proposed Development

Reference	Distance from closest Turbine	Schedule/Listing	Name	Scope In or Out
Scheduled Monuments				
SM01	2.4km	SM11119	Crimond old parish church, 240m NW of Kirkton Croft	Scoped into Assessment
SM02	2.5km	SM35	Netherton,standing stones & stone circle	Scoped into Assessment
SM03	2.9km	SM3303	Burgh of Rattray, St Mary's Chapel and Castle Hill, Old Rattray	Scoped into Assessment
SM04	3.3km	SM4331	Loch of Strathbeg, windmill W of	Scoped into Assessment
SM05	3.2km	SM11311	Rattray Line, pill box 640m SE of Rattray House	Scoped into Assessment
SM06	3.3km	SM11310	Rattray Line, pill box 585m SE of Rattray House	Scoped out of Assessment as it is not included in the ZTV.
SM07	3.4km	SM11312	Rattray Line, pill box 855m SE of Rattray House	Scoped out of Assessment as it is not included in the ZTV.
SM08	3.4km	SM11313	Rattray Line, pill box 1150m SSE of Home Farm	Scoped into Assessment
SM09	3.5km	SM11309	Rattray Line, pill box 650m E of Rattray House	Scoped into Assessment
SM10	3.5km	SM11320	Rattray Line, pill box 1550m SSE of Home Farm	Scoped into Assessment
SM11	3.7km	SM8	Berrybrae, stone circle 470m NNE of	Scoped into Assessment
SM12	3.8km	SM11314	Rattray Line, pill box 960m NNW of Annachie Bridge	Scoped into Assessment

Reference	Distance from closest Turbine	Schedule/Listing	Name	Scope In or Out
SM13	4.0km	SM11308	Rattray Line, pill box 780m ENE of Middleton of Rattray	Scoped into Assessment
SM14	4.1km	SM11316	Rattray Line, pill box 675m NE of Old Rattray	Scoped into Assessment
SM15	4.3km	SM11317	Rattray Line, pill box 875m ENE of Old Rattray	Scoped out of Assessment as it is not included in the ZTV.
SM16	4.3km	SM11318	Rattray Line, pill box 460m WNW of Seatown	Scoped out of Assessment as it is not included in the ZTV.
SM17	4.5km	SM11307	Rattray Line, pill box 55m SE of Rattray Head Shore Station	Scoped into Assessment
SM18	4.5km	SM11319	Rattray Line, pill box at Seatown	Scoped into Assessment
SM19	4.5km	SM11315	Rattray Line, pill box 80m E of Annachie Bridge	Scoped out of Assessment as it is not included in the ZTV.
SM20	6.7km	SM5622	St Fergus's Church,old parish church	Scoped into Assessment
SM21	7.1km	SM2496	Ravenscraig Castle	Scoped out of Assessment as it is not included in the ZTV.
SM22	7.1km	SM11137	West Cockmuir, enclosure 100m N of	Scoped into Assessment
SM23	7.4km	SM3259	Castle Hill,motte SW of Hallmoss Farm	Scoped into Assessment
SM24	7.9km	SM11116	St Combs, St Columba's Church	Scoped into Assessment
SM25	7.8km	SM98	Inverugie Castle	Scoped out of Assessment as it is not included in the ZTV.
SM26	7.9km	SM97	Inverallochy Castle	Scoped into Assessment
SM27	8.0km	SM11138	Knockmonean Cairn	Scoped into Assessment
SM28	8.1km	SM3999	Mount Pleasant,enclosure	Scoped into Assessment
SM29	8.1km	SM5810	St Ethernan's,Rathen old parish church	Scoped out of Assessment as it is not included in the ZTV.
SM30	8.6km	SM11141	Trefor Hill, motte	Scoped out of Assessment as it is not included in the ZTV.
SM31	8.7km	SM72	Gaval, standing stone 250m SW of	Scoped into Assessment
SM32	9.1km	SM7143	Fetterangus Church	Scoped out of assessment due to lack of visibility.
SM33	9.1km	SM71	Fetterangus Church, symbol stone	Scoped out Assessment due to lack of visibility.
SM34	9.1km	SM11024	Mormond Hill, cairn 410m NNE of Mormond Farm	Scoped into Assessment

Reference	Distance from closest Turbine	Schedule/Listing	Name	Scope In or Out
Category 'A' Listed Buildings				
LB1	1.6km	LB3028	Parish church of Crimond including enclosing walls railings and gates	Scoped into Assessment
LB3	2.3km	LB3034	Haddo House Mains of Haddo	Scoped into Assessment
LB4	3.9km	LB9270	Crimonmogate House	Scoped into Assessment
LB5	5.3km	LB9264	Cairness House, South Lodges, Gates and Railings	Scoped into Assessment
LB6	6.0km	LB9263	Cairness House	Scoped into Assessment
LB7	8.4km	LB9410	Old Parish Church of Longside	Scoped into Assessment
LB8	8.4km	LB9412	Churchyard Gateway, Longside Parish Church	Scoped into Assessment
LB9	9.6km	LB16143	Cairnbulg Castle	Scoped out of Assessment as it is not included in the ZTV.
Category 'B' Listed Buildings				
LB2	1.6km	LB3029	Old School and Schoolhouse, Crimond	Scoped into Assessment
Garden and Designed Landscapes				
GDL1	2.9km	GDL00397	Crimonmogate	Scoped into Assessment
GDL2	5.4km	GDL00396	Cairness	Scoped into Assessment

While there are a number of features present within the study area, not all of these will have visibility of the Proposed Development or an outward setting and as such, have been scoped out. The heritage assets outlined in Table 6.6 below have an outward setting and/or theoretical visibility of the Proposed Development and will, therefore, be included in the assessment.

Table 6.6 - Heritage Assets Scoped into Setting Assessment

Ref	Distance from Turbine	Schedule/Listing	Name	Description
SM01	2.4km	SM11119	Crimond old parish church, 240m NW of Kirkton Croft	The monument consists of the fragmentary remains of the old parish church of Crimond, and its burial ground. The remains of the church are believed to have been built in the early 15th century, although the single remaining wall exhibits evidence of later alterations, and earlier description of the building suggest it was repaired just after the Reformation.
SM02	2.5km	SM35	Netherton, standing stones & stone circle	Netherton Stone Circle in Aberdeenshire is a well preserved example of a recumbent Stone Circle.

Ref	Distance from Turbine	Schedule/Listing	Name	Description
				Most of the circle is complete with both flankers upstanding but the circle is in a copse of trees which threaten the integrity of the circle. Outside the circle is bounded by a wall.
SM03	2.9km	SM3303	Burgh of Rattray, St Mary's Chapel and Castle Hill, Old Rattray	The monument comprises the site of the deserted burgh of Rattray, including the remains of the medieval chapel of St Mary and the site of the castle.
SM04	3.3km	SM4331	Loch of Strathbeg, windmill W of	The monument comprises a windpump of late 18th century date, which survives as a largely intact upstanding building. The monument was first scheduled in 1981 and this is being revised in order to include some of the surrounding ground.
SM05	3.2km	SM11311	Rattray Line, pill box 640m SE of Rattray House	The monument comprises the remains of a well-preserved pill box situated behind the dune system stretching from the Rattray Head lighthouse shore station to the south, part of a larger defensive anti-tank stop line of 14 intervisible pill boxes and associated defences erected during World War II to protect against landings on the beach south of Rattray Head
SM08	3.4km	SM11313	Rattray Line, pill box 1150m SSE of Home Farm	The monument comprises the remains of a well-preserved pill box situated behind the dune system stretching from the Rattray Head lighthouse shore station to the south. The pill box is part of a larger defensive anti-tank stop line of 14 intervisible pill boxes and associated defences erected during World War II to protect against landings on the beach south of Rattray Head.
SM09	3.5km	SM11309	Rattray Line, pill box 650m E of Rattray House	The monument comprises the remains of a well-preserved pill box situated behind the dune system stretching from the Rattray Head lighthouse shore station to the south, part of a larger defensive anti-tank stop line of 14 intervisible pill boxes and associated defences erected during World War II to protect against landings on the beach south of Rattray Head.
SM10	3.5km	SM11320	Rattray Line, pill box 1550m SSE of Home Farm	The monument comprises the remains of a well-preserved pill box situated behind the dune system stretching from the Rattray Head lighthouse shore station to the south. The pill box is part of a larger defensive anti-tank stop line of 14 intervisible pill boxes and associated defences erected during World War II to protect against landings on the beach south of Rattray Head.
SM11	3.7km	SM8	Berrybrae, stone circle 470m NNE of	The monument comprises a stone circle of prehistoric date, visible as a series of upstanding and prostrate stones. Stone settings of this type are characteristic of the Neolithic and Bronze Age.
SM12	3.8km	SM11314	Rattray Line, pill box 960m NNW of Annachie Bridge	The monument comprises the remains of a well-preserved pill box situated behind the dune system stretching from the Rattray Head lighthouse shore station to the south. The pill box is part of a larger defensive anti-tank stop line of 14 intervisible pill boxes and associated defences erected during World War II to protect against landings on the beach south of Rattray Head.

Ref	Distance from Turbine	Schedule/Listing	Name	Description
SM13	4.0km	SM11308	Rattray Line, pill box 780m ENE of Middleton of Rattray	The monument comprises the remains of a well-preserved pill box situated behind the dune system stretching from the Rattray Head lighthouse shore station to the south. The pill box is part of a larger defensive anti-tank stop line of 14 intervisible pill boxes and associated defences erected during World War II to protect against landings on the beach south of Rattray Head.
SM14	4.1km	SM11316	Rattray Line, pill box 675m NE of Old Rattray	The monument comprises a well-preserved pill box situated behind a dune system stretching from Rattray Head to the south. The pill box is part of a larger defensive anti-tank stop line of 14 intervisible pill boxes and associated defences built during World War II to protect against landings on the beach south of Rattray Head. Only the pill boxes now remain.
SM17	4.5km	SM11307	Rattray Line, pill box 55m SE of Rattray Head Shore Station	The monument comprises the remains of a well-preserved pill box situated behind the dune system stretching from the Rattray Head lighthouse shore station to the south, part of a larger defensive anti-tank stop line of 14 intervisible pill boxes and associated defences erected during World War II to protect against landings on the beach south of Rattray Head.
SM18	4.5km	SM11319	Rattray Line, pill box at Seatown	The monument comprises the remains of a well-preserved pill box situated behind a dune system stretching from Rattray Head south. The pill box is part of a larger defensive anti-tank stop line of 14 intervisible pill boxes and associated defences built during World War II to protect against landings on the beach south of Rattray Head and against attacks on Rattray (Crimmond) Airfield. Only the pill boxes now remain.
SM20	6.7km	SM5622	St Fergus's Church,old parish church	The monument consists of the remains of a medieval church dedicated to St Fergus, originally the parish church of Inverugie. The much-reduced remains of the church stand in an old graveyard amidst an area of sand-dunes. The church was abandoned when the people moved landward to escape the encroaching sand. In 1603, the presbytery recorded that "Both kirk and kirkyard is ouircassin with the sand." All that survives upstanding of the church are stretches of the opposing N and S walls.
SM22	7.1km	SM11137	West Cockmuir, enclosure 100m N of	The monument comprises an enclosed settlement of prehistoric date, visible as a cropmark on oblique aerial photographs.
SM23	7.4km	SM3259	Castle Hill, motte SW of Hallmoss Farm	The mound known as the Castlehill of Inverugie was the site of the early earthwork castle of the Cheynes, who held the barony of Inverugie in the 13th century.
SM24	7.9km	SM11116	St Combs, St Columba's Church	The monument consist of the fragmentary remains of the medieval parish church of St Combs (St Columba) which served the parish of Lonmay. The monument stands within a burial ground which almost lies within sand dunes overlooking St Combs Haven.
SM26	7.9km	SM97	Inverallochy Castle	The monument comprises the remains of Inverallochy Castle, a massive but ruinous castle situated on an area of flat coastal plain,

Ref	Distance from Turbine	Schedule/Listing	Name	Description
				which in the past must have been quite marshy. The monument was first scheduled in 1960.
SM27	8.0km	SM11138	Knockmonean Cairn	The monument comprises a cairn of prehistoric date, visible as a grass-covered mound. The cairn is situated on the summit of a small knoll at about 45m O.D. and measures c. 19m in diameter. It comprises an extant mound composed of earth and stone with maximum height of c. 1.6m above the present ground surface.
SM28	8.1km	SM3999	Mount Pleasant, enclosure	There is a small fort at Mount Pleasant, directly opposite to the House of Inverugie, of which the moat, parapet, footbank, bastions etc. are conspicuous.
SM31	8.7km	SM72	Gaval, standing stone 250m SW of	The monument comprises a standing stone located on an E-facing hillslope 250m SW of Gaval.
SM34	9.1km	SM11024	Mormond Hill, cairn 410m NNE of Mormond Farm	The monument comprises a cairn of prehistoric date, visible as a gorse-covered stony mound. The monument is situated within rough grassland on a prominent spur on the southern slopes of Mormond Hill at between 180-190m O.D.
LB1	1.6km	LB3028	Parish Church Of Crimond Including Enclosing Walls Railings And Gates	1812; Gothick jerkin-head roofed rectangle harled with granite margins, original glass except at E. window, small W. tower with octagonal belfry stage and spire; clock. Session house dated 1854, internal alterations 1895, interior recast 1905 (retaining the R-doric columns of the galleries). Good original railings and w.i. gates of interesting design.
LB3	2.3km	LB3034	Haddo House, Mains of Haddo	Mid 18th century, apparently two building dates. 2-storey and attic T-plan, symmetrical. 6-window front, red sandstone chamfered arrises at ground floor, rounded at 1st (all chamfered at rear), centre doorpiece with segmental pediment having 5 incised keys, circular moulded panel over. Single centre swept dormer. Inscribed skewputs (., B.M.C.) only
LB4	3.9km	LB9270	Crimonmogate House	Archibald Simpson circa 1825. Neo-Greek. 2-storey ashlar granite with tall single storey centre section on S. front with advanced hexastyle unfluted Doric pedimented portico, with very short returns to antae between advanced single bay wings; 7-window E. front, centre 3 bowed. Maniard roof and dining room addition circa. 1860. Very fine interior work, cube central hall with Apollo Didyma type anta capitals, coffered ceiling and centre dome, other interiors simply but distinctively treated.
LB5	5.3km	LB9264	Cairness House, South Lodges, Gates and Railings	Designed by James Playfair (circa 1791-97), erected 1891 on occasion of Cairness House centenary. Outstanding principal approach to Cairness House with monolithic rusticated square-section gatepiers and sphinxes, linked by low walls with inset decorative ironwork railings to single storey, square-plan, pavilion-roofed lodges with pedimented centres incorporating arched windows in arched recesses flanked by niches. Ashlar with rock-

Ref	Distance from Turbine	Schedule/Listing	Name	Description
				faced base course, incised frieze, cornice, blocking course and fluted central stacks.
LB6	6.0km	LB9263	Cairness House	Replaced an earlier house of 1781 by Robert Burn,; enlarged and re-worked by James Playfair 1791-7, portico working drawings by Sir John Soane to Playfair design, for Charles Gordon of Buthlaw. French Neo-classic of Boullee Ledoux School, of outstanding merit inside and out. Main block 2-storey and basement 5-window centre original house with 3-storey advanced wings, 1-window to front with pedimented ground floor tripartites, 5 windows down flanks; tetrastyle R-doric porch with steps and broken column pedestals; cast iron columnar chimneys. Great 2-storey hemicycle of offices to rear with gables having proto-doric columns set in blind lunettes showing to main front, remarkable pend arch in semicircle of voussoirs diminishing in depth to crown, cupola over; circular ice-house in court.
LB7	8.4km	LB9410	Old Parish Church of Longside	Dated 1620 bellcote and S.E. skew, 16GB/MM. S.W. skew. Roofless rectangle, rubble-built, irregular fenestration, S. wall with double arched panel monument on exterior, W. gable with round arched doorway having red voussoirs, fine birdcage bellcote with cornice and gabled roof running E-W.
LB8	8.4km	LB9412	Churchyard Gateway, Longside Parish Church	Circa 1620(?). Moulded semi-circular arch, recesses within, curved wing walls to churchyard wall. Top cornice, originally gabled or pedimented with sundial and 1705 finial above.
LB2	1.6km	LB3029	Old School and Schoolhouse, Crimond	1791. 2-storey 4-window harled without margins, skewputs and coped chimneys; original glazing, later porch.
GDL1	2.9km	GDL00397	Crimonmogate	Crimonmogate contains an outstanding collection of architectural features, most notably Crimonmogate House, by Archibald Simpson. The polices are currently undergoing a long-term programme of renewal, with planting and thinning projects improving the quality of the woodland resource and adding to the range of tree and shrub specimens in the vicinity of the house.
GDL2	5.4km	GDL00396	Cairness	Tree planting in and around the main park aims to recreate the late 18th century landscape setting of Cairness House, as set out by landscape designer Thomas White (c.1793-1811). This unusual project will bear fruit in the coming decades and the new plantations, together with the existing mature timber will make a major contribution to the scenic value of this open, agricultural landscape. Playfair's neoclassical house, south lodges and gateway are of exceptional architectural merit.

6.5 Assessment of Impacts and Effects

6.5.1 Physical Impacts

One known archaeological feature was found to be within the development footprint of the Proposed Development during the desk-based assessment. One additional feature was found to be within 200m of the proposed turbine locations. The potential direct impact of the Proposed Development infrastructure on these features and on unknown archaeological features is assessed in Table 6.7 below.

Table 6.7 - Effects and Evaluation of Significance: Direct Effect Features

Feature	Sensitivity	Magnitude	Significance	Assessment
HER01	Medium	Negligible	Minor	The edge of the farmsteads remains are immediately next to existing access tracks. There are no upstanding remains and the feature is not visible on satellite imagery, but it is likely that archaeology would remain sub surface. There may some further impact due to vehicle movements during construction and decommission. Given that the tracks are pre-existing there is unlikely to be a further loss of information. The sensitivity of this feature is medium, the magnitude of change is negligible resulting in a **minor** level of effect which is not significant.
HER02	Medium	Negligible	Minor	This feature is outwith the area of groundbreaking. The feature survives as upstanding remains, however due to the distance from the Proposed Development, loss of information is unlikely to occur. The sensitivity of this feature is medium, the magnitude of change is negligible resulting in a **minor** level of effect which is not significant.
Unrecorded Archaeology	Unknown	Unknown	Unknown	The small areas of intrusive works are unlikely to have a significant impact on any archaeological remains. Should any features be uncovered, a suitable programme of works will be implemented.

6.5.2 Setting Impacts

6.5.2.1 Heritage Assets within 10km of the Proposed Development

Table 6.1 below assesses the setting impacts on heritage assets within 10km of the Proposed Development. The assessment focuses on heritage assets within the ZTV and heritage assets have been grouped together for assessment where appropriate.

Table 6.8 - Heritage Assets Within 10km of the Proposed Development

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
SM01	Crimond old parish church, 240m NW of Kirkton Croft	The feature is surrounded by a dense band of mature trees which provide an enclosed setting and prevent most outward views. Some glimpses of the Proposed Developmentmay be possible through gaps within the trees however these would be rare and so the Proposed Development would not be a prominent feature from the Scheduled Monument. The addition of the Proposed Development is	3	3	2.4km	High	Negligible	Moderate/Minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		unlikely to impact the features setting, which already includes the existing Greenside wind farm, and with no intervisibility, the ability to appreciate the feature and it's setting would remain intact.						
SM02	Netherton, standing stones & stone circle	The stone circle is sheltered by a pocket of trees which provides it with an enclosed setting. During winter months with less vegetative cover, glimpses of the Proposed Development may be visible. Farm buildings are located between the feature and the Proposed Development which have influence over the setting of the feature and would further screen	3	3	2.5km	High	Negligible	Moderate/Minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		visibility. Due to the enclosed nature of the feature and lack of prominence, intervisibility is unlikely to occur. As such, the ability to appreciate the feature and it's setting would remain intact.						
SM03	Burgh of Rattray, St Mary's Chapel and Castle Hill, Old Rattray	This feature has an open setting with widespread views. Some intervening vegetation between the feature and the Proposed Development may partially screen visibility however it is likely that the Proposed Development will be seen from most of the feature. Although visible, the Proposed Development would not be overly prominent and would	3	3	2.9km	High	Low	Moderate

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		not detract from the ability to appreciate the features. The presence of buildings, overhead lines and the existing Greenside wind turbines mean that the Proposed Development would not create material contrast to the baseline and setting.						
SM04	Loch of Strathbeg, windmill W of	This feature has a fairly open setting, visibility of the Proposed Development would be likely with some partial screening from intervening vegetation. The setting of the feature already includes surrounding man-made structures such as overhead lines and residential buildings as well as the existing Greenside wind farm which would be	3	3	3.3km	High	Low	**Moderate**

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		visible behind the Proposed Development. The addition of the Proposed Development therefor would not create material contrast to the baseline. Although visible, the Proposed Development would not detract from the feature or the ability to appreciate it. The upstanding nature of the feature allows for the possibility of intervisibility however this would be alongside other man made features.						
SM08, SM09, SM10, SM12, SM13, SM14, SM17, SM18	Rattray Line, pill boxes	This group of pill boxes lie along the coastline and have some predicted theoretical visibility of the Proposed Development from the hub upwards.	3	3	3.2 – 4.5km	High	Negligible	**Moderate/Minor**

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		There would likely be screening from intervening vegetation which would further restrict visibility from the features. Their position along the coast is key to their function and setting meaning that inland development would not likely have an impact on this. Additionally, their setting already includes views of St. Fergus gas terminal and further man-made structures including overhead lines and the existing Greenside wind farm. The addition of the Proposed Development would not create material contrast to the baseline and would						

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		not detract from the features.						
SM11	Berrybrae, stone circle 470m NNE of	This feature is located within a pocket of trees which create an enclosed setting and restrict visibility towards the Proposed Development. Although glimpses of the turbines may be possible, these would be very limited and, as such, would not detract from the ability to appreciate the feature.	3	3	3.7km	High	Negligible	Moderate/Minor
SM20	St Fergus's Church, old parish church	Vegetation and buildings would likely screen most visibility of the Proposed Development from the feature. Key sea views would remain uninterrupted and where visible the Proposed Development would be seen alongside St.	3	3	6.7km	High	Negligible	Moderate/Minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		Fergus Gas Terminal and other man-made structures including the existing Greenside wind farm. The church remains are considerably reduced and do not have a great presence within the area. As such,, it is unlikely that intervisibility with the Proposed Development would occur. Due to the distance, screening and the baseline setting of the feature, the Proposed Development would not detract from the ability to appreciate the feature.						
SM22	West Cockmuir, enclosure 100m N of	Intervening vegetation would screen most visibility of the Proposed Development from the feature. The features current	3	3	7.1km	High	Negligible	Moderate/Minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		setting includes existing wind turbines within the immediate area which are a dominant feature in the setting of the heritage asset as well as met masts and overhead lines. The addition of the Proposed Development would have a minimal presence and would not interrupt the existing baseline or appreciation of the feature.						
SM23	Castle Hill, motte SW of Hallmoss Farm	Although there is predicted theoretical visibility of the Proposed Development from this feature, turbine towers would be completely screened by topography. The Proposed Development would not interrupt any key	3	2	7.4km	High	Negligible	Moderate/Minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		views over the sea. Given the features proximity to the Proposed Development and the presence of intervening vegetation, visibility would be limited. Despite this, the elevated nature of the feature would allow blade tips to be visible from above vegetation. The addition of the Proposed Development would have little impact on the features setting or detract attention within views.						
SM24	St Combs, St Columba's Church	Predicted theoretical visibility of the Proposed Development from this feature would include blade tips only. Given the features distance to	3	0	7.9km	High	No Change	**None**

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		the Proposed Development and the presence of intervening vegetation and built environment, it is unlikely that any visibility would occur. The addition of the Proposed Development would have no impact on the features setting or detract from the ability to appreciate or understand it.						
SM26	Inverallochy Castle	This feature has an open setting with expansive views. Although the Proposed Development would theoretically be visible from the feature, there would likely be considerable screening from vegetation and intervening buildings. From areas within the	3	0	7.9km	High	Negligible	Moderate/Minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		feature where the Proposed Development may be seen, the existing Greenside wind farm will already be visible. Given the distance to the Proposed Development, where visible it would be minor feature in the setting of the heritage asset and would not interfere with appreciation of the feature or alter the existing baseline.						
SM27	Knockmonean Cairn	Although this cairn has predicted theoretical visibility of the Proposed Development, there would be considerable screening provided by vegetation and intervening buildings. Given the distance to the Proposed Development, where	3	3	8.0km	High	Negligible	Moderate/Minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		visible, the Proposed Development would be a minor feature and would occupy an area already characterised by the existing Greenside wind farm. The Proposed Development would not interfere with appreciation of the feature or materially alter the features setting.						
SM28	Mount Pleasant, enclosure	This feature has an enclosed setting provided by surrounding woodland. Given the features distance to the Proposed Development and the presence of vegetation, there is unlikely to be any visibility and so there would be no impact to the setting of the castle.	3	3	8.1km	High	No Change	None

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
SM31	Gaval, standing stone 250m SW of	This standing stone's current setting is open and includes an existing nearby turbine. The distance to the Proposed Development leaves opportunity for screening by intervening vegetation and buildings. Where visible, the Proposed Development would be a minor feature in the wider landscape and would appear from behind the existing Greenside wind farm. The addition of the Proposed Development would not impact the setting or detract from the feature itself.	3	3	8.7km	High	Negligible	Moderate/Minor
SM34	Mormond Hill, cairn 410m NNE of Mormond Farm	Although this cairn has predicted theoretical visibility of the Proposed	3	3	9.1km	High	No Change	None

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		Development, topography would screen most visibility whilst additional screening would be provided by vegetation and intervening buildings. The Proposed Development is unlikely to be visible from the feature and would have no impact to the setting or appreciation of the feature.						
LB1	Parish church of Crimond including enclosing walls railings and gates.	This feature is within a residential area and as such, there is considerable screening from houses as well as vegetation. Turbine blades and in some cases hubs may be visible rising above buildings and would be in the same view as the operational Greenside turbines.	3	3	1.6km	High	Low	Moderate

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		Given the urban setting of the feature, structures such as lampposts and overhead lines are prominent and so the addition of the Proposed Development would not materially alter the baseline setting. The Parish church of Crimond church tower may be visible in conjunction with the Proposed Development from some views. However, this would be intermittent and would not impact the understanding or detract from the ability to appreciate the feature.						
LB02	Old School and Schoolhouse, Crimond	This feature is within a residential area and as such, there is considerable screening from	3	3	1.6km	High	Low	Moderate

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		houses as well as vegetation. Turbine blades and in some cases hubs may be visible rising above buildings and would be in the same view as the operational Greenside turbines. Given the urban setting of the features, structures such as lampposts and overhead lines are prominent and so the addition of the Proposed Development would not materially alter the baseline setting. Any intervisibility would be intermittent and should not detract from the feature.						
LB3	Haddo House Mains of Haddo	Although close to the Proposed Development, a band of trees to the south-west of the Listed	3	3	2.3km	High	Negligible	Moderate/Minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		Buildings would screen most visibility. Blade tips may be visible rising from above the treeline but would not detract from the feature or ability to appreciate it. The features setting also includes many existing man-made elements including transmission lines and MOD properties. Greenside wind farm can also be partially seen rising from behind topography. The addition of the Proposed Development would not create material contrast to the baseline.						
LB7, LB8	Old Parish Church of Longside & Churchyard Gateway, Longside Parish Church	These Listed Buildings are within a residential area and have an enclosed setting with limited	3	3	8.4km	High	No Change	None

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		outward views. Additionally, the distance to the Proposed Development is considerable with further for screening provided by vegetation and buildings. Visibility would not occur and there would be no material alteration to the features baseline setting.						
GDL1 & LB4	Crimonmogate & Crimonmogate House	Crimonmogate GDL is focused around Crimonmogate House. Policy woodland surrounding the GDL create a relatively enclosed setting and limit potential visibility towards the Proposed Development. The garden itself includes a single turbine which would be a more	3	3	2.9km	High	Negligible	Moderate/minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		prominent feature. Any outward views of the Proposed Development would already include the existing Greenside wind farm and as such, the introduction of the Proposed Development would not materially alter the overall setting. Between trees, turbines may be visible but would not be prominent or detract from the ability to appreciate the or understand the GDL and LB.						

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
GDL2, LB5, LB6	Cairness, Cairness House, South Lodges, Gates and Railings & Cairness House	Cairness GDL encompasses both Listed Buildings and has an enclosed setting as a result of the estate woodland. This would limit some visibility towards the Proposed Development. Intervening vegetation and buildings between the GDL and the Proposed Development would further restrict visibility. Some views may be possible through gaps in trees however, at this distance the Proposed Development would not be a prominent feature in the setting of the GDL and LBs. Additionally, in locations where visibility is possible, the existing Greenside	3	3	5.4km	High	Negligible	Moderate/Minor

Reference	Name	Assessment	No. of blade tips theoretically visible	No. of hubs theoretically visible	Distance to Proposed Development	Sensitivity	Magnitude of Change	Level of Effect
		wind farm would already be present and as such, the setting would remain unaltered.						

6.6 Mitigation

Planning guidance states that it is Government policy to protect and preserve heritage assets in situ wherever feasible. Where preservation in situ is not possible, planning authorities should ensure that an appropriate level of excavation, recording, analysis, publication, and archiving is carried out, before and/or during development.

6.6.1 Permeant Land-take and Operation

There is one known heritage asset which is 5.6m from the existing access track. There will be no new construction required for this section of road, however further minor impacts due to vehicle movement could occur. Fencing off may be appropriate to prevent further loss of information.

There are no additional known features within the ground-breaking area however in the event that archaeological features are encountered, a suitable program of archaeological works will be implemented to the satisfaction of the planning authority.

6.6.2 Restoration

No restoration measures are currently proposed.

6.7 Summary of Predicted Impacts and Effects

6.7.1 Physical Impacts

One feature recorded on the Aberdeenshire Historic Environment Record was found to be within the development footprint and one further feature was found to be within 200m of the proposed turbine locations. Both features were assessed to experience a minor level of effect which is not significant.

6.7.2 Setting Impacts

The setting impact upon heritage assets within 10km of the Proposed Development have been considered in the assessment. There are only two features within 2km of the Proposed Development, one category A Listed Building and one category B Listed Building. Although they are the closest features, they were determined to experience moderate level of effects which is not significant.

A number of effects were found on features beyond 2km and out to 10km. None of these were significant. Additionally, a number of features were found to experience no impact.

6.8 Conclusion

With regards to physical effects, one feature is within the area of ground-breaking with one further feature within 200m of proposed turbine locations.

Within the 10km study area, undulating topography alongside intervening vegetation and buildings restrict visibility of the Proposed Development from many features. Views towards the Proposed Development are already characterised by the existing Greenside wind farm. This mitigates impacts which would arise from the addition of the Proposed Development. With regard to setting effects, the level of effect ranges from none to moderate. This includes effects found on any Scheduled Monuments, Category 'A' or 'B' Listed Buildings and Gardens and Designed Landscapes taken forward for assessment.

7 Noise

7.1 Introduction

The Proposed Development is an extension project to the existing four turbine Greenside Wind Farm (GWF) (APP/2011/1024) consisting of three Enercon E82 wind turbines with a maximum tip height of up to 100m and capacity of 2.35MW. For the purposes of this assessment, the candidate turbine model is the Enercon E82 with a hub height of 59m, tip height of 100m and a rated power output of 3MW. This model has been selected to assess the worst-case scenario for noise impacts while still fitting within the project proposal of a maximum tip height of 100m. Noise impacts could potentially arise during the construction, operational, and decommissioning phases of the Proposed Development.

The project was assessed using a combination of propagation modelling and noise limits that reference survey data collected within the study area, provided in respect of the existing GWF.

Operational noise from the Proposed Development was assessed against the current noise constraints which are imposed on the existing GWF project (discussed further in Section 7.2) to determine if the proposed extension turbines could feasibly be accommodated within existing noise limits.

7.2 GWF (APP/2011/1024)

The existing GWF project, approved in 2011, consists of four Enercon E70 2.35MW wind turbines, with a maximum tip height of 99.5m. All turbines are noted to be operating in their normal modes of operation.

Condition 10 of the GWF planning permission constraints immission levels due to the operation of the project to the lower fixed ETSU limits of 35dB(A) for daytime and 38dB(A) for night-time periods, or background noise level plus 5dB(A), whichever the greater. Furthermore, background noise levels within the context of this condition are defined as:

"The background noise level in this condition means the level determined at each property at the time of the Background Noise Level survey submitted with this application, as derived from the regression analysis polynomials stated in the March 2011 report, or the background noise levels measured at the time of subsequent monitoring required as a result of these conditions, whichever is the lower."

As such, baseline survey data (discussed in Section 7.6.3) is constrained to this condition.

7.3 Policy, Legislation and Guidance

The following sources provide guidance on the assessment of wind turbine noise:

- Scottish Government (2022): Onshore Wind Policy Statement[25];
- Scottish Government- Onshore wind turbines: Planning Advice[26];
- Planning Advice Note 1/2011 (PAN1/2011): Planning and Noise[27];

Onshore wind turbines: Planning advice endorses the use of ETSU-R-97 and the 'Good Practice Guide' for the assessment of operational wind turbine noise (see below) as does Aberdeenshire Council[28].

[25] Scottish Government (2022), 'Onshore Wind Policy Statement'. – Accessed 12/01/2024
[26] Scottish Government (2014), 'Onshore wind turbines: Planning Advice'. – Accessed 12/01/2024
[27] Scottish Government (2011), 'Planning Advice Note 1/2011'. – Accessed 12/01/2024
[28] Aberdeenshire Council (2023), 'Assessing Wind Energy Developments: Planning Advice PA2023-21 Available at: https://www.aberdeenshire.gov.uk/ – Accessed 12/01/2024

7.3.1 Guidance – Construction Phase Noise

Guidance for the assessment of construction noise is given in:

- BS 5228-1:2009+A1:2014- Code of practice for noise and vibration control on construction and open sites

The standard provides indicative source sound level data for a variety of construction plant for use within the calculations and suggests appropriate fixed noise limits. Assessment of the significance of impacts can be made through comparison of predicted levels with defined criteria.

7.3.2 Guidance – Operational Phase Noise

Guidance for assessing operational noise from wind farms is given in:

- The Institute of Acoustics, 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'[29]

This guidance was developed to standardise the approach to noise assessment of wind farms in the UK. The guidance also provides advice on the form of planning conditions that should be adopted for wind farm projects. The GPG does not address the question of what noise limits should be applied as this has been determined by government.

The basis for operational wind farm noise limits that have been adopted in the UK is given in: 'ETSU-R-97: The Assessment and Rating of Noise from Wind Farms (1997)'; the Department of Trade and Industry (usually referred to as the Noise Working Group Recommendations). National planning guidance is clear that the IoA GPG and ETSU-R-97 should be followed in the assessment of operational noise from wind farms.

Supplementary Planning Guidance Note Ref: SPG.12 NLLP Policy EDI.3(A)2, refers to consideration of PAN 1/2011 - Planning and Noise. PAN 1/2011 includes an endorsement of ETSU-R-97 as the overarching assessment framework for wind turbine noise.

7.3.2.1 Relevant Standards

The International Standard ISO 9613, 'Acoustics – Attenuation of Sound During Propagation Outdoors - Part 2', noise propagation model has been used for the turbine noise calculations.

IEC/TS 61400-14:2005 - Declaration of apparent sound power level and tonality values. This standard provides a method to derive appropriate sound power level values from a number of independent sources to improve robustness.

7.3.2.2 Low Frequency Noise

The planning guidance[30] is clear; that there are no grounds to suppose that infrasound or low frequency noise (LFN) is an issue at receptor distances from a wind farm and refers to the 2006 study[31] carried out by Hayes McKenzie on behalf of the Department of Trade and Industry (DTI). The report investigates the potential impact of infrasound or low frequency noise arising from wind turbines. The study concluded that infrasound or low frequency noise arising from the operation of wind turbines did not result in adverse health impacts.

[29] Institute of Acoustics (2013), 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'. – Accessed 12/01/2024

[30] Scottish Government (2014), 'Onshore wind turbines: Planning Advice'. – Accessed 12/01/2024

[31] Hayes McKenzie (2006), 'The measurement of low frequency noise at three UK wind farms'. – Accessed 12/01/2024

A further research study in 2016[32] stated the level of infrasound due to wind turbines is low in comparison to other technical and natural sources. The findings concluded 'that adverse effects relating to infrasound from wind turbines cannot be expected on the basis of the evidence at hand.'

This report does not consider any further effects of low frequency noise.

7.3.2.3 Vibration

In 2005, the Applied and Environmental Geophysics Research Group at Keele University conducted an extensive study titled 'Microseismic and Infrasound Monitoring of Low Frequency Noise and Vibrations from Windfarms'[33]. The study was requested by the MOD, the DTI and the British Wind Energy Association with the aim of establishing an acceptable limit that would not interfere with the detection capabilities of the seismic monitoring site located in Eskdalemuir, Scotland. The results of the investigation found that low levels of vibration and infrasound could be detected, with measurement apparatus, at large distances from the wind turbines included in the survey. The report concluded that a 10km buffer zone could be adopted at Eskdalemuir to protect the site from the interference due to wind turbines.

The outcome of this study has since been misinterpreted as the potential for adverse effects at residential receptors. The authors of the paper have clarified that[34]:

"The levels of vibration from wind turbines are so small that only the most sophisticated instrumentation and data processing can reveal their presence, and they are almost impossible to detect."

They also confirmed that the level of vibration measured was not unique to wind turbines:

"*Vibrations at this level and in this frequency range will be available from all kinds of sources such as traffic and background noise - they are not confined to wind turbines."*

A more recent study on the human perception of vibration from wind turbines was published in 2020[35]. The paper presents vibration measurements from inside properties at varying distances from a wind farm. The study compares the results against criteria given in AS 2670-1 (1990)[36] and BS 6472-1 (2008)[37] and suggests there is a low probability of adverse impact.

Therefore, as current research continues to conclude that vibration due to wind farms is very unlikely to disturb residential amenity, an assessment of vibration would not be within the scope of the NIA.

7.3.2.4 Amplitude Modulation

Amplitude Modulation (AM) as an element of turbine noise has been the subject of considerable research in recent years. The University of Salford conducted a study[38] on behalf of the Department for Business, Enterprise and Regulatory Reform to investigate whether noise complaints arising from wind farms were due to the presence of AM. The report found that complaints were highly likely to be caused by AM in 4 out of the 27 wind farms included in the study. However, it concluded, *'that the causes of AM are not fully understood, and that AM cannot be fully*

[32] Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg (2016), 'Low-frequency noise incl. infrasound from wind turbines and other sources'. – Accessed 12/01/2024

[33] Styles P, Stimpson I, Toon S, et al. (2005), 'Microseismic and Infrasound Monitoring of Low Frequency Noise and Vibrations from Windfarms'. Available at: https://docs.wind-watch.org/AEG-Eskdalemuir.pdf – Accessed 12/01/2024

[34] Renewable UK (2010), 'Low Frequency Noise and Wind Turbines'. Available at: https://archive.is/d3WB#selection-241.0-241.175 – Accessed 12/01/2024

[35] Nguyen D, Hansen K, Branko Z (2020), 'Human Perception of Wind Farm Vibration'. DOI: https://doi.org/10.1177/1461348419837115– Accessed 12/01/2024

[36] Australian Standards (1990), 'AS 2670-1:1990 Evaluation of human exposure to whole-body vibration'. – Accessed 12/01/2024

[37] British Standards (2008), 'BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings'. – Accessed 12/01/2024

[38] University of Salford, The Department for Business, Enterprise and Regulatory Reform, URN 07/1235, (2007), 'Research into aerodynamic modulation of wind turbine noise'. – Accessed 12/01/2024

predicted at current state of the art.' The findings of the investigation were reconfirmed in 2013 in an updated research report by Renewable UK[39].

In 2016[40] the IoA produced 'A Method for Rating Amplitude Modulation in Wind Turbine Noise', in which amplitude modulation is defined as the following:

"Wind turbine amplitude modulation is defined as periodic fluctuations in the level of audible noise from a wind turbine (or wind turbines), the frequency of the fluctuations being related to the blade passing frequency of the turbine rotor(s)."

The report acknowledges that certain levels and/or characteristics of amplitude modulation may lead to disturbance and noise complaints. The guidance does not aim to define the level at which AM could pose an issue but outlines a proposed methodology to assess and rate AM arising from operational wind farms.

Currently, there is no method of assessment for amplitude modulation pre-construction. As such, the assessment can only be conducted after the wind farm is operational. A requirement for post-completion assessment of amplitude modulation could be included within an appropriate planning condition, should this aspect of turbine noise be deemed to be excessive by environmental health following a verified noise complaint.

7.4 Terminology

Sound pressure level (SPL) is a logarithmic measure of the effective sound pressure of a sound relative to a reference value: 20 µPa. It is measured in decibels (dB) above this standard reference level. The SPL descriptors referenced in this report are:

- $L_{A,eq}$ is the A-weighted equivalent continuous sound pressure level;
- $L_{A90,10min}$ is the A-weighted sound pressure level exceeded for 90 percent of the time in the averaging time interval specified – in this case 10 minutes – and is the index most widely used for background noise level measurements;
- L_{WA} is the A-weighted sound power level – a measure of the total sound energy emitted by a source of noise (the reference value for sound power is $1x10^{-12}$W).

The IoA GPG states that the $L_{A90,10min}$ descriptor should be adopted for the noise assessment and that 2dB(A) should be subtracted from $L_{A,eq}$ levels when converting them to $L_{A90,10min}$ values.

The wind speeds referred to in this report are:

Standardised 10m wind speeds (v_{10}): Hub height wind speeds translated to 10m height above ground level assuming a standard roughness length of 0.05m. All turbine sound power levels are quoted with reference to standardised 10m wind speeds.

7.5 Assessment Methodology

7.5.1 Construction Phase

The assessment of noise impacts from construction activities includes the installation of ancillary infrastructure as well as the turbines themselves.

The factors influencing the impact of plant noise are:

- The number and character of noise sources

[39] Renewable UK (2013), 'Wind Turbine Amplitude Modulation: Research to improve understanding as to its Cause and effects'. – Accessed 12/01/2024
[40] Institute of Acoustics (2016), 'A Method for Rating Amplitude Modulation in Wind Turbine Noise'. – Accessed 12/01/2024

- The duration of activity and hours of work
- Separation distance between source and receptor
- Reduction of noise by absorption or screening

The exact construction schedule is not yet known, however, through the experience of assessing similar scale developments, an estimate of worst-case impacts can be made. These should be treated as indicative.

Although BS 5228-1 does not specify absolute noise limits relating to construction activities, it does provide detailed guidance on the steps that can be taken to minimise potential noise effects.

During the construction phase of the project, it is expected that noise levels in the area will be greater due to the operation and movement of plant. In BS 5228-1, the ABC method outlined in section E3[41] sets out the following for classifying the significance of the construction noise:

"Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,\ T}$, from construction noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact."

Works and operation of plant on this site are expected to be limited to the daytime periods: Monday to Friday (07.00–19.00) and Saturdays (07.00–13.00). As a result, the cut off value for significant construction noise impact is deemed to be 65dB(A) $L_{Aeq,T}$. It is possible that, due to weather constraints (e.g., the impact of weather on the crane operation), the erection of the turbines could occur outside of the working hours defined above. For this or any other activity that extends beyond daytime periods, the lower cut-off limits of 55dB(A) and 45dB(A) would apply dependent on time of day.

The methodology for determining the levels of the construction noise involves calculating the total sound pressure level at the nearest sensitive receptor for a construction task, $L_{Aeq(12hr)}$, [equation 1], by summing the total potential sound power level for a given construction phase [equation 2] and subtracting a correction for its distance from the nearest property, K_S [equation 3]. These three equations are shown below:

[1] $L_{Aeq,T} = L_{WA} - K_S$

[2] $L_{WA} = 10\log\{10^{(Lactivity1/10)} + 10^{(Lactivity2/10)}...\}$

[3] $K_S = 25\log(R)+1$ [for R > 25m]

The calculations assume by default that each activity lasts for the full daytime period at 100% intensity.

7.5.2 Operational Phase

The assessment of operational noise impacts arising from the proposed Wind Farm takes the form of an ETSU-R-97 assessment following the IoA GPG.

7.5.2.1 Noise Sensitive Receptors (NSRs)

The study area adopted for the identification of NSRs was the 35dB(A) noise contour as calculated from the Proposed Development and existing GWF.

Where NSRs were located adjacent to each other or readily formed a grouping, a single Noise Assessment Location (NAL) was selected representing the closest of the adjacent receptors to the proposed turbines. NALs were

[41] BS 5228-1 'Code of practice for noise and vibration control on construction and open sites', p119 – Accessed 12/01/2024

positioned at NSRs, 15m from a dwelling façade in the direction of the nearest Project turbine or as far in that direction as the curtilage would allow.

This approach follows the ETSU-R-97 principle of assessing nearest receptors; focussing on the highest impacts allows for a more concise assessment.

The selected NSRs are shown on **Figure 7.1** below.

7.5.2.2 Noise Limits

The ETSU-R-97 guidelines recommend that wind turbine noise should be limited to an absolute lower limit between 35 and 40dB(A) [LA90,10min] for quiet daytime periods and 43dB(A) for night-time periods (defined below), or 5dB(A) above the background noise levels, whichever the greater. For locations where the resident has a demonstrable financial involvement in the project, a lower fixed limit of 45dB(A) is applicable, or 5dB(A) above the background noise levels, whichever is the greater.

Table 7.1 – ETSU-R-97 Assessment Periods

The quiet daytime periods (amenity hours) are:	
18:00 - 23:00	Monday to Friday
13:00 - 23:00	Saturdays
07:00 - 23:00	Sundays
Night-time periods are: 23:00 – 07:00 every day	

For a project whose noise immission are not expected to exceed 35dB(A) at the closest Noise Sensitive Receptors (NSRs), a simplified approach may be taken that allows the project to be approved with a single fixed 35dB(A) noise limit applicable at all times or 45dB(A) where a resident has financial involvement. Where proposed project noise levels exceed 35dB(A), the ETSU-R-97 noise assessment should be undertaken with reference to noise limits derived from background noise levels.

This assessment has assumed the lowest applicable ETSU-R-97 limits of 35dB(A) and 38dB(A) for daytime and night-time periods respectively. This approach is in-line with the previous methodology adopted for the existing GWF, as set out within Condition 10 of the developments Planning Permission (APP/2011/1024). These limits have been applied to the combined immission from the existing GWF plus the proposed turbines.

Provided that GWF immission limits can be met by the expanded 7 turbine project, it can be concluded that cumulative impacts would also be acceptable as this operational noise headroom (limits) has previously been approved for the site and no additional operational noise headroom is required.

7.5.3 Propagation Model

The International Standard ISO 9613, 'Acoustics – Attenuation of Sound During Propagation Outdoors - Part 2', sound propagation model has been used for the turbine immission calculations. L_{Aeq} sound propagation was modelled using the software WindFarm v5.0.1.2 by ReSoft. Predicted wind turbine immission levels were calculated, inclusive of appropriate allowance for measurement uncertainties.

L_{A90} levels were derived by subtracting two decibels from the L_{Aeq} values as per the ETSU-R-97 guidance and subsequent IOA GPG. The input parameters shown in Table 7.2 have been used and are consistent with the IOA Good Practice Guide.

Table 7.2 – Propagation Input Parameters

Atmospheric Attenuation Assumptions	
Temperature (°C)	10
Humidity (%)	70

Ground Attenuation Assumptions	
Attenuation factor, G (all regions)	0.5 (semi-soft ground)
Receptor height (m)	4.0

The attenuation of sound as it travels through the air varies with frequency. The atmospheric attenuation coefficients used in the assessment, corresponding to the assumptions in Table 7.2, are tabulated in Table 7.3.

Table 7.3 – Attenuation Coefficients Used for the Sound Propagation Model

Octave Band (Hz)	63	125	250	500	1000	2000	4000	8000
Attenuation Coefficient (dB/km)	0.12	0.41	1.04	1.93	3.66	9.66	32.77	116.88

7.5.3.1 Barrier Effect

Line of sight visibility was checked between proposed turbine and each receptor's assessment position at 4m height. Where a turbine is not visible from any particular assessment position (at 4m height) a -2dB adjustment to the predicted level from the screened turbine(s) is applicable. Any adjustments are reported.

7.5.3.2 Valley Effect

Certain topographic characteristics have the potential to reinforce the propagation of sound between two locations. The GPG refers to these characteristics as a 'valley' to describe a concave topographic profile. Where this criterion is met, these instances are reported.

7.5.3.3 Directivity

Where turbine sound propagates from opposing directions relative to an NSR, the result will be a reduction in predicted noise, as the receptor will not experience simultaneous downwind conditions from both directions. Example reductions are given in the GPG[42] at 4.4. Any adjustments for directivity are reported.

7.5.4 Noise Impact Assessment

Predicted turbine immission levels at the nearest receptors resulting from the propagation model (inclusive of all above adjustments) were compared to the applicable ETSU-R-97 limits to determine whether those limits could be met.

7.6 Baseline

7.6.1 Construction Phase Baseline

All construction activities are planned to occur within the project boundary.

Drawing C5865-GCR-WF-GA-DR-P-005 – Site Layout Access C shows the location of the proposed turbines, hard standing areas and the new access track for the Proposed Development.

7.6.2 Operational Phase Baseline

7.6.2.1 Study Area

The Proposed Development is located within the existing GWF boundary, approximately 1.7km south of the settlement of Crimond, ~9km northwest of Peterhead, Aberdeenshire. The land surrounding the site is

[42] A Good Practice Guide to the Application of ETSU-R-97 For the Assessment and Rating of Wind Turbine Noise, May 2013, page 21, 4.4 – Accessed 12/01/2024

predominantly agricultural, with scattered settlements. The nearest main road to the Proposed Development is the A80, located approximately 1.6km to the east of the development.

The proposed layout showing turbine positions and nearest noise sensitive receptors is shown in **Figure 7.1.** The red contours enclose an area predicted to receive an L90 turbine noise level in excess of 35dB(A) from the Proposed Development and existing GWF, given for a v_{10} wind speed of 10ms^{-1}.

Table 7.4 lists the names, NAL GPS coordinates and minimum distance to the proposed turbines for each NAL.

Table 7.4 – Details of Noise Assessment Locations

ID	Easting	Northing	Name	Distance to turbine (m)
NAL 1	406560	855935	Tillyduff	750
NAL 2	407263	855352	Tophead	670
NAL 3	407275	854764	Dalriach	785
NAL 4	407139	854493	Howe	870
NAL 5	406609	854209	Overside (FI)	980
NAL 6	405065	855072	South Lothian	890
NAL 7	404909	855621	Lothian	1070
NAL 8	405226	856097	Moss-side	1055
NAL 9	406022	856272	North Mosstown	965

NAL 5 (Overside) is known to be financially involved with the Proposed Development, whilst all remaining NALs are third-party.

It should also be noted that Greenwellheads, a property located approximately 10m south of T2 (shown in **Figure 7.1**) has not been assessed within this study as it has been stated that the property is not currently occupied and will not be used for residential habitation throughout the lifespan of GWF, as set out under condition 12 of Planning Decision APP/2011/1024.

Details of the existing GWF are provided in **Section 77.2**.

7.6.3 Baseline Survey Data

Baseline noise survey data was collected via the most recent compliance monitoring conducted for the GWF development in 2018[43]. A noise survey was conducted between 29th May and 27th June 2018 at two of the nearest properties neighbouring the GWF site to test turbines against the noise limits set out in Condition 10 within the Planning Permission.

Table 7.5 below details the names, locations and GPS coordinates of both measurement locations.

Table 7.5 - Background Monitoring Locations

ID	Easting	Northing	Name
ML1	406619	854193	Overside
ML2	407427	854730	Bylands

It was noted that during the compliance survey, T1 (**Figure 7.1**) remained operational. Measured backgrounds were checked for the influence of T1. It was found that T1 had a marginal influence at ML1 (Overside). To account for this, background noise levels was reduced by 1dB across all windspeeds. The lowest resulting background noise levels over the duration of the compliance survey, were found to occur during compliance assessment hours (19:00 – 03:00). As such, background noise levels during this period were used to assess compliance, as set out within the requirements stated in Condition 10.

[43] Green Cat Renewables., (2018)., Greenside Wind Farm (APP/2011/1024) Noise Assessment: Compliance with planning conditions – Accessed 12/01/2024

Table 7.6 & Table 7.7 details the background noise levels measured at both Overside & Bylands from the original 2011 NIA and 2018 compliance assessment, demonstrating the selection of the lower background noise levels.

Table 7.6 - Summary of Measured Backgrounds at Overside

	10m wind speed (m/s)								
Source	4	5	6	7	8	9	10	11	12
2011 (NT)	32.7	32.9	33.8	35.2	37.0	39.1	41.4	43.8	46.2
2011 (QDT)	32.9	33.1	34.1	35.9	38.1	40.8	43.6	46.5	49.3
2018 (AH)	30.5	31.4	32.1	33.0	34.1	35.7	38.0	41.3	45.7
2018 (AH) -1dB	29.5	30.4	31.1	32.0	33.1	34.7	37.0	40.3	44.7
Lowest	29.5	30.4	31.1	32.0	33.1	34.7	37.0	40.3	44.7

[1] Assessment hours = period in which assessed turbines are non-operational to accurately capture prevailing background level (19:00 – 03:00)

Table 7.7 - Summary of Measured Background at Bylands

	10m wind speed (m/s)								
Source	4	5	6	7	8	9	10	11	12
2011 (NT)	35.5	35.6	36.4	37.7	39.4	41.4	43.7	46.0	48.3
2011 (QDT)	37.1	37.5	38.3	39.5	41.0	42.8	44.7	46.7	48.7
2018 (AH)	26.1	28.2	31.1	34.6	38.4	42.1	45.3	47.8	48.8
Lowest	26.1	28.2	31.1	34.6	38.4	41.4	43.7	46.0	48.3

Full details of the compliance background survey and data analysis are provided in the attached appendices.

7.6.4 Noise Limits

Table 7.8 lists the nine NALs for the Proposed Development and the location of the background noise measurement assigned to each, based on proximity. Profiles have also been allocated based on the expectation of have a similar acoustic environment, largely based on proximity to road traffic noise from the A90 and proximity to settlements. For properties based in more rural areas (NAL6 & NAL7) profiles have been assigned from measurements conducted at Overside (NAL5) – where background noise is typically quieter than found at Bylands (NAL3). Properties which are similar in distance to the A90 have been assigned the profile based on Bylands: NAL1, NAL2, NAL3, NAL4, NAL8 & NAL9.

Table 7.8 - Allocation of Noise Limit Profiles

Location	Name	Limit profile
NAL 1	Tillyduff	Bylands
NAL 2	Tophead	Bylands
NAL 3	Dalriach	Bylands
NAL 4	Howe	Bylands
NAL 5	Overside (FI)	Overside
NAL 6	South Lothian	Overside
NAL 7	Lothian	Overside
NAL 8	Moss-side	Bylands
NAL 9	North Mosstown	Bylands

As stated in Section 7.2, Condition 10 of Planning Permission for GWF states that noise limits should make reference to the lower ETSU noise limits of 35dB(A) and 38dB(A) for daytime and night-time periods respectively, or background noise plus 5dB(A), whichever the greater. The lower of planning or contemporary background noise levels should be used when determining compliance.

Table 7.9 & Table 7.10 lists the daytime and night period ETSU noise limits for all assessment locations, derived from the lower background noise levels in Table 7.6. Overside (NAL 5) is known to be financially involved with the

Proposed Development. Following Aberdeenshire SPG (2015)[44], a limit of 45dB $L_{A90,\ 10\ min}$ or ETSU derived limits of background noise level plus 5dB (whichever is greater) for all wind speeds up to 12m/s, may be applied at properties with valid financial interest where there are also cumulative noise impacts. Overside is assessed to meet these criteria.

Table 7.9 - ETSU Noise Limits (Daytime)

L90	v_{10} wind speed (Daytime periods)								
Location	4	5	6	7	8	9	10	11	12
NAL 1	35.0	35.0	36.1	39.6	43.4	46.4	48.7	51.0	53.3
NAL 2	35.0	35.0	36.1	39.6	43.4	46.4	48.7	51.0	53.3
NAL 3	35.0	35.0	36.1	39.6	43.4	46.4	48.7	51.0	53.3
NAL 4	35.0	35.0	36.1	39.6	43.4	46.4	48.7	51.0	53.3
NAL 5	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
NAL 6	35.0	35.4	36.1	37.0	38.1	39.7	42.0	45.3	49.7
NAL 7	35.0	35.4	36.1	37.0	38.1	39.7	42.0	45.3	49.7
NAL 8	35.0	35.0	36.1	39.6	43.4	46.4	48.7	51.0	53.3
NAL 9	35.0	35.0	36.1	39.6	43.4	46.4	48.7	51.0	53.3

Table 7.10 - ETSU Noise Limits (Night-time)

L90	v_{10} wind speed (Night-time periods)								
Location	4	5	6	7	8	9	10	11	12
NAL 1	38.0	38.0	38.0	39.6	43.4	46.4	48.7	51.0	53.3
NAL 2	38.0	38.0	38.0	39.6	43.4	46.4	48.7	51.0	53.3
NAL 3	38.0	38.0	38.0	39.6	43.4	46.4	48.7	51.0	53.3
NAL 4	38.0	38.0	38.0	39.6	43.4	46.4	48.7	51.0	53.3
NAL 5	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
NAL 6	38.0	38.0	38.0	38.0	38.1	39.7	42.0	45.3	49.7
NAL 7	38.0	38.0	38.0	38.0	38.1	39.7	42.0	45.3	49.7
NAL 8	38.0	38.0	38.0	39.6	43.4	46.4	48.7	51.0	53.3
NAL 9	38.0	38.0	38.0	39.6	43.4	46.4	48.7	51.0	53.3

7.6.5 Sound Power Levels

7.6.5.1 Candidate Turbine Model

The proposed wind turbine type for the Proposed Development is the Enercon E82 with a hub height of 59m and rated power output of 2.35MW. As discussed in **Section 7.1**, the E82 3MW variant has been selected for the assessment of operational noise to represent worst-case conditions as it is the loudest E82 model aligning with the project height constraints. The turbine rotors would be fitted with Trailing Edge Serration (TES), a technology that reduces noise emissions. These reductions are reflected in the sound power values obtained from the manufacturer's sound power report[45] dated 2021-12-09 as given in **Table 7.11.** To account for the upper limit of warranty in measurement, a +1dB addition to the provided levels has been made.

[44] Submission Guidance Note (2015) – Accessed 12/01/2024
[45] Document no.: D0602644/2.0-en– Accessed 12/01/2024

Table 7.11 – Octave Band Sound Power Level for the Enercon E82 E4 59m Hub Height

Octave Band (Hz)	V_{10} wind speed (ms^{-1})								
	4	5	6	7	8	9	10	11	12
	Sound Power Level [L_{WA}] for a hub height of 59m [dB(A)]								
63	74.9	78.3	81.6	84.2	85.3	85.4	85.8	85.8	85.8
125	80.1	83.7	87.0	89.9	91.1	91.3	91.6	91.6	91.6
250	83.3	86.8	90.2	93.5	95.3	95.5	95.5	95.5	95.5
500	85.8	89.9	93.8	97.4	99.3	99.6	99.4	99.4	99.4
1000	84.7	89.2	93.3	96.7	98.3	98.5	98.5	98.5	98.5
2000	82.3	86.8	90.6	93.4	94.5	94.7	95.1	95.1	95.1
4000	76.1	80.7	84.4	86.6	87.4	87.5	88.3	88.3	88.3
8000	63.6	68.4	72.3	74.5	75.0	75.2	76.4	76.4	76.4
Total	90.9	95.0	98.8	102.1	103.8	104.0	104.0	104.0	104.0
Uncertainty	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IOA Total	91.9	96.0	99.8	103.1	104.8	105.0	105.0	105.0	105.0

Information regarding tonality and impulsivity were not included in the manufacturer's sound power report therefore it is proposed that the provision of manufacturer warranties regarding the absence of tonality and impulsivity are included within suitable planning conditions.

Sound power details for GWF are given in the attached appendices.

7.7 Assessment of Predicted Impacts and Effects

7.7.1 Construction Impact Assessment

An estimate of typical activities required for each construction objective has been made based on experience at similar developments. The construction assessment assumes all plant runs at full capacity at all times. It assumes all activities take place concurrently and occur at their minimum distance to each receptor. The assessment of project construction activities and resulting sound levels for the nearest receptor, are detailed in Table 7.12.

Table 7.12 – Construction Noise Impact Assessment for H2 – Nearest Receptor

Task	Plant/ equipment	Sound Power Level (dB(A))	BS 5228-1:2009 Ref	Total SPL for task (dB(A))	to nearest 5dB(A)	Distance to nearest property	Equivalent noise level at nearest property [LAeq,T (dB(A)]
Construction of access tracks	Dozers	116	Table D.3-67	119	120	670	48
	Tipper	113	Table D.3-112				
	Vibrating rollers	106	Table D.3-116				
	Excavator	105	Table D.3-97				
	Dumper	102	Table D.3-110				
	Road Lorry (39T)	111	Table C.6-22				
Construct crane hardstanding	Excavator	105	Table D.3-97	116	115	670	43
	Concrete mixer	108	Table D.5-11				
	Batching plant	112	Table D.5-12				
	Dumper	102	Table D.3-110				
	Roller	106	Table D.3-116				
	Road Lorry (39T)	111	Table C.6-22				
Construct turbine foundations	Excavator	105	Table D.3-97	118	120	670	48
	Tipper	113	Table D.3-112				
	Concrete mixer	108	Table D.5-11				
	Batching plant	112	Table D.5-12				

Task	Plant/ equipment	Sound Power Level (dB(A))	BS 5228-1:2009 Ref	Total SPL for task (dB(A))	to nearest 5dB(A)	Distance to nearest property	Equivalent noise level at nearest property [LAeq,T (dB(A)]
	Compressor	100	Table D.6-19				
	Water pumps	109	Table D.7-71				
	Vibratory pokers	102	Table D.6-20				
	Road Lorry (39T)	111	Table C.6-22				
Excavate and lay site cable	Excavator	105	Table D.3-97	107	105	670	33
	Dumper	102	Table D.3-110				
Erect turbines	Cranes	113	Table D.7-117	114	115	670	43
	Generators	108	Table D.7-60				
Reinstatement/Clearance works	Dozer	109	Table D.3-62	114	115	670	43
	Dump Truck	110	Table D.3-60				
	Tracked loader	105	Table D.3-59				
	Dumper	102	Table D.3-110				
All activities							53

The cumulative calculated noise levels meet the 65dB(A) and 55dB(A) criteria for daytime and evening, respectively. Turbine erection activities are also shown to meet the lower 45dB(A) limit for night-time periods.

These assumptions make for a very conservative assessment of the worst-case scenario. In practice construction activities would take place sequentially and plant would not be running at full intensity for the duration of the work to be carried out.

7.7.2 Operational Impact Assessment

7.7.2.1 Proposed Development Predicted L90 Levels

No topographic screening or concave topography was found to occur between the proposed turbine and the NSRs. Therefore, no adjustment to account for these features was made.

The following predicted L_{A90} immission levels are given for the Proposed Development only, using the octave band sound power levels detailed in Table 7.13 that are inclusive of uncertainty.

Table 7.13 – The Proposed Development Immission Levels

L90	dB(A)	V_{10} wind speed (m/s)								
Location	Name	4	5	6	7	8	9	10	11	12
NAL1	Tillyduff	23.8	27.8	31.6	35.0	36.7	36.9	36.8	36.8	36.8
NAL2	Tophead	22.6	26.6	30.4	33.8	35.5	35.7	35.7	35.7	35.7
NAL3	Dalriach	21.1	25.1	28.9	32.3	34.0	34.3	34.2	34.2	34.2
NAL4	Howe	20.4	24.4	28.2	31.5	33.2	33.5	33.4	33.4	33.4
NAL5	Overside (FI)	20.2	24.2	27.9	31.3	33.0	33.3	33.2	33.2	33.2
NAL6	South Lothian	19.9	23.9	27.7	31.1	32.8	33.0	32.9	32.9	32.9
NAL7	Lothian	18.2	22.2	25.9	29.3	31.0	31.3	31.2	31.2	31.2
NAL8	Moss-side	18.5	22.5	26.2	29.6	31.3	31.6	31.5	31.5	31.5
NAL9	North Mosstown	20.5	24.5	28.3	31.7	33.4	33.6	33.5	33.5	33.5

7.7.2.2 Summary

The highest predicted operational noise immission from the Proposed Development is noted as 36.9dB(A) at a wind speed 9 m/s at NAL 1 (Tillyduff). NAL 2 (Tophead) is predicted to receive a maximum immission level of 35.7dB(A) at wind speeds >= 9 m/s. All other assessment locations are predicted to receive levels less than 35dB(A).

7.7.3 Cumulative Impact Assessment with GWF

7.7.3.1 Predicted L90 Project Levels with GWF

Table 7.14 details the operational noise predictions from the existing GWF in isolation. Conservative predictions have assumed all turbines are operating in their standard mode of operation in simultaneous downwind conditions at each receptor. Results in Table 7.14 are inclusive of uncertainty.

Table 7.14 – Predicted Nose Immission Levels from GWF

L90	dB(A)	V_{10} wind speed (m/s)								
Location	Name	4	5	6	7	8	9	10	11	12
NAL1	Tillyduff	21.1	23.9	29.1	31.7	33.4	34.8	34.8	34.8	34.8
NAL2	Tophead	22.1	24.9	30.1	32.7	34.4	35.8	35.8	35.8	35.8
NAL3	Dalriach	25.0	27.8	33.0	35.6	37.3	38.7	38.7	38.7	38.7
NAL4	Howe	27.1	29.9	35.1	37.7	39.4	40.8	40.8	40.8	40.8
NAL5	Overside (FI)	29.2	32.0	37.2	39.8	41.5	42.9	42.9	42.9	42.9
NAL6	South Lothian	24.2	27.0	32.2	34.8	36.5	37.9	37.9	37.9	37.9
NAL7	Lothian	20.2	23.0	28.2	30.8	32.5	33.9	33.9	33.9	33.9
NAL8	Moss-side	19.0	21.8	27.0	29.6	31.3	32.7	32.7	32.7	32.7
NAL9	North Mosstown	19.2	22.0	27.2	29.8	31.5	32.9	32.9	32.9	32.9

Table 7.15 details the cumulative operational noise from both the Proposed Development and existing GWF.

Table 7.15 - Predicted Noise Immission Levels from the Proposed Development & GWF

L90	dB(A)	V_{10} wind speed (m/s)								
Location	Name	4	5	6	7	8	9	10	11	12
NAL1	Tillyduff	25.6	29.3	33.5	36.6	38.3	39.0	38.9	38.9	38.9
NAL2	Tophead	25.3	28.8	33.2	36.3	38.0	38.7	38.7	38.7	38.7
NAL3	Dalriach	26.5	29.7	34.4	37.3	39.0	40.0	40.0	40.0	40.0
NAL4	Howe	27.9	31.0	35.9	38.6	40.3	41.5	41.5	41.5	41.5
NAL5	Overside (FI)	29.7	32.6	37.7	40.3	42.0	43.3	43.3	43.3	43.3
NAL6	South Lothian	25.5	28.7	33.5	36.3	38.0	39.1	39.1	39.1	39.1
NAL7	Lothian	22.3	25.6	30.2	33.1	34.8	35.8	35.8	35.8	35.8
NAL8	Moss-side	21.8	25.2	29.7	32.6	34.3	35.2	35.2	35.2	35.2
NAL9	North Mosstown	22.9	26.4	30.8	33.8	35.5	36.3	36.3	36.3	36.3

7.7.3.2 Summary

Table 7.15 shows the maximum cumulative predicted noise immission level for the Proposed Development and existing GWF is 43.3dB(A), expected at NAL 5 (Overside) for windspeeds >=9m/s. NAL5 is known to be financially involved with the Proposed Development, and thus subject to higher noise limits. Out of all third-party locations, the highest predicted immission level is 41.5dB(A), expected to occur at NAL4 (Howe), for windspeeds >=9m/s.

7.7.3.3 Assessment of Compliance with Condition 10 Noise Limits

Table 7.16 & Table 7.17 demonstrate the level of exceedance with ETSU noise limits derived from Condition 10 of the GWF development (shown in Section 7.6.4) for daytime and night-time, respectively.

Table 7.16 - Exceedance of Daytime Cumulative ETSU-R-97 Noise Limits

L90	v_{10} wind speed (Daytime periods)								
Location	4	5	6	7	8	9	10	11	12
NAL 1	-9.4	-5.7	-2.6	-3.0	-5.1	-7.4	-9.8	-12.1	-14.4
NAL 2	-9.7	-6.2	-2.9	-3.3	-5.4	-7.7	-10.0	-12.3	-14.6
NAL 3	-8.5	-5.3	-1.7	-2.3	-4.4	-6.4	-8.7	-11.0	-13.3
NAL 4	-7.1	-4.0	-0.2	-1.0	-3.1	-4.9	-7.2	-9.5	-11.8
NAL 5	-15.3	-12.4	-7.3	-4.7	-3.0	-1.7	-1.7	-1.7	-1.7
NAL 6	-9.5	-6.7	-2.6	-0.7	-0.1	-0.6	-2.9	-6.2	-10.6
NAL 7	-12.7	-9.8	-5.9	-3.9	-3.3	-3.9	-6.2	-9.5	-13.9
NAL 8	-13.2	-9.8	-6.4	-7.0	-9.1	-11.2	-13.5	-15.8	-18.1
NAL 9	-12.1	-8.6	-5.3	-5.8	-7.9	-10.1	-12.4	-14.7	-17.0

Table 7.17 - Exceedance of Night-time Cumulative ETSU-R-97 Noise Limits

L90	v_{10} wind speed (Night-time periods)								
Location	4	5	6	7	8	9	10	11	12
NAL 1	-12.4	-8.7	-4.5	-3.0	-5.1	-7.4	-9.8	-12.1	-14.4
NAL 2	-12.7	-9.2	-4.8	-3.3	-5.4	-7.7	-10.0	-12.3	-14.6
NAL 3	-11.5	-8.3	-3.6	-2.3	-4.4	-6.4	-8.7	-11.0	-13.3
NAL 4	-10.1	-7.0	-2.1	-1.0	-3.1	-4.9	-7.2	-9.5	-11.8
NAL 5	-15.3	-12.4	-7.3	-4.7	-3.0	-1.7	-1.7	-1.7	-1.7
NAL 6	-12.5	-9.3	-4.5	-1.7	-0.1	-0.6	-2.9	-6.2	-10.6
NAL 7	-15.7	-12.4	-7.8	-4.9	-3.3	-3.9	-6.2	-9.5	-13.9
NAL 8	-16.2	-12.8	-8.3	-7.0	-9.1	-11.2	-13.5	-15.8	-18.1
NAL 9	-15.1	-11.6	-7.2	-5.8	-7.9	-10.1	-12.4	-14.7	-17.0

7.7.3.4 Summary

All assessment locations are shown to comply with the derived limits for daytime and night-time as defined within the constraints of GWF Condition 10 respectively.

A minimum margin of exceedance (-0.1dB) is shown at NAL 6 (South Lothian).

Modelling predictions for all turbines assume all machines are operating in their respective standard modes of operation in simultaneous downwind conditions.

Furthermore, noise limits have been derived based on the constraints outlined in Condition 10 of GWF Planning Permission. This highly conservative approach, which derives limits from the lowest measured background noise level (noted between the hours of 19:00 – 03:00) (shown in **Table 7.6** & **Table 7.7**) produces a quieter baseline level than would generally be expected throughout an entire 24-hour period.

Notwithstanding the conservative approach, results in **Table 7.15** & **Table 7.16** have identified that the Proposed Development could be constrained within the existing limits for the existing GWF, demonstrating a non-significant level of impact on the nearest receptors.

7.8 Mitigation

7.8.1 Construction Phase

The construction phase assessment demonstrated that mitigation of noise would not be required.

Nevertheless, it is good practice to minimise impact of construction noise by employing best practicable means to maintain equipment and limit activities to daytime hours where possible.

7.8.2 Operational Phase

The operational assessments found that the Proposed Development, operating with turbines in their normal mode of operation, with the existing GWF would be able to meet the derived ETSU-R-97 noise limits at all receptors. Therefore, no mitigation is expected to be required.

7.9 Conclusions

The highly conservative noise impact assessment carried out for the construction phase of the Proposed Development demonstrated that the project would not exceed the limit of 65dB(A) for daytime hours and 55dB(A) for evening hours as per BS 5228-1. As such, construction noise is not expected to have an adverse impact on nearby receptors. Construction phase noise can therefore adequately be controlled via a suitably worded planning condition.

Using conservative baseline data from 2018 compliance monitoring of GWF, a noise modelling exercise was undertaken to assess potential impacts from the Proposed Development.

When considering the Proposed Development in isolation, maximum predicted immissions of 36.9dB(A) at NAL1 (Tillyduff) and 35.7dB(A) at NAL2 (Tophead) are expected. All other properties are predicted to receive levels of <35dB(A).

An assessment of predicted operational noise immissions from the Proposed Development and GWF found that the expanded (7 turbine) GWF project would comply with Condition 10 noise limits by a minimum margin of 0.1dB at NAL6 (South Lothian).

It is therefore concluded that the development could be accommodated in the area without significant impact on amenity at the surrounding receptor locations.

Should the project receive consent it is proposed that planning condition noise limits reference the derived cumulative ETSU limits shown in Section 7.6.4.

Appendix 7.1 - Details of GWF 2018 Compliance Monitoring

The following compliance assessment was carried out under Condition 14 of Planning Permission APP/2011/1024 for GWF on 29th May and 27th June 2018. The purpose of the assessment was to identify if the operational GWF turbines were operating within the consented noise limits as stated in Condition 10. This was the latest of two compliance monitoring assessments carried out for the development since its consent in 2011. The following is a summary of the survey conducted, summarised from GWF Noise Assessment: Compliance with planning conditions report.[46]

7.9.1 Noise Monitoring Location 1: Overside

A noise monitoring kit was placed in the amenity area to the south of the property. The position is approximately 430m south of the nearest turbine (T4). Details of monitoring location, equipment and calibrations are tabulated in Table 7-18.

Table 7-18 - Monitoring details and equipment list at Overside

Equipment List		Calibration Date
Sound Level Meter (IEC 61672-1 Class 1):	Rion NL-51 SN: 01032465	14/02/2018
Acoustic Calibrator (IEC 60942 Class 1):	Rion NC-74 SN: 35125826	14/02/2018
Microphone:	Instrument standard	14/02/2018
Tripod:	Single integrated pole	N/A
Wind Shield:	Rion WS-15 double skinned wind shield	N/A
Tripod/measurement GPS position:	406619, 854193	N/A
List nearest reflecting elements & distances from microphone:	Property façade 4m.	N/A

The monitoring equipment's position relative to the property surrounds and T4 is shown in Figure 7-1.

Figure 7-1 - Noise monitoring position at Overside

[46] Green Cat Renewables., (2018)., Greenside Wind Farm (APP/2011/1024) Noise Assessment: Compliance with planning conditions

7.9.2 Noise Monitoring Location 2: Bylands

A noise monitoring kit was placed to the East of the property at a field boundary corner. Details of monitoring location, equipment and calibrations are tabulated in Table 7-19.

Table 7-19 - Monitoring details and equipment list at Bylands

Equipment List		Calibration Date
Sound Level Meter (IEC 61672-1 Class 1):	Rion NL-52 SN: 00810307	23/11/2017
Acoustic Calibrator (IEC 60942 Class 1):	Rion NC-74 SN: 35125826	14/02/2018
Microphone:	Instrument standard	23/11/2017
Tripod:	Single integrated pole	N/A
Wind Shield:	Rion WS-15 double skinned wind shield	N/A
Tripod/measurement GPS position:	407427, 854730	N/A
List nearest reflecting elements & distances from microphone:	None	N/A

The monitoring equipment's position relative to the property and turbines is shown in Figure 7-2 and is approximately 735m from the nearest turbine. The monitoring position is marked as a red arrow on the satellite image.

Figure 7-2 - Noise monitoring position at Bylands

7.9.3 Results

Full analysis and results for both Overside and Bylands can be found within Section 6.3 & Section 6.4 respectively, of Greenside Wind Turbines (APP/2011/1024) Noise Assessment: Compliance with planning conditions report[47].

[47] Green Cat Renewables Ltd. (2018), Greenside Wind Turbines (APP/2011/1024) Noise Assessment: Compliance with planning conditions

Appendix 7.2 - Sound Power Levels of Cumulative Developments

GWF (APP/2011/1024)

The sound power levels for the Enercon E70 have been reproduced from the manufacturers document: 'SA-04-SPL Guarantee E-70 2,3MW Revision 1' and are inclusive of an additional 1dB for the upper extent of the manufacturer's warranted uncertainty.

Table 7-20 – Octave band sound power level for the Enercon E70 2.3MW 64m hub height

Octave Band (Hz)	V_{10} wind speed (ms^{-1})						
	4	5	6	7	8	9	10
	Sound Power Level [L_{WA}] for a hub height of 64m [dB(A)]						
63	74.7	77.5	82.7	85.3	87.0	88.4	88.4
125	83.3	86.1	91.3	93.9	95.6	97.0	97.0
250	85.8	88.6	93.8	96.4	98.1	99.5	99.5
500	84.4	87.2	92.4	95.0	96.7	98.1	98.1
1000	82.9	85.7	90.9	93.5	95.2	96.6	96.6
2000	79.6	82.4	87.6	90.2	91.9	93.3	93.3
4000	72.7	75.5	80.7	83.3	85.0	86.4	86.4
8000	65.1	67.9	73.1	75.7	77.4	78.8	78.8
Total	90.8	93.6	98.8	101.4	103.1	104.5	104.5
Uncertainty	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IOA Total	91.8	94.6	99.8	102.4	104.1	105.5	105.5

8 Hydrology and Hydrogeology

8.1 Introduction

Understanding surface and groundwater environments is critically important to designing a successful project. Surface water includes watercourses, water bodies, and precipitation runoff. It provides an important resource for: potable and other uses, amenity, aesthetic value, conservation, ecological environments, and for recharge to groundwater systems. Groundwater is also an important resource. It provides more than a third of the potable water supply in the UK and includes all water stored in permeable underground strata (or aquifers). In addition, it provides essential baseflow to rivers and wetland areas, often supporting important ecological systems.

The risk of pollution or disruption of watercourses, groundwater bodies, and private water sources, within or near the site, needs to be assessed and appropriately mitigated where necessary. Potential impacts could include:

- Erosion and sedimentation;
- Impacts to surface runoff characteristics;
- Impacts on surface water quality;
- Impacts on river flows and flooding;
- Impacts on groundwater dependent terrestrial ecosystems (GWDTE);
- Impacts on soils;
- Impacts on peat hydrological regime;
- Chemical pollution of groundwater;
- Disruption or fouling of private water supplies;
- Impacts on public water supplies and abstractions;
- Modifications to hydrogeological regime;
- Peat Slide Risk.

This chapter presents the impact assessment of the Proposed Development on the hydrology and hydrogeology environments.

The report is supported by the following figures associated with this chapter and within the Ecological Impact Assessment (EcIA) by GLM Ecology Ltd and IMT Ecology Ltd:

- Figure 8.1: Hydrological Context Map, and
- Appendix 15.1: Vantage Point Map.

8.2 Guidance

Statutory, general, national, and local guidance consulted during this assessment is listed below.

Table 8.1 - Policy, Legislation & Guidance

Retained European Legislation	Freshwater Fish Directive 2006/44/EC Water Framework Directive (WFD) 2000/60/EC Dangerous Substances Directive 76/464/EEC
Scottish Government Policy, Advice and Legislation	The Housing Scotland (Act) 1987 (Sect 86) National Planning Framework 4 (NPF4) PAN 79: Water and Drainage, 2006 Planning Advice Note (PAN) 61: Planning and SUDS, 2001 Scottish Government (2017) Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments Water Environment and Water Services (Scotland) Act 2003 The Flood Risk Management (Scotland) Act 2009 The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations, 2017 The Public and Private Water Supplies (Miscellaneous Amendments) (Scotland) Regulations 2017 The Pollution Prevention and Control (Scotland) Regulations, 2000
SEPA Guidance	GPP1 'Understanding your environmental responsibilities – good environmental practices' GPP 2 Above Ground Oil Storage Tanks PPG 3 Use and design of oil separators in surface water drainage systems GPP 4 Treatment and disposal of wastewater where there is no connection to the public foul sewer GPP 5 Works and maintenance in or near water PPG 6 Working at Construction and Demolition Sites GPP 8 Safe Storage and Disposal of Used Oils GPP 13 Vehicle washing and cleaning GPP 21 Pollution Incident Response Planning GPP 22 Dealing with spills Managing River Habitats for Fisheries, 2002 Special Requirements for Civil Engineering Contracts for the Prevention of Pollution, Version 2, SEPA, 2006 Culverting of Watercourses, WAT-PS-06-02, 2015 Natural Flood Management Handbook, 2015 Indicative River & Coastal Flood Map (Scotland) Planning advice on wastewater drainage, 2011 Temporary Construction Methods, WAT-SG-29, 2009 SEPA Flood Risk and Planning Briefing Note, 2009 Groundwater Protection Policy for Scotland, v3, 2009 SEPA Position Statement 'The role of SEPA in Natural Flood Management', 2012 Technical flood risk guidance for stakeholders, SS-NFR-P-002, 2015 SEPA Regulatory Position Statement – Developments on peat, 2010

	Engineering in the water environment: good practice guide - River crossings, 2010 Environmental Standards for River Morphology, WAT-SG-21, 2012 The Water Environment (Controlled Activities) (Scotland) Regulations 2011 - A practical guide, Version 8.3 February 2019 Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, 2017 Land Use Planning System SEPA Guidance Note 4: Planning guidance on onshore windfarm developments, 2017 SEPA Water quality classification interactive database (2019 data)
Other Guidance	CIRIA C515 Groundwater Control - Design and Practice CIRIA C532 Control of Water Pollution from Construction Sites CIRIA C648 Control of Water Pollution from Linear Construction Projects CIRIA C689 Culvert Design and Operation Guide CIRIA C741 Environmental Good Practice on Site CIRIA C753 SUDS Manual A handbook on environmental impact assessment - Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland. NatureScot, 2018 River Crossings and Migratory Fish: Design Guidance, A Consultation Paper, The Scottish Executive Good Practice During Windfarm Construction, 2019 (4th Edition), Scottish Renewables (SR), NatureScot, SEPA, Forestry Commission Scotland (FCS), Historic Environment Scotland and Marine Scotland Science Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, on-line version only Forestry & Water Scotland (2018) Protecting Private Water Supplies During Forestry Activities

8.3 Methodology

The assessment of the potential impact of the proposal on hydrology and hydrogeology was carried out by the general method described in the following Sub-Sections.

8.3.1 Study Area

Given the scale of the development, a conservative study radius of 1.2km around the proposed turbines has been used for the assessment. The criteria for defining the study area have been established based on professional judgement, experience regarding expected working areas, relevant SEPA guidance, and other relevant guidance on hydrological assessment.

8.3.2 Identification of Baseline Conditions

The purpose of the baseline study is to identify:

- Land use across the site;
- Topography and surface water hydrology, including water courses, springs, and drains;
- The extent of river catchments and all flooding risk;

- Geological and hydrogeological conditions of the site;
- Any current dewatering, abstraction, or foul drainage;
- Private drinking water abstractions and private water supplies;
- The extent of habitats across the site, particularly any GWDTE.

Baseline conditions within the site are established through a desktop survey and later through a site visit. The following sources have been consulted:

- Ordnance survey 1:10,000 and 1:50,000 map data
- Ordnance survey digital terrain model (DTM)
- BGS – Geology of Britain Viewer https://www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/
- BGS – Hydrogeological Map 1:625,000
- BGS – Groundwater Vulnerability Map 1:625,000
- Scotland's soils, Carbon and Peatland 2016 Map https://map.environment.gov.scot/Soil_maps/?layer=10
- Scotland's Environment Map https://map.environment.gov.scot/sewebmap/?layers=riverClass
- Consultation with statutory and non-statutory organisations, including SEPA, NatureScot, Scottish Water, and the Council's Environmental Health Department.
- SEPA Flood Maps https://map.sepa.org.uk/floodmap/map.htm
- SEPA River Basin Management Plan (RBMP) interactive Map https://www.sepa.org.uk/data-visualisation/water-environment-hub/
- NatureScot Sitelink https://sitelink.nature.scot/map

8.3.3 Assessment of Receptor Sensitivity

With the baseline established, sensitive receptors can be determined. The criteria set out in the Table below outlines the various factors considered in the assessment of the sensitivity of potential receptors.

Table 8.2 - Sensitivity Table

Sensitivity	Definition
High	Receptor of high quality, rarity of a regional or national scale, and limited potential for substitution or replacement. This includes: • Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPA) or Special Area of Conservation (SAC) • SEPA Water Quality defined as High • Abstraction for public water supply • Private water supplies – 0 to 100m from construction activities • Designated salmonid fishery and/or salmonid spawning grounds present • Watercourse widely used for recreation, directly related to watercourse quality (e.g., swimming, salmon fishery) <1.2km downstream of development • Active flood plain area (important in relation to flood defence) • Groundwater - public drinking water supply • Groundwater aquifer productivity classed 1A or 2A in the BGS 1:625000 Hydrogeology Map • Geology that is rare or of national importance as defined by SSSI or Regional Important Geological Site (RIGS)

Sensitivity	Definition
	• Groundwater dependent terrestrial ecosystems (GWDTE) defined as Class 1, and/or defined as 'High Conservation Value' by Ecologist • Peat defined as Class 1 and Class 2 • Peat Slide Risk likelihood of 'probable' or 'almost certain'
Medium	Receptor of medium quality, rarity of a local, regional, or national scale, and limited potential for substitution/replacement. This includes: • SEPA Water Quality defined as Good • Surface water abstractions for private water supply for more than fifteen people • Private Water Supplies – Surface water abstractions within 100 – 600m of construction activities, groundwater spring abstractions within 100 – 400m of construction activities, and groundwater borehole abstractions within 0 – 200m of construction activities • Designated salmonid fishery and/or cyprinid fishery • Watercourse widely used for recreation, directly related to watercourse quality (e.g., swimming, salmon fishery) >1.2km downstream of development • Groundwater aquifer productivity classed as 1B or 2B in the BGS 1:625000 Hydrogeology Map • Groundwater dependent terrestrial ecosystems (GWDTE) defined as Class 2, and/or defined as 'Medium Conservation Value' by Ecologist • Peat Slide Risk of 'Likely'
Low	Receptor of low quality, rarity of a local, regional, or national scale, and limited potential for substitution/replacement. This includes: • SEPA Water Quality defined as Moderate or Poor • Occasional or local recreation (e.g., local angling clubs) • Conveyance of flow and material, main river <10 m wide or ordinary watercourse >5 m wide • Existing flood defences • Private Water Supplies – Surface water abstractions >600m from construction activities, groundwater spring abstractions within 400 – 800m of construction activities, and groundwater borehole abstractions within 200 – 600 m of construction activities • May be subject to improvement plans by SEPA • Designated cyprinid fishery, salmonid species may be present and catchment locally important for fisheries • Watercourse not widely used for recreation, or recreation use not directly related to watercourse quality • Groundwater aquifer productivity classed as 1C or 2C in the BGS 1:625000 Hydrogeology Map • Groundwater dependent terrestrial ecosystems (GWDTE) defined as Class 3, and/or defined as 'Local Conservation Value' by Ecologist • Peat Slide Risk of 'Unlikely'
Negligible	Receptor of low quality, rarity of a local scale, and limited potential for substitution/replacement. Environmental equilibrium is stable and is resilient to changes that are greater than natural fluctuations, without detriment to its present character. This includes: • SEPA water quality defined as Bad • Fish sporadically present or restricted, no designated features • Receptors not used for recreation, e.g., no clubs or access route associated with watercourse

Sensitivity	Definition
	• Watercourse <5 m wide – flow conveyance capacity of watercourse low - very limited floodplain as defined by topography, historical information and SEPA flood map • Private Water Supplies – groundwater spring abstraction >800 m from construction activities, and groundwater borehole abstractions >600 m from construction activities • No public drinking water supplies • Groundwater aquifer productivity classed as 3 in the BGS 1:625000 Hydrogeology Map • Receptor heavily engineered or artificially modified and may dry up during summer months • Geology not designated under a SSSI or RIGS or protected by specific guidance • Peat defined as Classes 3, 4 and 5 • Peat Slide Risk of 'Negligible'

8.3.4 Assessment of Magnitude of Impact

The analysis of the significance of each impact is based on its magnitude. The magnitude of impact includes the timing, scale, size and duration of the potential impact. For the purposes of this assessment the magnitude criteria are defined as follows.

Table 8.3 - Magnitude of Impact Table

Magnitude	Criteria	Description and Example
Large	Results in loss of attribute	• Fundamental (long term or permanent) changes to geology, hydrology, water quality and hydrogeology • Loss of designated Salmonid Fishery • Loss of national level designated species/habitats • Changes in WFD water quality status of river reach • Loss flood storage/increased flood risk • Pollution of potable source of abstraction compared to pre-development conditions
Medium	Results in impact on integrity of attribute or loss of part of attribute	• Material but non-fundamental and short to medium term changes to the geology, hydrology, water quality and hydrogeology • Loss in productivity of a fishery • Contribution of a significant proportion of the discharges in the receiving water, but insignificant enough to change its water quality status
Small	Results in minor impact on attribute	• Detectable but non-material and transitory changes to the geology, hydrology, water quality and hydrogeology
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity	• No perceptible changes to the geology, hydrology, water quality and hydrogeology • Discharges to watercourse but no loss in quality, fishery productivity or biodiversity • No significant impact on the economic value of the receptor • No increase in flood risk

8.3.5 Assessment of Significance of Impact

The sensitivity of the receptor together with the magnitude of impact defines the significance of the impact as outlined below.

Table 8.4: Significance of Impact Matrix

		MAGNITUDE			
		LARGE	MEDIUM	SMALL	NEGLIGIBLE
SENSITIVITY	HIGH	Major	Major	Moderate	Negligible
	MEDIUM	Major	Moderate	Minor	Negligible
	LOW	Moderate	Minor	Minor	Negligible
	NEGLIGIBLE	Negligible	Negligible	Negligible	Negligible

The significance of any identified effects will be assessed in terms of Major, Moderate, Minor or Negligible. The matrices should not be used as a prescriptive tool but will allow for the exercise of professional judgement.

Any effects that are classified as Major or Moderate, will be considered to be equivalent to likely significant effects referred to in the EIA Regulations. Where an effect is deemed to be significant, mitigation will be employed to reduce those impacts to a non-significant level.

8.3.6 Mitigation & Assessment of Residual Impact

There are recognised best practices and measures to mitigate and eliminate predicted impacts. These may be grouped in decreasing order of preference as follows: Avoid; Cancel; Reduce; and Remediate/Compensate. Consideration will also be given to potential enhancement measures, and the possibility of creating a net environmental benefit.

Once each predicted impact is associated with a mitigating measure, the residual magnitude is derived. The sensitivity of the receptor together with the residual magnitude of impact defines the significance of the post-mitigation impact, as outlined in Table 8.4.

8.4 Baseline

8.4.1 Site Overview

The Proposed Development is situated within the Greenwellheads Farm and will form an extension onto the existing Greenside Wind Farm, approximately 1.6km from Crimond and c.3.9km from St Fergus, Aberdeenshire, Scotland. The study area is dissected by several unnamed roads and farm tracks that connect the surrounding residential properties. The A90 road also runs through the north-eastern section of the study area, running in a north-west to south-east trajectory.

The study area is predominantly comprised of arable farmland, grassland, and forestry parcels, that are intersected by scattered farmhouses. The south-western boundary of the study area traverses the St Fergus Moss, which has a history of peat cutting. The surrounding area also has a history of renewable energy, shown in the existing Greenside Wind Farm and the North Lothian turbine c.926m west of the Proposed Development.

The terrain within the area consists of relatively flat land with elevations ranging from 32 - 40m AOD. The land is higher to the west and gradually slopes down to the east, in the direction of the coast.

The Proposed Development is discussed in further detail within Chapter 3 – Project Description.

8.4.2 Hydrology overview

The study area is fully situated within the Buchan Coastal Catchment of the Scotland River Basin District.

The hydrology of the study area is primarily characterised by the numerous drains associated with the arable fields. There is a network of drains that encompass the central study area, issuing from the parcels of forestry and nearby fields. The drains flow in an eastern direction and merge to form a single watercourse that passes under an unnamed minor road, before continuing beyond the study area and reaching the St Fergus Gas Terminal c.1.2km to the east of the study area. Similarly, within the western section of the study area, there are several drains that pass along the field edges and drain the surrounding arable land.

An unnamed drain enters the south-western section of the study area from within the area of Class 1 Peat associated with St Fergus Moss. This drain then merges with several unnamed drains to form the Black Water watercourse, which then that flows in an eastern trajectory and passes underneath the existing access tracks for Greenside Wind Farm and an unnamed road, before exiting the study area. The Black Water watercourse then continues to flow in a predominantly eastern trajectory, before passing through the sand dunes and dispelling into the North Sea c.2.3km from the study area.

There are several unnamed drains within the northern section of the study area that flow in a predominantly northern trajectory, before passing outwith the study area and flowing towards Crimond. These drains appear to be ephemeral and dispel into the surrounding farmland.

Within the centre of the study area, it was noted that there are small periodic pools noted within marshier ground, which are likely to be associated with periods of heavy rainfall.

8.4.3 Surface & Groundwater Classification

SEPA has classified the quality of all significant waterbodies in Scotland under the Water Framework Directive (WFD) (2022). The nearest classified surface waterbody is the 'Black Water – u/s St Fergus' River[48] (SEPA ID: 23064) that flows through the southern section of the study area in a west to east trajectory.

The river was recorded as having an overall status of 'Moderate Ecological Potential for the year 2022, with a pre-heavily modified water body (pre-HMWB) and overall ecology status of 'Bad', and a water quality status of 'High'.

[48] https://www.sepa.org.uk/data-visualisation/water-classification-hub/ Accessed - 18/10/2023

Additionally, it was noted that the waterbody has been designated as a heavily modified water body due to the physical alterations. These alterations are unable to be addressed due to the potential significant impact on drainage of agricultural land.

SEPA have also classified the quality of all groundwater bodies in Scotland under the Water Framework Directive (WFD). The study area is fully sited on the Fraserburgh Groundwater Unit (ID: 150634) that is 207.4km^2 in area. The groundwater was recorded as having an overall status of 'Good' with no limiting parameters for the year 2022[49].

8.4.4 Flood Risk

SEPA's Flood Hazard and Risk Map illustrates the indicative flood extents of high likelihood (1 in 10-year probability), medium likelihood (1 in 200-year probability), or low likelihood (1 in 1000-year probability) of coastal, surface, and river floods[50].

A review of the map highlighted there are no areas of river flood risk within the study area although, there are pockets of high likelihood of surface water flooding. These areas appear to be primarily associated with periodic pools within the surrounding farmland, and the small, forested area noted adjacent to the Proposed Development. Where the flood risk is associated with existing small waterbodies and ponds, it is illustrated as remaining within the confines of these waterbodies.

8.4.5 Hydrogeology

The British Geological Survey (BGS) 1:50,000 map indicated that the study area is entirely underlain with the Crinan Subgroup and Tayvallich Subgroup – Semipelite, pelite and psammite. This is a metamorphic bedrock comprised of pelite, psammite, quartzite and semipelite with subsidiary basalt, calcsilicate-rock and limestone[51].

In terms of superficial deposits, the study area is primarily comprised of Hatton Till Formation – Diamicton, clay, sand and gravel. It is described as diamicton, clayey, pebbly, calcareous, red and crudely stratified. Additionally, alongside the local rock types, it is noted to contain red sandstone, Mesozoic/Tertiary mudstone and limestone, shell fragments[52].

The BGS Hydrogeological 1:625,000 Map classifies the potential for bedrock to supply groundwater and describes the potential groundwater flow mechanism[53]. The study area is situated within the Argyll Group, which has been classed as a low productivity aquifer (2C). The flow mechanism for this aquifer is almost entirely through fractures and other discontinuities, with small amounts of groundwater found in near surface weathered zones and fractures[54].

8.4.6 Private Water Supplies

From discussions with Aberdeenshire Council in October 2023, one private water supply (PWS) within 1.2km of the development was identified and listed in Table 8.5.

[49] https://www.sepa.org.uk/data-visualisation/water-classification-hub/ Accessed - 18/10/2023
[50] https://map.sepa.org.uk/floodmap/map.htm Accessed - 18/10/2023
[51] https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=DBCT Accessed - 18/10/2023
[52] https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=HATT Accessed - 18/10/2023
[53] https://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSHydroMap Accessed - 18/10/2023
[54] https://map.environment.gov.scot/sewebmap/ Accessed - 18/10/2023

Table 8.5 - Private Water Supplies within 1.2km of the Proposed Development

Property Name	ID	Easting	Northing	Distance from Development	Source	No of Properties Served	Regulatory Classification
Overside	PWS1	406615	854208	724m	Unknown	Unknown	Unknown

The nearest PWS (PWS1) is located approximately 962m from to the south of the Proposed Development at its nearest point, as illustrated on Figure 9.1. The PWS is located at BNG 406615 854208 at an elevation of 37m AOD, and following discussion with the council, it was identified that the source, number of properties served, and regulatory classification are not currently known. Following from the hydrological walkover and discussion with the landowner, it was identified that the PWS is not active, and the nearby residential properties are now on mains supply.

8.4.7 Peat

The NatureScot Carbon and Peatland Map (2016) identifies an area of Class 1 Peat along the fringes of the south-western study area, associated with the St Fergus Moss and c.0.5km from the Proposed Development. This is further illustrated on Figure 9.1 – Hydrological Context Map. Class 1 Peat is nationally important carbon-rich soil that is considered to be of high conservation value.

The northern and western study area is comprised of Class 4 (predominantly mineral soil with some peat soil) and Class 5 (Peat soils with no peatland vegetation) peatland. The remainder of the study area is primarily comprised of mineral soil where peatland habitats are not typically found[55]. The Proposed Development is predominantly sited on mineral soils although, one of the proposed turbines and a spur of new access track is sited upon an area of Class 5.

8.4.8 Designated Habitats

There are no ecological statutory or non-statutory designated sites within the study area. The nearest designated site is the Rora Moss Site of Special Scientific Interest (SSSI) that is located 2.3km to the south-west of the Site. The site was designated for its raised bog habitat, which was last assessed in June 2012 and was noted to be in an unfavourable condition[56].

A site walkover and National Vegetation Classification (NVC) study was conducted by IMTeco Ltd (See Appendix 14.1 – Habitat & National vegetation Classification Survey). In addition to various grassland habitats, some areas of the Site are comprised of broadleaved, coniferous, and mixed woodland, hedges, swamp habitat, standing water, and ditch systems. With regards to hydrology, several areas of GWDTE were identified in mosaics across the Site. Present communities include:

- MG10a;
- M27;
- S28; and
- MG6.

The above communities have been assigned varying degrees of groundwater dependency, based on the Scotland (GW) Dependency Score (UKTAG Guidance 5ab Annex 1).

[55] https://map.environment.gov.scot/sewebmap/ Accessed - 18/10/2023
[56] https://sitelink.nature.scot/site/1371 Accessed - 12/02/2024

The MG10a and M27 communities within the study area are regarded as Class 2 GWDTE with a moderate dependency on groundwater. However, it should be noted that these communities are likely to rely on a rainfall and surface water runoff. All other communities on Site were categorised as Class 3 GWDTE, where groundwater discharge is considered to be irrelevant, and the communities are fed by other sources.

Further details regarding GWDTEs, and other vegetation communities present on the Site is available in **Appendix 14.1 – Habitat & National Vegetation Classification Survey**.

8.5 Sensitive Receptors

It was identified that the nearest classified surface waterbody within the study area is the 'Black Water u/s St Fergus' waterbody, which is situated in the southern study area. At its closest point, it sits approximately 114m from the Proposed Development. Additionally, there are several drain networks associated with the surrounding farmland and forestry that intersect various sections of the study. The Flood Risk and Hazard Map also identified an area of high-risk surface water flooding directly north of the Proposed Development. With consideration to the potential negative impacts resulting from construction and operation of the development, sensitive watercourses will be included as a sensitive receptor with a sensitivity of 'Medium'.

The study area is situated upon the Fraserburgh Groundwater unit, which was recorded has having a status of 'Good' with no limiting parameters. Additionally, the study area is entirely sited upon the 'Argyll Group' rock unit, which is classed as a low productivity aquifer (2C). As such, there is potential for sedimentation, contaminates and pollution to move through the groundwater units, and the groundwater unit will be included as a sensitive receptor with a sensitivity of 'Medium'.

There is one PWS within the study area. The PWS sits on a lower elevation and is c.0.5km from the Proposed Development at its closest point. However, it was confirmed with the landowner during the site visit that the PWS unused and the property is now supplied by mains at present. As such, the PWS will not being included as a sensitive receptor.

According to the Carbon and Peatland Map 2016, there is an area of Class 1 Peat along the fringes of the south-western study area. This peatland is situated uphill from the Proposed Development and, despite being classed as Class 1 peatland, it is evident that the peatland has a history of peat cuttings and is currently bare peat with no vegetation cover. Due to the distance and elevation difference, the area of Class 1 Peat is not considered to be hydrologically connected to the Proposed Development and therefore, Class 1 Peat will not be included within the assessment.

The NVC study identified several pockets of plant communities within the Site that are thought to be partially groundwater dependent (GWDTE), with these vegetation communities graded as Class 2 and Class 3 GWDTE communities, as detailed within **Appendix 14.1 – Habitat & National Vegetation Classification Survey**. These habitats are of conservation value and may be impacted by constructional works on the Site. As such, the Class 2 GWDTEs are considered as receptors with 'Medium' Sensitivity. Given the spread of Class 2 and Class 3 GWDTEs on Site, the Class 3 GWDTE are taken to also be covered by the Class 2 review, providing a conservative element to the assessment.

The identification of sensitive receptors, considering baseline conditions, is summarised below.

Table 8.6 - Sensitive Receptors

Receptor	Sensitivity	Comment
Watercourses & Fisheries	Medium	The 'Black water u/s St Fergus' waterbody is a classified surface waterbody that passes through the southern section of the study area.

Receptor	Sensitivity	Comment
		Although the tributaries to these watercourses are also considered, for ease of reference these are referred to collectively as the 'Black water u/s St Fergus' waterbody in the remainder of this assessment.
Groundwater Units	Medium	The Fraserburgh Groundwater Body has a status of 'Good' with no limiting parameters. This is classed as a low productivity aquifer (2C).
GWDTE	Medium	One PWS has been identified within the 1.2km study area, which is noted to no longer serve any residential properties.

8.6 Assessment of Predicted Impacts and Effects during Construction

8.6.1 Increase in Runoff

Replacing natural land cover with impermeable surfaces will reduce the rate of infiltration of rainwater into the underlying strata and increase runoff from the site.

Construction of access track and crane hardstandings will increase the impermeable footprint of the site and result in localised changes to surface water hydrology. In addition, the cambered tracks may interrupt natural flow paths and will shed water more quickly than the existing ground cover.

An increase in runoff in the area can compound various other predicted impacts, such as sedimentation, erosion, chemical pollution, and flood risk.

Table 8.7 - Impact of Increase in Runoff (without mitigation)

Receptor	Comment	Sensitivity	Magnitude of Impact	Significance of Impact
Watercourses & Fisheries	The 'Black Water u/s St Fergus' waterbody is situated c.139m from the Proposed Development however, with consider to the elevation, it is not anticipated that surface runoff from the Proposed Development will issue into the watercourse. There are a series of drains surrounding the immediate site area, and there is potential for runoff to issue into these drains and to be carried further downstream. Additionally, the surface water flood risk noted adjacent to the proposed turbines could be elevated with the introduction of new infrastructure.	Medium	Medium	Moderate
Groundwater Units	There increase in potential runoff may also result in elevated risk of pollution entering the groundwater unit. However, the extend of impermeable surfaces proposed is limited in relation to the size of the groundwater bodies.	Medium	Medium	Moderate

Receptor	Comment	Sensitivity	Magnitude of Impact	Significance of Impact
GWDTE	The topography on Site dictates that surface water runoff will be directed over GWDTE communities.	Medium	Medium	Moderate

8.6.2 Sedimentation & Erosion

Construction activities on or near the edges of watercourses can impact the structural integrity of the banks of watercourses, either through direct damage to bankside material or indirect loosening of soil structure. This can affect localised watercourse morphology and water quality through erosion or even collapse of the banks.

Construction works such as excavations for infrastructure can involve the relocation of peats and mineral soils, and the importation of new substrates such as aggregate for civil enabling works. This introduces the possibility for sediments to be washed out of materials before they are sufficiently compacted.

Poorly implemented drainage systems can create new runoff pathways that have the potential to erode rills into loosely aggregated substrates such as alluvial deposits.

Although the cable trenches proposed will require only shallow excavations, the action of cable-laying also has the potential to damage soils and introduce new drainage pathways which could generate silt laden runoff.

If erosion was to occur around the proposed infrastructure, an increased sediment load could lead to the constriction of the channels draining into the local river systems. This would negatively impact water quality and degrade habitat for any existing aquatic receptors.

The amount of suspended solids pollution will be greater during heavy rainfall events, although the dilution potential of the watercourses is also at its greatest during these periods.

Table 8.8 - Impact of Sedimentation & Erosion (without mitigation)

Receptor	Comment	Sensitivity	Magnitude of Impact	Significance of Impact
Watercourses & Fisheries	Due to the hydrological connectivity of the Proposed Development to the surrounding drains and watercourses, there is potential for increased sediment to be washed into and carried along these drains.	Medium	Medium	Moderate
Groundwater Units	Sedimentation from construction activities could result in silt-laden runoff entering the groundwater, if unmitigated. However, this is tempered by the relatively large size of the groundwater bodies.	Medium	Small	Minor
GWDTE	Due to the proximity, these communities have the potential to be impacted if sediment-laden runoff is distributed over sensitive communities.	Medium	Medium	Moderate

8.6.3 Chemical Pollution

There are various sources of potential contamination during construction. Runoff from construction areas and excavations may become contaminated by construction material or spilt pollutants, which ultimately enter

watercourses or groundwater. Concrete or cement brought onto site for the construction of foundations may be spilt. Construction-related oil, grease, fuel, or foul water may also be accidentally leaked. Only small quantities of potential chemical pollutants will be brought on site; however, even a small amount of these pollutants can have a serious negative impact on water quality and aquatic ecosystems.

Table 8.9 - Impact of Chemical Pollution (without mitigation)

Receptor	Comment	Sensitivity	Magnitude of Impact	Significance of Impact
Watercourses & Fisheries	Due to the topography on site, as well as close proximity of watercourses and drains, there is potential for runoff containing constraints related pollutants to contaminate and negatively impact the water quality.	Medium	Large	Major
Groundwater Units	The Fraserburgh Groundwater body is situated on a low productivity aquifer (2C). There is potential for sedimentation and contaminants to infiltrate and carry through the groundwater. This is tempered by the relatively large size of the groundwater units.	Medium	Small	Minore
GWDTE	Due to the proximity, unmitigated chemical pollution has potential to degrade GWDTE in the vicinity of the construction works.	Medium	Medium	Moderate

8.6.4 Disruption to Flow Paths & Flood Risk

Construction of proposed infrastructure may interrupt natural flow paths and result in localised changes to surface water hydrology. This can result in the 'drying out' of hydrologically sensitive areas, or alternatively, result in an increase in flood risk that can see sensitive areas flooded and contaminated with mineral matter.

Table 8.10 - Impact of Disruption to Flow Paths & Flood Risk (without mitigation)

Receptor	Comment	Sensitivity	Magnitude of Impact	Significance of Impact
Watercourses & Fisheries	The construction of the turbine foundations, access tracks and crane hardstandings could interrupt surface water flow paths and increase the downstream flood risk.	Medium	Large	Major
Groundwater Units	There is potential for flow to local groundwater bodies to be interrupted due to proposed infrastructure. This will be tempered by the size of the groundwater bodies.	Medium	Small	Minor
GWDTE	Due to their proximity, the construction of access track, crane hardstandings, and new watercourse crossings may all interrupt groundwater flow to the GWDTE communities.	Medium	Medium	Moderate

8.6.5 Dewatering & Abstraction

Given what is known about the ground conditions in the area and the expected extent of the excavation works, groundwater is unlikely to enter excavations. However, if required, dewatering will temporarily lower the water table for larger excavations, such as those for the turbine foundations. This can result in the temporary 'drying out' of hydrologically sensitive areas.

SEPA guidance specifies that the potential zone of dewatering impact can be up to 250m from excavations that exceed 1m in depth, and 100m from excavations less than 1m in depth. Once construction activities within the excavation are complete and the excavations are reinstated the groundwater table is expected to recover in a matter of days.

Table 8.11 - Impact of Dewatering & Abstraction (without mitigation)

Receptor	Comment	Sensitivity	Magnitude of Impact	Significance of Impact
Watercourses & Fisheries	Due to the proximity of the Proposed Development to nearby watercourses, there is potential for watercourses to be impacted by any temporary dewatering activities.	Medium	Small	Minor
Groundwater Units	There is potential for dewatering activities to impact the groundwater table. However, this is not anticipated to have a significant impact due to the size of the groundwater units and any dewatering being temporary.	Medium	Small	Minor
GWDTE	Dewatering may temporarily affect groundwater in the vicinity of these communities.	Medium	Small	Minor

8.6.6 Foul Drainage

The site compound facilities (sinks and toilets) will be self-contained. No foul drainage is proposed.

As such, there is no potential impact from foul drainage at the construction stage.

8.7 Assessment of Predicted Impacts and Effects during Operation

The access track and crane hardstanding will remain in-situ during operation requiring some basic maintenance and resulting in localised changes to the surface water hydrology for the duration of the project.

Regular on-site activities will be required during operation of the Proposed Development relating to regular maintenance and repair of the equipment. During these activities there will be a need to bring small quantities of oil, greases, and other materials on to the site.

For the purposes of this assessment, the potential unmitigated impacts are as discussed for Construction Impacts in Section 8.6. This is considered a conservative approach due to the operational phase requiring less on-site activities.

8.8 Assessment of Predicted Impacts and Effects during Decommissioning and Restoration

It is envisaged that detailed method reports, in compliance with relevant current legislation, will be drawn up prior to decommissioning. The following is based on the standards at time of writing.

No new infrastructure will be added to the site during decommissioning and the required removal of infrastructure would decrease the impermeable footprint of the site. Infrastructure such as access tracks and hardstandings will remain in situ, while foundations would only have the top 1m removed.

Any earthworks or landscaping undertaken as part of the decommissioning may provide scope for sedimentation or erosion to occur. However, the scope of the required works is predicted to be significantly reduced relative to that of the construction phase.

There will be no new excavations opened during the decommissioning phase of the development, so no dewatering or abstraction activities will take place.

For the purposes of this assessment, the potential unmitigated impacts are as discussed for Construction Impacts in Section 8.6. This is considered a conservative approach due to the decommissioning and restoration phase requiring less on-site activities.

8.9 Mitigation

Proposed mitigation measures can be grouped under three headings:

- Mitigation built into the design. The design process has aimed to reduce environmental impacts through careful siting of proposed infrastructure.
- Adoption of Best Practice during construction, including further micro-siting where required.
- Restoration and enhancement of the site post-construction.

8.9.1 Mitigation through Design

Clean water cut-off ditches

Clean water cut-off ditches are proposed for the access track and hardstandings at all turbines. This system will allow clean discharge from ground uphill of the track to pass into the ground downstream, to maintain existing conditions and prevent drying out.

Ditches will be located on the 'high-side' of the relevant infrastructure and will be installed immediately ahead of construction. Stone check dams will be employed to slow water flow along the ditches.

Surface runoff will be collected in the ditches and passed through regularly spaced dedicated piped culverts under the access track to reduce the volumes of flows in the ditch and provide a more even redistribution on the downhill side.

Discharge points will be designed to encourage sheet flow, rather than as a single point discharge, in order to slow and spread the flow and minimise potential scour. Clean discharge will thus infiltrate into the existing vegetation in close proximity to its origin.

The presence of cut-off ditches will also restrict capacity build-up of infiltration trenches adjacent to the relevant infrastructure.

Access Track Sizing, Camber, and Cross-drains

All tracks will be constructed with a camber sufficient to minimise ponding and prevent the track becoming a conduit for runoff. The track will be constructed using a relatively large aggregate size, enabling runoff to percolate through the track. A large aggregate size also minimises the amount of fine sediment in the construction material.

Low verges will be constructed, allowing surface water to drain naturally and diffusely. Any runoff will be collected in adjacent infiltration trenches.

Infiltration trenches

V-Ditches with check dams will also be installed alongside the hardstanding and access tracks to collect any runoff. The check dams will be constructed from clean, granular materials or straw bales. This will help sediments and pollutants will be filtered from the water and will also slow water flow along the ditches.

Where infrastructure lies in close proximity to sensitive hydrological features such as watercourses, runoff will be diverted into a settlement pond to remove any potential contaminants prior to discharge into the environment.

8.9.2 Mitigation during Construction

Tree Felling

Upon felling, tree residues (i.e. needles, twigs and branches) will be left in situ to form brash material mats, which are effective in protecting the disturbed topsoil underneath and reducing erosion. This can also be used to form windrows for reforestation purposes after construction.

Excavations

Prior to excavations, an end-use will be identified for the excavated material and an appropriate storage solution determined accordingly. Stored materials will be kept away from surface water bodies to minimise the possibility for sediments entering the aquatic environment.

Soils will be stripped to avoid cross contamination between distinct horizons. Stripped materials will be side- cast or stockpiled for use in the same area as they are excavated from, or they will be stored in appropriately designed and clearly defined separate stockpiles for re-use elsewhere.

Where appropriate, temporary silt fences will be installed to filter runoff that is potentially carrying silt from excavations or stockpiles. This will be effective in protecting surface water quality in adjacent watercourses and eliminate the possibility for silt laden runoff to enter them.

Reinstatement

Early reinstatement of excavated materials is required to minimise visual impact, to reduce time required for temporary storage/stockpiling of soils, and to encourage vegetation and habitat restoration as early as possible.

As far as is reasonably practical and achievable, excavated material horizons will be replaced in sequence and depths similar to those recorded prior to excavation, or similar to the surrounding undisturbed ground at the point of reinstatement.

Any detailed reinstatement and restoration proposals will consider and mitigate all residual risks to environmental receptors.

Dewatering

Dewatering shall be avoided where possible to minimise impacts on sensitive habitat. However, formation of the turbine foundations would likely involve dewatering to temporarily lower the water table and enable work in the excavated areas. Gravity foundations are proposed, which will limit depths of excavations and associated impacts.

Details of the pre-construction ground investigation will include an assessment of the ground permeability and water potential; the results will be used to inform any dewatering required on site.

Where dewatering is required, it shall comply with the Abstraction Regime of CAR General Binding Rule (GBR) 2 and GBR 15.

Details of how dewatering will be managed shall be provided within a Construction Method Statement (CMS) prior to construction of the proposed project. Mitigating measures will include: using an irrigation sprinkler head to maintain moisture in the upper soil horizons of nearby GWDTE; and, keeping the foundation construction duration as short as possible. This will maintain a continuous water supply to sensitive habitats and minimise the overall impact of dewatering.

Enhanced sedimentation control

To avoid potential impacts on sensitive habitats, any potential runoff will be appropriately treated prior to discharge into the natural environment. This will keep clean and contaminated runoff separate to avoid further contamination and maintain the SuDs capacity, which will mitigate the possibility of contaminants entering watercourses and impacting the aquatic environments.

These mechanisms of clean water cut-off ditches, sediment capture, and infiltration trenches, are intended to reduce the speed of flow, filter runoff, and allow suspended silts and particulates to settle out naturally thus minimising the potential impacts upon downstream aquatic environments, nearby PWS, or GWDTEs.

If the standard system is not proving to be effective, then a 'Siltbuster' system of control via settlement tanks will be employed. The 'Siltbuster' system is regularly used on construction sites situated close to waterways or in extreme situations where the combination of soil stripping and wet weather has given rise to normal silt control methods being overrun.

General Site Pollution Control

The proposed mitigation for the construction of the access roads will continue to function through the life of the project. Routine maintenance for the roads will be carried out in summer months when the tracks are dry. Operational best practice procedures will continue to be adopted, with the risk of water pollution from such activities considered to be negligible.

With regard to vehicles, fleet vehicles entering the site will be regularly checked and maintained to prevent leakage of contaminants. Concrete will be premixed offsite and delivery wagons will only be washed out in areas where suitable control measures are in place. The concrete used will be of a high grade that is not prone to leaching alkalis. The number of onsite vehicles will be highest during construction. The ongoing risk of pollution on the site after construction is considered to be very low.

Best practice procedures in the handling, use and storage of fuel, oils, and chemicals will be adhered to at all times.

Prior to construction, an Environmental Management Plan (CEMP) and a Pollution Prevention Plan (PPP) will be put in place, adhering to the standards set out by SEPA and Aberdeenshire Council. These documents will outline mitigation measures to reduce or nullify potential impacts on the ground and surface water environment.

The CEMP and PPP will address the following issues:

- Reinstatement and Restoration
- Decommissioning
- Contractor Duties
- Tool Box Talks
- Pollution Prevention and Mitigation
- COSHH

- Pollution Monitoring & Controls
- Site Waste Management Plan

8.9.3 Mitigation during Restoration

Early reinstatement of excavated materials is required to minimise visual impact, to reduce time required for temporary storage/stockpiling of soils, and to encourage vegetation and habitat restoration as early as possible.

As far as is reasonably practical and achievable, excavated material horizons will be replaced in sequence and depths similar to those recorded prior to excavation, or similar to the surrounding undisturbed ground at the point of reinstatement.

Any detailed reinstatement and restoration proposals will consider and mitigate all residual risks to environmental receptors.

8.10 Summary of Impacts and Effects

The following section provides a summary of the initial and residual impacts during the construction, operational and decommissioning stages of the development.

The Residual Overall Impacts are outlined below.

Table 8.12 - Residual Impacts

Receptor	Sensitivity	Impact	Significance without mitigation	Significance with mitigation
Watercourses & Fisheries	Medium	Increased Runoff	Moderate	Negligible
		Sedimentation & Erosion	Moderate	Negligible
		Chemical Pollution	Major	Negligible
		Disruption to Flow Paths & Flood Risk	Major	Negligible
		Dewatering & Abstraction	Minor	Negligible
Groundwater Units	Medium	Increased Runoff	Moderate	Negligible
		Sedimentation & Erosion	Minor	Negligible
		Chemical Pollution	Minore	Negligible
		Disruption to Flow Paths & Flood Risk	Minor	Negligible
		Dewatering & Abstraction	Minor	Negligible
GWDTE	Medium	Increased Runoff	Moderate	Negligible
		Sedimentation & Erosion	Moderate	Negligible
		Chemical Pollution	Moderate	Negligible
		Disruption to Flow Paths	Moderate	Negligible
		Dewatering & Abstraction	Minor	Negligible

8.11 Summary

A desk-based study and site walkover were conducted to establish the baseline hydrological environment of the site, whereby potential impacts from the development were identified.

It was determined that there were three categories of sensitive receptor within the study area, these being: Surface Water Features, including the 'Black Water u/s St Fergus' watercourse and its tributaries; Fraserburgh Groundwater Unit; and vegetation characteristic of Class 2 and Class 3 GWDTE communities.

It is anticipated that careful design of the site layout, and the implementation of the mitigation methods proposed, will ensure that any potential risks identified are avoided and the associated risk is reduced to acceptable levels.

9 Traffic and Transport

9.1 Introduction

The Traffic and Transport Assessment has been developed to provide an assessment of how traffic associated with the development will be managed throughout the construction and operation phases of the project. Specific attention has been given to the following items:

- Estimated levels of traffic;
- Consideration of the proposed abnormal load route(s) to include:
  - Swept path assessment for abnormal loads;
  - Safe operation for all traffic on the proposed abnormal load route(s);
  - Safety of road users.
- Approach to framework Construction Traffic Management Plan (CTMP).

9.2 Approach

The approach to the Traffic and Transport Assessment is as follows:

- Estimate the levels of traffic associated with the construction and operation of the Proposed Development;
- Identify, assess, design, and implement any special procedures or control measures to protect the local road network;
- Outline the content of the CTMP which is to be produced during the pre-commencement phases which will eventually replace the Traffic and Transport Assessment in full. Once fully developed, the CTMP will include details of how the construction of the Proposed Development will be managed;
- Produce an outline Monitoring Plan for the CTMP. This Monitoring Plan will detail how the impact of traffic on the local road network will be reviewed and updated throughout the construction phase of the Proposed Development.

9.3 Structure

The Traffic and Transport Assessment is made up of five subsidiary sections which are listed below:

- Overview of Route to Site:
  - Section9.6 summarises the routes to the Site that will be used by construction traffic throughout the development.
- Traffic Increase Assessment:
  - Section 9.8 highlights the potential for increased traffic levels on the public road network within the Study Area.
- General Traffic Management Measures:
  - Section 9.10.1 describes the ''best practice method'' that will be employed during the construction of the Proposed Development.
- Outline CTMP:

- Section 9.12 provides an overview of what will be included within the CTMP, that will be produced during the pre-commencement phases. The Outline CTMP can be viewed in Appendix 9.1.

- Monitoring Plan:
  - Section 9.13 summarises the monitoring plan that should be adopted to ensure the Traffic and Transport Assessment and subsequent CTMP are appropriate and up to date for the project. The monitoring plan can be viewed in Appendix 9.2.

9.4 Scope

As discussed above in Section 9.3, the Traffic and Transport Assessment is an indicative report which will be replaced by a full CTMP, following the receipt of statutory consultee responses and in line with any proposed planning conditions which may be attached to the decision notice if granted, as well as revisions when the final detailed design is completed and approved.

Before the commencement of works the Traffic and Transport Assessment and CTMP will be used to inform the development of site-specific documents employed by contractors throughout the project delivery phase, which may include the following:

- Construction Method Statement;
- Construction Phase Plan;
- Construction Environmental Management Plan (CEMP).

The Traffic and Transport Assessment has been written for the pre-construction and construction phases of the Proposed Development. During the operational phase, the Proposed Development is unmanned and only requires visits from service and maintenance personal. As such, these do not cause any significant traffic issues. This Traffic and Transport Assessment does not cover the decommissioning phase of the project and we would expect a future CTMP or planning condition to deal with transport issues relevant to this phase.

9.5 Limitations

GCR have produced this Traffic and Transport Assessment for the Proposed Development with all the information available to them at the time of preparation to identify the most suitable access route for abnormal load traffic, the key risks associated with this traffic and the key methods which should be employed to minimise the risks.

9.6 Overview of the Abnormal Load Route to Site

The Proposed Development is located on farmland at Greenside approximately 2km southeast of Crimond, Aberdeenshire. The Proposed Development will consist of a three-wind turbine development to the north of the operational Greenside Wind Farm.

For the purposes of planning, an Enercon E82 machine has been selected as the candidate turbine for assessment. As well as the wind turbines, the development will consist of the construction of new access tracks, crane hard standings, turbine foundations and other ancillary works.

The study of routes was carried out using 1:50,000 and 1:25,000 OS maps. This study shows that there is a possible route for the turbine delivery vehicles to gain access to the Site provided that offsite works are undertaken. It is considered that Peterhead Port is the most accessible for turbine delivery. As such, this assessment will focus on the road network from the Port to Site. One site access option has been considered within the study, the route is detailed below and highlighted in Figure 9.3 and Figure 9.4.

Abnormal Load Route to Site

- Exit Peterhead Port using Merchants Quay Road;
- Turn left onto Charlotte Street;
- Continue along Charlotte Street until the junction;
- Turn left at the junction to join Kirk Street;
- Continue westbound on kirk Street for approximately 200m until the roundabout;
- Take the second exit at the roundabout to join the A950;
- Continue westbound along the A950 for approximately 2.2km until the Howe o'Buchan Roundabout;
- Take the second exit at the roundabout and continue westbound on the A950 to Longside;
- Navigate through the town of Longside remaining on A950
- Continue Westbound on A950 to Mintlaw
- At the roundabout turn right contraflowing the normal flow of traffic onto the A952 northbound, North Street;
- Continue north on the A952 traversing a single roundabout for approximately 11km;
- Turn right onto the A90 south-east bound;
- Continue approximately 13km south on A90 towards St. Fergus;
- Turn right at the crossroads to join Newton Road;
- Travel through the settlement of St Fergus for approximately 1.5km and turn right to join South Essie Road;
- Continue along South Essie Road for approximately 2km and enter the Site.

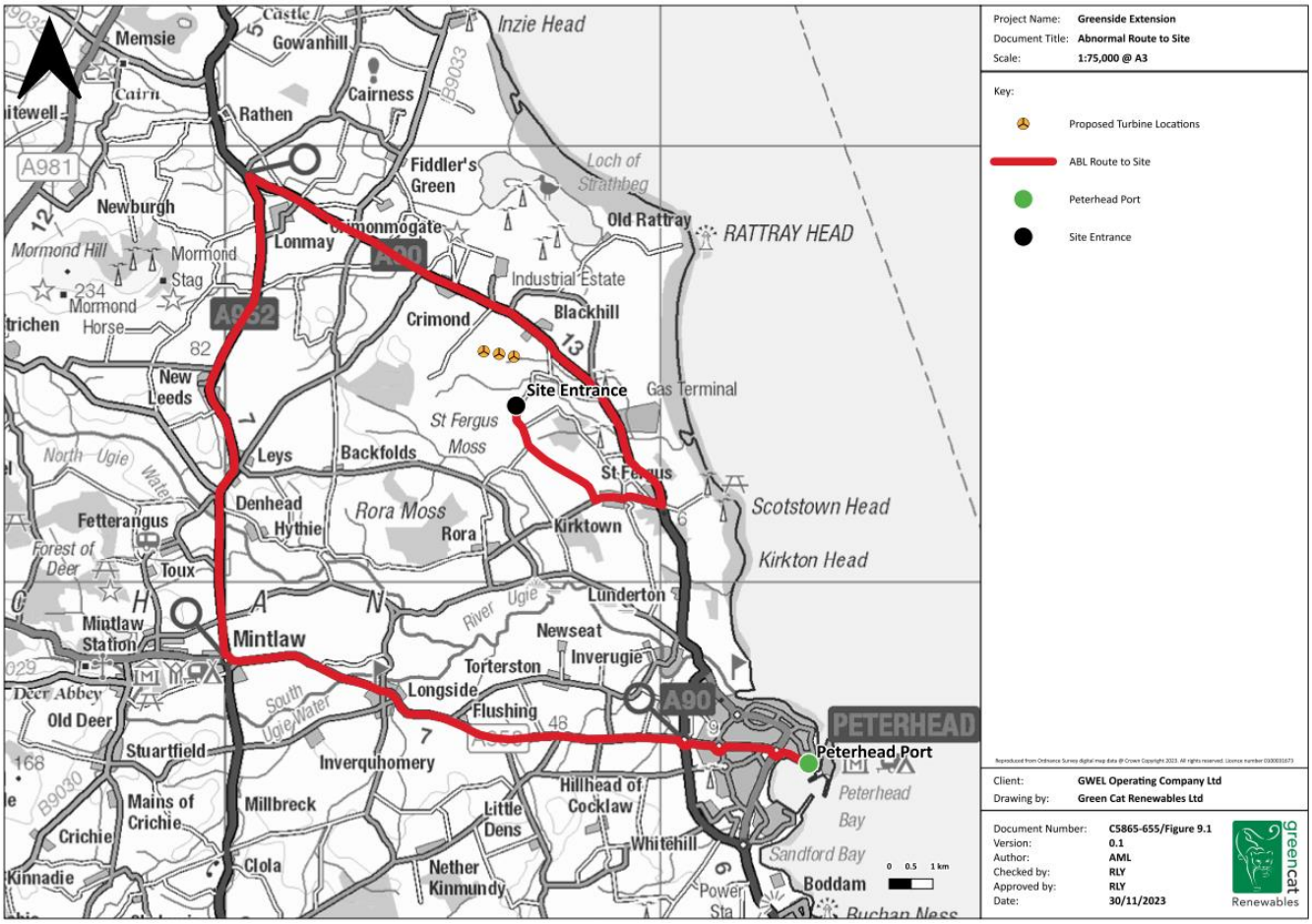

Figure 9.3 Abnormal Load Route to Site

The final route will be selected following the outcome of further assessments post consent.

Once on-site, each of the turbine locations will be accessed via a combination of existing roads and new access tracks within the planning application boundary. A detailed site layout plan is provided in C5865-GCR WF-GA-DR-P-0005-Site Layout Access C.

9.7 Site Access

It should be noted that third-party land will be required and a GS6 assessment will be required to establish clearance heights from overhead lines.

The detailed abnormal load site access is highlighted in Error! Reference source not found..

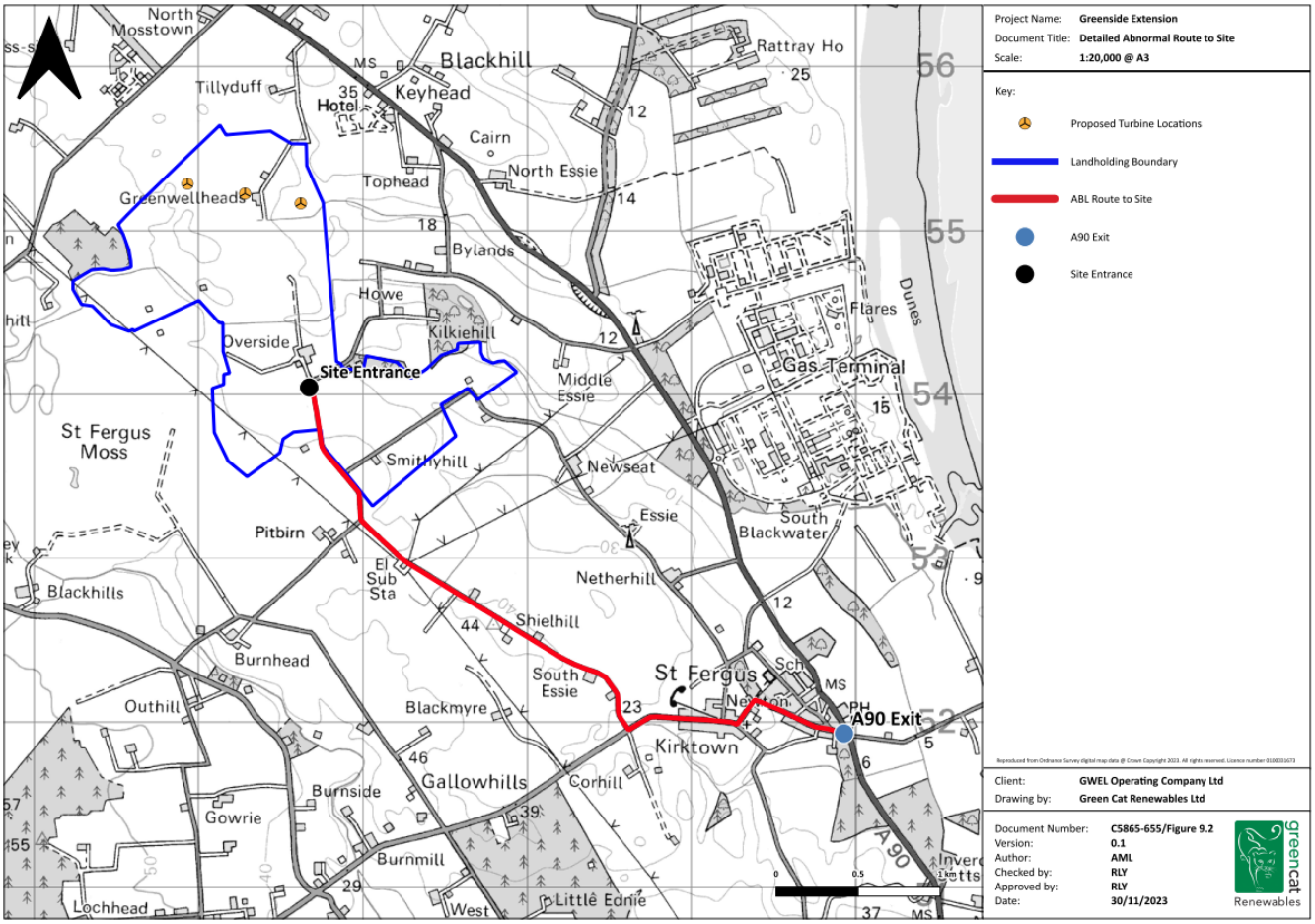

Figure 9.4 Detailed Abnormal Load Route from A90 to Site

9.8 Construction Traffic

There are six main sources of construction traffic. These comprise:

- Site compound, welfare and office establishment;
- Deliveries of aggregate for the site access tracks and crane hardstandings;
- Deliveries of concrete for the foundation pours;
- Deliveries of reinforcement steel and cabling;
- Delivery of the turbine components and cranes (blades, tower sections and turbine nacelles); and
- Personal trips to and from the site.

These deliveries will facilitate the construction of access tracks, hardstandings and turbine foundations, as well as the site compound and the erection of the turbines themselves. Table 9.13 gives an indicative estimate of the volumes of traffic likely to be involved during the construction phase. The volumes of traffic would be confirmed in the Construction Traffic Management Plan produced to discharge any pre-commencement planning conditions.

Table 9.13: Estimated Construction Traffic

	Duration	Traffic Load (typical)
Wind farm construction:		
Mobilisation, welfare set up etc.	1 week	○ 5no. hiab with cabins/welfare facilities ○ 7no. flat beds with plant
Construction of access tracks and crane hardstanding	6 months	○ Base course aggregate to be acquired from a local quarry ○ 1,568 no. aggregate deliveries required for capping layer ○ 18no. HGV delivery of geotextile/geogrid
Foundation preparation	1-2 weeks per foundation	Per foundation: ○ 2no. deliveries of concrete for blinding ○ 1no. lorry mounted crane for delivery of foundation bolt basket ○ 3no. delivery of steel rebar (standard HGV)
Foundation pour	1-2 days per foundation	Main foundation concrete pour requires approximately 478m^3 (60no. 8m^3 concrete wagons)
Turbine delivery	3-4 days per turbine	Per Turbine: ○ 8no. abnormal loads ○ 5no. standard loads
Crane delivery	1-2 days	○ 2no. cranes (750t & 200t) ○ 20no. ballast lorries
Commissioning and connection works	4 weeks	○ Electrical equipment (16no. Hiab, typically lorry-mounted crane)

The following sections provide further details of typical vehicle activity that would be required throughout the construction and operational phases of the development.

9.8.1 Turbine Delivery Vehicles

A number of abnormal loads will be needed to deliver the components of the three turbines to site, specifically:

- The longest loads are the turbine blades with a total vehicle length of up to 46m, including load overhang.
- The widest loads are the turbine generators with a maximum width of 5m.
- The tallest loads are the tower section with a maximum height of 4.5m.

These dimensions are subject to confirmation at the detailed design stage.

Due to these dimensions, the access route needs a minimum clearance width of 5.5 and height of 4.6m and the ability to withstand a maximum axle load of 12 tonnes and a maximum gross weight of 180 tonnes. The transport vehicles involved require a minimum ground clearance of 100mm.

9.8.2 Cranes

Two cranes are required to lift the turbine components into place on site, typically a 750-tonne capacity main crane and a 200-tonne capacity support crane. The largest crane proposed to be used on site is the Liebherr LG 1,750 mobile crane which is 19.3m long, 4m high, and 3m wide when fully disassembled for travel. The crane has 8 axles, with axle loads up to 12 tonnes; and a total vehicle transport weight of 96 tonnes.

9.8.3 Site Construction Plant

This is anticipated to include:

- Two tracked excavators;
- Two dumpers;
- One heavy vibrating roller

Deliveries of these would be likely to take place over the course of one or two days, arriving in the morning hours. The only additional deliveries to site would be site cabins/welfare facilities, occasional hire equipment and small material deliveries (e.g., rolls of geotextile/drainage pipe spares) which could occur at any hour during the working day.

These vehicles will likely access the site via the A90 and the proposed access option, however, this will be dependent on where the plant is dispatched from. A finalised access route will be confirmed by the civil contractor appointed to produce the Construction Traffic Management Plan.

9.8.4 Construction Materials for Access Tracks and Hardstanding Areas

The Proposed Development entails the construction of 1,217m of new access tracks and hardstandings to facilitate the access of the turbines to their sitting positions. Approximately 47,042, tonnes of aggregate will be required, which would result in approximately 1,568 HGV deliveries.

It is the intention to use stone from local quarries, such as Kirkmyres Quarry, located approximately 13km northwest of the Site. Deliveries would likely access the Site by connecting to the A98 before joining the B9032 eastbound and connecting to the A90 southbound towards the A90 exit at St. Fergus (Error! Reference source not found.). It is anticipated that vehicles containing aggregate for new access tracks will use the same access route as abnormal loads vehicles when after exiting the A90.

9.8.5 Construction Materials for Turbine Foundations

The preparation of each foundation will require six HGV deliveries of reinforcement steel, an HGV with a foundation anchor ring and up to five concrete wagons to pour a blinding layer. After these deliveries, steel fixers normally take about two weeks to fix the reinforcement steel.

For the main pour at each foundation, it is estimated that approximately 60no. deliveries of concrete would be required. Concrete wagons will be of standard sizes (8m^3).

The exact access route of concrete vehicles is dependent on the batching plant used, which will be finalised by the civils contractor appointed following a tender process.

The concrete deliveries would be scheduled to arrive at steady intervals, up to 12 per hour, over a one-day period. At worst, an increase in traffic of a single wagon every 5 minutes, would have minimal effect on the local road network. Traffic management would involve spacing deliveries to ensure that there is a sufficient and consistent supply of concrete whilst avoiding unnecessary impact on the public road.

9.8.6 Personnel/Small Deliveries

In addition to the traffic described above, during all phases of construction, there will be between 6-12 vehicles per day carrying personnel to the site. These will be light vehicles – cars, minibuses, or vans – arriving and exiting the site during the am and pm peak hours. In addition, throughout the project, there may be occasional delivery of visitors and equipment, such as fuel bowsers, survey equipment, testing subcontractors etc. These movements will not require any particular traffic management provisions beyond the route management plan.

9.8.7 Commissioning and Connection Works

This stage of the work requires 16 standard HGVs and will have almost no effect on the road network. Any traffic that may be required is likely to be light commercial vehicles required at low volume and frequency. As such, no traffic management is proposed.

9.9 Operational Traffic

Once the wind farm is operational, it will be monitored off-site using a telecommunication system. As such, the development will only require maintenance every few months with no other scheduled visits required. In addition, routine maintenance would only require a single vehicle to access the site which would not require any traffic management.

9.10 Mitigation

9.10.1 General Traffic Management Measures

The following are general traffic management measures which will be employed during construction. Non-compliance will be dealt with by the site manager, with disciplinary actions taken at their discretion. These issues will be captured in the Construction Traffic Management Plan.

9.10.1.1 Site Access

Preferred routes for heavy goods vehicles (HGVs) to and from the site will be agreed with the local authorities.

9.10.1.2 Hours of Deliveries

Typically, deliveries will fall between the construction hours of 0700hrs to 1800hrs on Monday to Friday, Saturdays between 0700hrs and 1300hrs and at no time on Sundays and Bank Holidays. Turbine component deliveries will be governed by the availability of Police Scotland and may take place outside these times. Care will be taken to avoid local refuse collection, school bus movements, and events where practicable in order to minimise the impact on the local road network.

9.10.1.3 Loading and Unloading of Vehicles

Where possible all loading and unloading of vehicles will take place within the site boundary. There will be no requirement to use the highway at any point for loading or unloading.

9.10.1.4 Temporary Warning Signage

On-site signage will consist of construction site signage at the site entrance, displaying the name of the site and contractor. Temporary warning signage will be placed on the public road near the site entrance to warn road users, cyclists, pedestrians, and equestrians of the nearby construction works.

9.10.1.5 Traffic Control at Site

At least one turning bell will be constructed on-site to enable all vehicles to be forward facing when exiting the site and re-joining the public highway.

9.10.1.6 Debris/Dust Control

All vehicles exiting the site shall be checked for excess dirt and where necessary, wheels will be hand cleaned. The adjacent road shall be periodically inspected for debris on the public highway. Should a surplus of debris be noted, the contractor will endeavour to actively clean the road to ensure that the carriageway is kept clear throughout the construction phase. If excessive quantities of dust are consistently arising from the development, water will be sprayed over the working areas to keep the dust down.

9.10.1.7 Monitoring

The local road network shall be monitored throughout construction; where road sweeping is required it shall be undertaken as necessary. Should issues with the condition of the road be noted, the Local Roads Authority shall be notified, and an agreement struck on how best to proceed.

9.10.1.8 Roadworthiness

- All vehicles will be kept in safe and efficient operational order, complying with the Roads Traffic Act Construction and Use Regulations. Special attention should be paid to the following requirements:
- All lights must function correctly and be clean, including indicators, brake lights, flashing beacons, reversing lights (and alarms where fitted).
- Steering and brakes must operate correctly and efficiently.
- Tyres must be undamaged and have adequate tread depth remaining.
- All mirrors must be correctly fitted, adjusted and unbroken.
- Suspension is maintained to a standard where noise (particularly when travelling empty) is minimised.
- Exhaust emissions should comply with all legal requirements.
- The vehicle is to be kept clean by regular washing.

Vehicles should contain a first aid kit and fire extinguisher at all times.

Any escort vehicles are to carry 6 x cones, 2 x emergency triangles and beacons. The regional police, who are anticipated to escort blades, nacelle and towers, will also have a provision of lights and cones in case of an

9.10.1.9 Driver Conduct

The Road Traffic Regulations and the advice given in the Highway Code will be included within site health and safety documentation and distributed to all parties. A summary of key aspects is given below:

- Driving to conditions. Speed will always be adjusted to varying road and weather conditions. Allowance will also be made for the potential of poor driving standards of other road users.
- Speed. Under no circumstances will the speed limit be exceeded. Extra care should be taken when passing villages and built-up areas. To further minimise the impact of heavy vehicles on the local population, speed restrictions on the site should be adhered to.
- Driving etiquette. Care will be taken to drive considerately, minimising impact on other road users.
- Convoying. Where practicable grouping of HGVs will be avoided to ensure room for smaller vehicles to overtake easily without having to pass multiple vehicles at once.

- **Reduce Noise.** Efforts will be made to minimise noise from engines, suspensions and tipper bodies, particularly in villages and built-up areas, and especially in the early morning and late at night. Tailgate should be locked when running empty.
- **Parking.** Overnight parking will be off public highways, so it does not inconvenience members of the general public.
- **Work Legally.** All drivers shall adhere to Hours Legislation and with the Tacho-graph Regulations.
- **Routing**. Approved routes to and from the delivery point will be used, and the use of narrow and hilly routes which are unsuitable for large vehicles should be avoided where practicable. Where the route restrictions are breached, penalties shall be applied at the site manager's discretion.
- **Safety**. Reflective high-visibility jackets/waistcoats will be worn at all times at the site, at delivery points, or at the scene of a vehicle accident/breakdown.
- **Accidents and Breakdowns**. Site and delivery vehicles will carry details of breakdown procedures, and contacts to be used in the event of an emergency. At the scene of a road traffic accident (or vehicle breakdown), wherever possible, approaching traffic should be warned of the potential danger by use of warning triangles and traffic cones. Details (names and addresses) of any witnesses will be obtained and emergency services should be contacted.

9.10.1.10 Emergency Services

Throughout the construction programme, the site manager will ensure access to the site is not impeded and congestion does not occur. This will ensure traffic is not backed onto the main road and access is kept clear for emergency service use.

During delivery of components to site, there is the possibility of an emergency situation arising. Planning of transport operations cannot remove the possibility that a single site access would be blocked to emergency response vehicles. To remedy this, a secondary site access is included, making the overall site a loop, where emergency response vehicles can access the site from either side.

9.11 Conclusion

A suitable route to the site has been identified to be viable. The finalised route will be presented as part of the Abnormal Load Routing Plan and Construction Traffic Management Plan. There is potential for mitigation of a number of movements through the use of local quarries to procure materials which will be investigated further. We have demonstrated that the turbine components can be safely delivered to the site and that suitable management plans will be enacted in agreement with the LPA and other key stakeholders, post consent.

Appendix 9.1 - Outline CTMP

9.12 CTMP

The following section summarises the key items expected to be covered in the site specific CTMP which will be prepared prior to the commencement of construction works and agreed with Dumfries and Galloway Council, Transport Scotland and Police Scotland. The exact content may vary depending on the wording of planning conditions associated with the Proposed Development. The CTMP documents will set out in detail:

- Detailed Overview of the Route to Site
  - This section will include all information noted in Section 9.2 of this EIA Report and be updated accordingly to align with any design or technology changes that occur before the commencement of the works.
- Construction Phases, Traffic Volumes, Access Routes, and Management
  - This section will include all information noted in Section 9.2 and 9.3 of this EIA Report and will be updated accordingly.
  - A detailed construction programme will also be provided to help capture the durations and quantities of deliveries more accurately. Specific attention will be given to the timings of deliveries of abnormal loads.
- Construction Traffic Management and Banksmen
  - Detailed Traffic Management Plans will be produced by a specialist Traffic Management Consultant. These plans will indicate locations of temporary and permanent signage for the Proposed Development and the surrounding delivery routes.
  - A detailed site-specific plan will be developed by the Principal Contractor for the use of Banksmen and on-site traffic management.
  - This will include quantities of appointed personnel.
- Communication with Other Developments
  - This section will include details of expected development timelines for other construction sites, specifically renewable energy projects, in the area and identify times where deliveries can be made to minimise the impact on the local road network.
- Operational Traffic Management
- Decommissioning Traffic Management

Appendix 9.2 -Traffic Monitoring Plan

9.13 Monitoring Plan

9.13.1 Communication

At all times, there will be good communications between all parties on the Site and during construction works. The Principal Contractor will be responsible for all contractors on the Site and any issues or conflicts should be brought to their attention in the first instance.

The overall project programme is the responsibility of the Project Manager, in consultation with the Principal Contractor and the developer. Any wider technical and programme issues will be managed by the Project Manager.

9.13.1.1 Project Phases

Throughout the post-planning and construction phase of the Proposed Development there will be various meetings between parties to ensure that good communication is achieved. These meetings will follow the following format:

- Post-Planning Phase
  - Weekly client and project manager meetings. These will include the Principal Contractor and other sub-contractors as necessary.
- Construction phase
  - Daily toolbox talks andbriefings on site. These will be chaired by the appointed Principal Contractors Site Manager and all stakeholders and sub-contractors working on the Site as necessary;
  - Weekly client and project manager meetings;
  - Monthly balance of plant progress meetings.

9.13.1.2 Monthly Progress Meeting Agenda

The monthly balance of plant progress meetings will be used to cover all aspects of the Proposed Development and will look at the following structure:

- Review of outstanding actions;
- Health and safety;
- Security;
- Environmental;
- 3rd party interfaces including consents;
- Design, quality assurance and testing;
- Site progress, programme and look ahead;
- Grid connection and communications;
- Access;
- Any other business.

The following key items, which directly link to the CTMP, will be reviewed in detail:

- Inspection reports;
- Monitoring results and reports;
- Mitigation measures being employed and their effectiveness;
- Incidents and near misses;
- Impact on and feedback from key users:
  - Residents;
  - Agricultural activities;
  - Cyclists.
- Permits, licenses and consents;
- Introduction of new works, new working methods and operational procedures.

9.13.2 Condition Surveys

Condition surveys of the proposed construction access route and abnormal load route will be carried out to ensure the quality of the public road is monitored and maintained throughout construction phase of the development.

Visual inspections will occur on a weekly basis by the appointed Principal Contractor and their site teams. In addition to this there will also be formal inspections, with supporting photographic evidence, carried out at the following frequencies:

- Once no later than 1 month prior to the commencement of works;
- Once per month during construction works;
- Once no later than 1 month following completion of construction works.

The results of these formal inspections shall be recorded and shared with Dumfries and Galloway Council Roads and Infrastructure Department. The Principal Contractor will ensure that where changes in the road quality are identified, out with the above frequencies, they will be communicated to Dumfries and Galloway Council and remedial works will be completed at the earliest opportunity to prevent compounding issues from occurring.

9.13.3 On-Site Meetings / Inspections

On-site meetings/inspections will be carried out as necessary to confirm the appropriate use of mitigation measures identified within the CTMP. These meetings/inspections will highlight any further issues/measures which may be relevant either prior to commencement or during the works.

Regular checks of plant and equipment will be undertaken by the Contractor to identify any oil or fuel leaks. Records will be kept of all inspections/findings by the Contractor for review by the appointed Project Manager for discussion during regular meetings.

All records will be kept for inspections carried out by the Contractor. These records will be kept on-site for internal or external monitoring as required. The records will detail the date, location, frequency, and findings of each inspection along with persons notified and identified actions as appropriate.

10 Carbon Balance

10.1 Introduction

This chapter addresses the potential effects of the Proposed Development on climate change and its overall carbon balance.

The following assessment areas are considered for the Proposed Development:

- The impact of the Proposed Development on climate;
- The vulnerability of the Proposed Development to climate change.

This chapter encompasses several distinct elements:

- Greenhouse Gas (GHG) Impact Assessment: This aspect involves assessing the impact of the Proposed Development on greenhouse gas emissions. The goal is to comprehend how the Proposed Development might influence the climate.
- Resilience to climate change consideration: This part involves evaluating how the Proposed Development can withstand and adapt to the effects of climate change. The focus is on understanding how climate change might impact the Proposed Development itself and identifying strategies to enhance its resilience against these impacts.

10.2 Legislation, Policy and Guidance

10.2.1 United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty that came into force on 21st March 1994. Its primary objective is to stabilise greenhouse gas (GHG) concentrations in the atmosphere at a level that prevents dangerous human interference with the climate system. The treaty facilitates intergovernmental climate change negotiations and provides technical expertise. The Conference of the Parties (COP) is the supreme decision-making body that meets annually to discuss and assess progress in addressing climate change.

The first significant agreement under the UNFCCC was the Kyoto Protocol, signed in 1997 and enforced in 2005. This protocol committed industrialised countries to limit and reduce GHG emissions according to individual targets, aiming to reduce global warming rates. The Kyoto Protocol acknowledges the role of economic development in a country's ability to combat and adapt to climate change, and it requires developed countries to reduce their current emissions due to their historical responsibility for atmospheric GHG concentrations.

Subsequent COP meetings have led to various important and binding agreements, including the Copenhagen Accord (2009), the Doha Amendment (2012), and the Paris Agreement (2015). The Copenhagen Accord raised climate change policy to the highest political level and introduced the potential commitment to limit the global average temperature increase to below 2°C above pre-industrial levels. The Doha Amendment set targets for reducing GHG emissions from 2013 to 2020, and the Paris Agreement aims to limit global temperature increases to well below 2°C, with efforts to limit it to 1.5°C above pre-industrial levels.

COP26, held in 2021 in Glasgow, focused on securing global net zero emissions, adapting to protect communities and natural habitats, mobilising climate finance, and finalising the Paris Rulebook to accelerate action in tackling climate change. The Glasgow Climate Pact was signed, providing a framework for tackling climate change, and the Paris Rulebook outlined guidelines for implementing the Paris Agreement.

Overall, these international climate agreements represent significant efforts to address climate change and work towards a sustainable and low-carbon future.

10.2.2 Climate Change Act (2008)

The Climate Change Act 2008 is landmark legislation in the United Kingdom that commits the country to significant reductions in greenhouse gas emissions. It sets legally binding targets to reduce emissions by at least 100% by 2050[57], relative to 1990 levels. The Act establishes a system of 'Carbon Budgets' to guide emission reductions over five-year periods. This legislation aims to tackle climate change and transition the UK towards a low-carbon future through ambitious and sustained decarbonisation efforts.

The six carbon budgets which have been placed into UK legislation are identified in Table 10.1 below[58].

Table 10.1 - UK Carbon Budgets

Budget	Carbon Budget Level ($MtCO_2e$)	Reduction Below 1990 Levels (UK Targets)	Reduction Below 1990 Levels (Achieved by the UK)[59]
1st Carbon Budget (2008 to 2012)	3,018	26%	30%
2nd Carbon Budget (2013 to 2017)	2,782	32%	38%
3rd Carbon Budget (2018 to 2022)	2,544	38%	47%*
4th Carbon Budget (2023 to 2027)	1,950	52%	To be assessed in the CCC 2029 Progress Report
5th Carbon Budget (2028 to 2032)	1,725	58%	To be assessed in the CCC 2034 Progress Report
6th Carbon Budget (2033 to 2037)	965	77%	To be assessed in the CCC 2039 Progress Report
7th Carbon Budget (2038 to 2042)	To be set in 2025	-	-

**Provisional figure from 2020 UK Greenhouse Gas Emissions, Final Figures[60]*

10.2.3 UK Clean Growth Strategy (2017)

In October 2017, the UK Government released the Clean Growth Strategy (CGS) titled 'Leading the Way to a Low Carbon Future.' The central objective of the CGS is to achieve clean growth, which means promoting economic growth while simultaneously reducing greenhouse gas emissions. The CGS presents a comprehensive set of policies and proposals aimed at accelerating the pace of clean growth, fostering economic development, and curbing emissions. It emphasizes the importance of nurturing low-carbon technologies, processes, and systems that are cost-effective. It states that "in order to meet these objectives, the UK will need to nurture low carbon technologies, processes and systems that are as cheap as possible". The CGS is considered to be "at the heart of the UK's Industrial Strategy"[61].

The CGS builds upon the UK's commitments under the Climate Change Act 2008.

[57] https://www.legislation.gov.uk/ukpga/2008/27/section/1 Accessed - 30/01/2024
[58] https://www.theccc.org.uk/about/our-expertise/advice-on-reducing-the-uks-emissions/ Accessed - 30/01/2024
[59] https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf Accessed - 30/01/2024
[60] https://assets.publishing.service.gov.uk/media/61f7fb418fa8f5389450212e/2020-final-greenhouse-gas-emissions-statistical-release.pdf Accessed - 30/01/2024
[61] https://www.gov.uk/government/publications/clean-growth-strategy Accessed - 30/01/2024

The UK has demonstrated significant progress in achieving its emission reduction targets set by the first, second, and third Carbon Budgets, surpassing the expected reductions compared to 1990 levels.

- First Carbon Budget: The UK achieved a 30% reduction in emissions from 1990 levels by 2011, exceeding the target set for this period.
- Second Carbon Budget: By 2015, the UK achieved a remarkable 38% reduction in emissions compared to 1990 levels, again surpassing the set target for this period.
- Third Carbon Budget: As of 2021, the UK has outperformed the targets set for the third Carbon Budget, achieving a provisional 47% reduction from 1990 levels. This represents a substantial decrease of 10% from the 2019 emission levels.

However, it's important to note that while there has been significant progress in reducing emissions, the Covid-19 pandemic impacted emission levels. In 2021, emissions were 4% higher than those in 2020, attributed to a rebound effect following the disruptions caused by the pandemic[62].

The Climate Change Committee (CCC) Progress Report to Parliament in 2022 highlighted the UK's commendable achievements in reducing emissions and meeting its carbon budgets. Continued efforts and robust policies are essential to maintain this positive trend and stay on track to meet future carbon budgets and long-term climate goals, including those set by the Paris Agreement.

Overall, the CGS serves as a central element of the UK's Industrial Strategy, focusing on the dual goals of economic growth and reduced emissions. It aligns with the UK's long-term climate goals and international commitments, emphasizing the importance of adopting and investing in clean technologies and policies to create a low-carbon and sustainable future.

10.2.4 The Climate Change (Scotland) Act 2009

The Climate Change (Scotland) Act 2009 is key legislation which creates the statutory framework for GHG emissions reductions in Scotland. This legislation set an interim target of 42% reduction for 2020 and an 80% reduction target for 2050.

The Progress in Reducing Emissions in Scotland Report (2022)[63] by the Climate Change Committee states in 2019 the Scottish Parliament legislated an interim target of a 75% reduction on 1990 levels by 2030. This report finds this is an extremely challenging target and suggests a 65-67% reduction in Scotland's emissions by 2030 is more feasible. The Report finds that Scotland must do more to reach this ambitious target particularly through making homes more energy efficient and through the restoration of peatland.

10.2.5 Onshore Wind Policy Statement 2022

The Onshore Wind Policy Statement[64] was published in December 2022 and sets out the Scottish target to deploy 20GW of onshore wind by 2030. The Scottish Government wants to accelerate the transition to renewable energy and a net zero society to combat climate change. Scotland currently has 9GW of operational onshore wind which highlights this is a cheap and reliable source of zero carbon electricity. This policy is supported by the Onshore Wind Sector Deal 2023[65] which sets out commitments from the Scottish Government to deliver 20GW of onshore wind while delivering maximum benefits to Scotland.

[62] https://www.theccc.org.uk/wp-content/uploads/2022/06/Progress-in-reducing-emissions-2022-Report-to-Parliament.pdf Accessed - 30/01/2024
[63] Progress in Reducing Emissions in Scotland 2022 Accessed - 30/01/2024
[64] https://www.gov.scot/publications/onshore-wind-policy-statement-2022/ Accessed - 30/01/2024
[65] https://www.gov.scot/publications/onshore-wind-sector-deal-scotland/ Accessed - 30/01/2024

10.2.6 IEMA Guidance

In the absence of widely recognized guidelines for evaluating the significance of the impact of GHG emissions, the Environmental Impact Assessment (EIA) Guidance issued by the Institute of Environmental Management and Assessment (IEMA) in 2017 (the "**IEMA Guidance**") has been adhered to[66]. This guidance offers a structured approach to incorporating GHG emissions consideration within the EIA process, aligning with the amended EIA Directive 2014/52/EU. The guidance details how to:

- Establish the GHG emissions baseline by considering both current and projected GHG emissions.
- Identify key sources contributing to GHG emissions and determine the assessment's scope and methodology.
- Evaluate the potential impact of GHG emissions and assess their level of significance.
- Integrate mitigation strategies, following the hierarchy for managing project associated GHG emissions, which involves avoiding, reducing, substituting, and compensating for emissions.

By following this guidance, the evaluation of GHG emissions within the EIA process is carried out systematically and in line with contemporary directives and frameworks, ensuring a comprehensive understanding of the potential environmental impact of GHG emissions.

The IEMA Guidance, which pertains to evaluating climate change resilience and adaptation in EIA[67], has likewise been adhered to. This guidance furnishes instructions on integrating climate change impacts into project design. The guidance outlines procedures for:

- Identifying and defining future climate baseline conditions for historic and current climate conditions
- Identifying and determining sensitivity of receptors. This includes identifying receptors and evaluating their susceptibility and vulnerability to climate change.
- Reviewing and determining the magnitude of effect. This includes reviewing effects likely to arise from the development and considering the probability and consequence to determine magnitude of effect.
- Determination of significance which involves using information from previous steps and professional judgement to determine the significance of effect.
- Develop additional adaption and mitigation measure to protect the development from Climate change.

By following this guidance, the assessment of climate change effects on projects is executed in a structured manner, ensuring that climate change vulnerabilities and adaptation strategies are incorporated into the Proposed Development's design and planning process.

10.3 Methodology

10.3.1 Context

- Embedded Carbon and GHGs: This refers to the emissions resulting from the entire life cycle of the wind turbine components and their associated physical infrastructure. From the extraction and refinement of raw materials to the manufacturing processes, there are GHG emissions associated with the production of wind turbine generators and other components. This includes emissions from mining, transportation, manufacturing, and construction processes.
- Operational Emissions: Once the wind farm is operational, there are ongoing emissions related to the combustion of fuels and energy used in various activities. These emissions arise from activities such as

[66] IEMA (2017) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance. Accessed - 30/01/2024
[67] IEMA (2020) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation 2020 Accessed - 30/01/2024

operating and maintaining the wind turbines, as well as from general site operations and maintenance. Over the lifetime of the wind farm, there will be continuous energy consumption and fuel use, contributing to operational emissions.

- Decommissioning Emissions: When the wind farm reaches the end of its useful life and is decommissioned, there are additional emissions associated with dismantling and removing the infrastructure. The process of decommissioning may also involve transportation and disposal of materials, leading to emissions.

The manufacturing phase of wind turbines has the most significant environmental impact across various impact categories and indicators, including global warming potential, acidification potential, eutrophication potential, and non-renewable primary energy demand. This category encompasses the production of several wind turbine components such as the foundation, tower, nacelle, hub, and rotor blades. The transportation and manufacturing processes of these components also contribute to the environmental impact.

The main reason for this substantial impact is the production of significant quantities of materials, particularly concrete and metals like steel, cast iron, stainless steel, aluminium, and copper. Extraction, processing, and manufacturing of these materials result in high greenhouse gas emissions and energy consumption, leading to a considerable environmental footprint during the wind turbine manufacturing phase.

Other stages of wind farm development, such as the manufacturing of substations, maintenance (including spare parts provision), transportation, logistics, installation, and dismantling, have relatively smaller contributions to the overall environmental impact.

In efforts to reduce the environmental impact, the use of recycled materials during the manufacturing phase, particularly metals, has a positive effect. By giving end-of-life credits for recycled materials, the overall environmental impact of wind turbines can be partially mitigated. This underscores the importance of sustainable practices and recycling in the wind energy industry to promote a more environmentally friendly approach to wind farm development and operation.

10.3.2 Baseline Methodology - Vulnerability of the Proposed Development to Climate Change

This section of the EIA identifies aspects of the Proposed Development which may be vulnerable and susceptible to the impacts of climate change. Where identified, vulnerabilities can be mitigated through embedded mitigation and the application of other measures.

This methodology uses a significance assessment where the sensitivity of receptors and receptors' magnitude of effect are combined to reach an overall judgement on the significance of the likely effect.

To identify the Proposed Development's sensitivity to climate change baseline and future climatic conditions are identified in Section 10.3.4.

10.3.2.1 Sensitivity of Receptors

The sensitivity of the Proposed Development in relation to climate change effects involves identifying the susceptibility of the receptor and the vulnerability of the receptor. This is based on evidence and professional judgement. These outcomes are then combined to reach a determination for the overall sensitivity of receptor.

According to IEMA (2020) Guidance susceptibility is determined using the scale in Table 10.2.

Table 10.2 - Susceptibility of Receptor

Susceptibility	Definition
High susceptibility	Receptor has no ability to withstand/not be substantially altered by the projected changes to the existing/prevailing climatic factors (e.g.lose much of its original function and form).

Moderate susceptibility	Receptor has some limited ability to withstand/not be altered by the projected changes to the existing/prevailing climatic conditions (e.g. retain elements of its original function and form).
Low susceptibility	Receptor has the ability to withstand/not be altered much by the projected changes to the existing/prevailing climatic factors (e.g. retain much of its original function and form)

The vulnerability of a receptor can be defined using the scale in Table 10.3.

Table 10.3 - Vulnerability of Receptor

Vulnerability	
High vulnerability	Receptor is directly dependent on existing/prevailing climatic factors and reliant on these specific existing climate conditions continuing in future (e.g. river flows and groundwater level) or only able to tolerate a very limited variation in climate conditions
Moderate vulnerability	Receptor is dependent on some climatic factors but able to tolerate a range of conditions (e.g. a species which has a wide geographic range across the entire UK but is not found in southern Spain).
Low vulnerability	Climatic factors have little influence on the receptors (consider whether it is justifiable to assess such receptors further within the context of EIA – i.e. it is likely that such issues should have been excluded through the EIA scoping process).

10.3.2.2 Magnitude of Effect

The magnitude of effect will be determined through the degree of change to baseline conditions predicted as a result of the Proposed Development. The duration, reversibility of impact and professional judgement will also factor into the determination. The magnitude of effect can be defined using the scale in Table 10.4 which is taken from severity scores used in the IEMA (2020) Guidance.

Table 10.4 - Magnitude of Effect

Magnitude of Effect	
Major	Major loss of function and extreme loss of asset
Moderate	Moderate loss of some capacity and likely regular loss of some function
Minor	Very low change in serviceability and occasional loss of some capacity
Negligible	Very low/Negligible measurable change

10.3.2.3 Significance Assessment

Once the sensitivity and magnitude have been determined, these are combined to reach an overall judgement. Table 10.5 is used as a guide to determine the overall significance of effect using the relationship between the sensitivity of the identified receptor and the anticipated magnitude of effect. Major or moderate levels are considered to be 'significant' in the context of EIA Regulations. More information can be found in Chapter 2 - EIA Methodology.

Table 10.5 - Significance of Effect Matrix

Sensitivity	Magnitude of Effect			
	High	Medium	Low	Negligible
High	Major	Major/Moderate	Moderate/Minor	Negligible
Medium	Major/Moderate	Moderate	Minor	Negligible
Low	Moderate/Minor	Minor	Minor/Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible
Key:		Significant in terms of EIA regulations		
		Not significant		

There is no legislative definition of 'significance' therefore the conclusion of whether an effect is significant/the level of significance is down to professional judgement.

10.3.3 Baseline Methodology - Influence of the Proposed Development on Climate Change

This section will consist of GHG assessment to quantify the effect of the Proposed Development on climate change. This methodology provides a carbon balanced of the savings and loss over the lifetime of the Proposed Development. Subsequently a pay time is estimated which is the time needed to generate carbon saving equivalent to the amount of carbon lost.

The GHG impact assessment within this chapter has been based on the guidance provided from the Scottish Government's Carbon Calculator Tool V1.7.0[68]. The tool is designed to calculate the carbon impact of wind farms. The calculator will be used to inform the discussion in this chapter. Details of the carbon calculator input data, their sources, and results for the expected, maximum and minimum (best and worst case) scenarios can be viewed online at https://informatics.sepa.org.uk/CarbonCalculator/.

The annual carbon dioxide emissions saving of a wind turbine are estimated as:

CO_2 Emissions Saving =

Total electricity generation expected [MWh]

x

Emission Factor of Displaced Generation [tCO_2/MWh]

The SNH Technical Guidance Note[69] states that *"in most circumstances, it is not possible to define the electricity source for which a renewable electricity project will substitute"*, although it does state that as nuclear power generation is not affected by renewable energy generation *"this suggests that carbon emission savings from wind farms should be calculated using the fossil fuel sourced grid mix as the counterfactual"*. SNH's Technical Note presents the result for each of the three sets of figures, as shown in **Table 10.6 -** Counterfactual emission factors.

[68] https://informatics.sepa.org.uk/CarbonCalculator/index.jsp Accessed - 30/01/2024
[69] https://www.gov.scot/publications/calculating-carbon-savings-wind-farms-scottish-peat-lands-new-approach/pages/13/ Accessed - 30/01/2024

Table 10.6 - Counterfactual Emission Factors

Energy	Emission Factor (tCO2e per kWh)[70]
Grid Mix	0.19
Coal Fired	1.00
Fossil Fuel Mix	0.43

The predicted carbon savings against both the Grid Mix and the Fossil Fuel Mix are presented within this assessment. The Grid Mix figures present a more conservative estimate of CO_2 emission savings.

10.3.4 Baseline Climate Conditions

10.3.4.1 Historic and Current Climate Conditions Baseline

The climate change resilience assessment's initial reference point are the current climate conditions at the Site. Historical climate data, retrieved from the Met Office website[71], is derived from the closest meteorological station to the Proposed Development, namely Fraserburgh Climate Station situated approximately 29km south-west of the Site. The summarised climate data for the 30-year period spanning from 1991 to 2020 is provided in Table 10.7 below. This baseline data serves as a foundation for evaluating the Site's resilience to climate change impacts.

Table 10.7 - Met Office Data (Fraserburgh Station) for 30-year Climate Period of 1991-2020

Climate Change	Month	Climate Figure
Average annual maximum daily temperature (°C)	-	11.67
Warmest month on average (°C)	August	11.22
Coolest month on average (°C)	February	2.38
Mean annual rainfall levels (mm)	-	759.75
Wettest month on average (mm)	October	87.89
Driest month on average (mm)	May	48.72

The Met Office's baseline climate averages for the East of Scotland region reveal a gradual increase in temperatures from 1961 to 2020, accompanied by higher levels of rainfall. The data pertaining to mean maximum annual temperatures (°C) and mean annual rainfall (mm) is provided in Table 10.8 below. This information offers insights into the changing climatic patterns within the East of Scotland region during the specified period.

Table 10.8 - Climate Variations in East of Scotland (1961-2020)

Climate Period	Climate Variables	
	Mean maximum annual temperatures (°C)	Mean annual Rainfall (mm)
1961-1990	10.31	1086.88
1971-2000	10.57	1117.02

[70] Taken from the Scottish Government Online Carbon Calculator V1.7.0 Accessed - 30/01/2024
[71] https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcv12y3xn Accessed - 30/01/2024

Climate Period	Climate Variables	
	Mean maximum annual temperatures (°C)	**Mean annual Rainfall (mm)**
1981-2010	10.86	1165.13
1991-2020	11.13	1188.03

Climate change will directly impact Scotland's weather and environment in the next century. Increased rainfall particularly in winter, increased temperatures and sea level rise are examples of potential predicted impacts. Storms are predicted to become more frequent but there is uncertainty surrounding how climate change will increase their intensity. Greater precipitation and wetter catchment conditions may lead to more frequent river floods within Scotland.

SEPA's Flood Hazard and Risk Map also illustrates the indicative flood extents of high likelihood (1 in 10-year probability), medium likelihood (1 in 100-year probability), or low likelihood (1 in 200-year probability) of coastal, surface, and river floods[72].

A review of the map highlighted there are no areas of river flood risk within the study area. There are pockets of high likelihood of surface water flooding throughout the area. These are primarily associated with periodic pools within the surrounding farmland, and the small, forested area noted adjacent to the Proposed Development. Where the flood risk is associated with existing small waterbodies and ponds, it is illustrated as remaining within the confines of these waterbodies.

10.3.4.2 Climate Future Baseline

Anticipated climate conditions in the future are projected to deviate from the current baseline. In 2018, the UK Climate Impacts Programme (UKCIP) formulated the UK Climate Projections (UKCP18), offering insights into potential future climate scenarios and trends. UKCP18 data stands as the most reliable and comprehensive repository of information concerning the forthcoming climate in the UK.

UKCP18 offers climate change projections encompassing predetermined 30-year climate intervals[73] (such as 2010-2039, 2040-2069, and 2070-2099), covering annual and seasonal shifts in mean climatic conditions across terrestrial regions. Pertaining to the Proposed Development, the Proposed Development has engaged UKCP18 projections for the subsequent average climate parameters, systematically assessed against a reference point of 1991-2020:

- Change in mean summer temperature (˚C);
- Change in mean winter temperature (˚C);
- Precipitation rate anomaly in summer (%); and
- Precipitation rate anomaly in winter (%)

Various potential Representative Concentration Pathway (RCPs), drawn from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report[74], have been employed by UKCP18 to model distinct future emission trajectories. Among these are four scenarios: RCP2.6, RCP4.5, RCP6.0, and RCP8.5. RCP8.5 corresponds most closely to the high emissions scenario from UKCP09, which was previously utilised for climate assessments.

[72] https://map.sepa.org.uk/floodmap/map.htm Accessed - 30/01/2024
[73] Climate change projections over land - Met Office Accessed - 30/01/2024
[74] IPCC (2014) Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change Accessed - 30/01/2024

RCP	Description
RCP2.6	Details a scenario where GHG emissions are significantly reduced, culminating in a best estimate global average temperature rise of 1.6°C by 2100 compared to pre-industrial levels.
RCP4.5	A medium stabilised scenario with moderate mitigation accounts for a 2.4°C global temperature increase by 2100 from pre-industrial levels.
RCP6.0	A medium stabilised scenario, involving moderate mitigation, is projected to lead to a 2.8°C global average temperature by 2100, relative to pre-industrial levels.
RCP8.5	An unmitigated growth in greenhouse gas emissions leads to a projected 4.3°C global temperature rise by 2100 from pre-industrial levels.

The IPCC Fifth Assessment Report presents evidence indicating that prevailing trends in global population growth and urbanisation, coupled with a gradual adoption of renewable energy sources, delayed progress in expanding nuclear power, and a gradual advancement in international climate change policies, suggest that it is highly probable that global emissions will align with the projected RCP8.5 trajectory.

UKCP18 provides future climate projections with varying levels of probability assessment, ranging from a 10% probability to a 90% probability:

- 10% probability level: This represents a scenario where the projected change is unlikely to be less than this value. There is a 90% probability that the actual change will be greater.
- 50% probability level: This is the central estimate, indicating an equal likelihood of the change occurring or not occurring.
- 90% probability level: This demonstrates a scenario where the projected change is unlikely to be greater than this value. There is a 10% probability that the actual change will be greater.

In consideration of the projected design life of the Proposed Development, UKCP18 climate projections for the RCP8.5 pathway[75] were applied to the East of Scotland Region. Table 10.9 below summarises these climate projections relative to a baseline period of 1991-2020.

Table 10.9 - Climate Projections for the East of Scotland (RCP 8.5 and 1991-2020 baseline)

Climate Variable		2040 – 2059 Climate Projection (Approximately)
Change in mean winter temperature (°C)	50% probability	+1.3
	Range 10% - 90%	+0.3 to +2.5
Change in mean summer temperature (°C)	50% probability	+1.8
	Range 10% - 90%	+0.7 to +3
Precipitation rate anomaly in winter (%)	50% probability	+12
	Range 10% - 90%	-4 to +30
Precipitation rate anomaly in summer (%)	50% probability	-10

[75] https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/summaries/climate-change-projections-over-land (Accessed December 2023)

Climate Variable		2040 – 2059 Climate Projection (Approximately)
	Range 10% - 90%	-25 to +5

10.4 Capacity Factor

A wind project capacity factor has to be determined in order for the total electricity generation of the wind project to be calculated. This is the ratio of the actual energy generated to the theoretical amount that the machine would generate if running at full-rated power during a given period of time. The average capacity factor (load factor) observed for the onshore wind farms in Scotland for 2022 was 30.5%[76].

The Proposed Development is estimated to have a capacity factor of 30%. This estimate reflects local wind conditions and takes into account the layout and wake interaction between turbines. The turbine model used for this estimate is an Enercon E82 2.35MW turbine with 59m hub height.

10.5 Assessment of Likely Significant Effects

10.5.1 Vulnerability of Proposed Development to Climate Change

As stipulated by the EIA Regulations[77], it is necessary to incorporate information about the susceptibility of the Proposed Development to climate change. Consequently, a comprehensive evaluation of climate change resilience concerning the Proposed Development has been undertaken. This evaluation encompasses the identification of potential climate change impacts, potential impacts on the Proposed Development, and highlights mitigation measures.

Potential impacts associated with climate change which could affect the vulnerability of the Proposed Development are presented in Table 10.10 together with an appraisal of the likelihood that these would affect the Proposed Development.

Table 10.10 - Potential Climate Impacts and Resilience Measures

Climate variables	Potential Impacts on the Proposed Development	Appraisal/Mitigation Measures
Projected increase in mean summer and winter temperatures (East of Scotland)	Overheating of equipment in summer months	Overheating is unlikely, but there may be a loss in efficiency. However, as the turbines will only operate intermittently as wind power is inherently variable, this is not likely to result in an impact on performance. Additionally, turbines are designed to withstand temperature extremes with standard operating temperatures for a Enercon E82 2.35MW being between -20°C and 50°C.
Projected increase in winter precipitation (East of Scotland)	• Vulnerability to higher river levels, requiring higher maintenance of the plant. • Flooding of site; resulting in possible generation unit	The potential for flooding, encompassing tidal, fluvial, and pluvial sources, will be meticulously factored into the detailed design process. This comprehensive approach ensures that the infrastructure remains resilient against the various forms of flooding and their potential intensification due to changing climatic conditions.

[76] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/838179/ET_6.1.xls Accessed - 30/01/2024
[77] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 Accessed - 30/01/2024

	shutdown and water damage to infrastructure. • Flooding of access routes to Site resulting in Operations and maintenance disruption; insufficient staff to maintain safe operation; partial or complete shutdown	
Extreme weather events (such as storms) (East of Scotland)	Damage to turbine components and negative impact on efficiency.	Turbines are designed for optimal performance and reliability in an unpredictable environment. Turbines are designed to a higher wind class than is needed. Wind turbines are designed to have brake mechanisms and storm control functions to prevent damage in extreme conditions.

Turbines and the associated infrastructure could withstand the projected climatic conditions for the East of Scotland and retain their original function. Precipitation and higher temperatures are unlikely to affect their performance. Therefore, the Proposed Development can be classified as having low vulnerability. Based on the future climatic conditions predicted for the East of Scotland the magnitude of effect is likely to be negligible as there would be a Low or Negligible measurable change.

Based on the above, the sensitivity of the Proposed Development to these changes is classified as Low. Therefore, the overall level of effect and is Minor/Negligible or Negligible and **not significant**.

10.5.2 GHG Assessment

The calculations were carried out in accordance with the figures provided in the Scottish Government's most recent version of the Carbon Calculator. Counterfactual emissions factors have been taken from fixed data provided by the Scottish Carbon Calculator Tool. The results are presented in **Table 10.11.**

Table 10.11 - Calculated CO_2 Emission Savings

Power Generation Characteristics	
Number of Turbines	3
Turbine Capacity	2.35MW
Capacity Factor	30
Lifetime	30 years
Annual Energy Output*	~18,540MWh/yr

Counterfactual Emissions Factors	
Overall 'grid' mix generation	0.25 tCO_2 /MWh
Fossil fuel sourced mix	0.44 tCO /MWh

Project estimated CO_2 emission savings over:	tCO_2 /yr	tCO_2 /40yr
Grid mix generation*	4,635	185,400

Fossil fuel mix generation*	8,343	333,721

Assuming 1 tCO_2 = 0.27 tC;

Total Project Estimated Carbon saving over:	tC /yr	tC /40yr
Grid mix generation*	1,251	50,058
Fossil fuel mix generation*	2,252	90,104

**Values rounded to two significant figures.*

Based upon an average UK electricity consumption of 3,509kWh per household[78], the turbines are expected to provide enough electricity to power an additional **~5,283** homes per year.

10.5.3 Carbon Cost due to Wind Farm

10.5.3.1 Backup Power Generation

Wind generated electricity is inherently variable therefore as the SNH Technical Guidance Review states extra capacity is required for backup power generation to meet consumer demand. Backup power generation is assumed to be by fossil-fuel mix of electricity generation. The additional CO_2 output is calculated using the SNH Carbon Calculator.

At the Proposed Development, the CO_2 emissions associated with the requirement for extra backup generation over the years of operation is calculated as a loss of **~11,250** tonnes of CO_2.

10.5.3.2 Reduced Carbon Fixing Potential

Peatlands contain large reservoirs of carbon, containing about one-third of the global amount of carbon in all soils. Undisturbed, peatlands sequester carbon from the atmosphere through photosynthesising vegetation. This carbon is then stored in the soil. This accumulates primarily in waterlogged conditions, where there is a low potential for decomposition. This element of the calculation accounts for the loss of carbon fixing potential of the peat that is removed during construction of access tracks, hardstandings, turbine foundations and other site infrastructure. It also factors in the impact of areas of peat that might be drained as a result of the wind turbine.

In order to establish peat presence and depth on Site, a peat probing survey was undertaken across the Site, concentrating on potential access track routes and turbine locations. Where maximum and minimum inputs for average peat depths where required for the carbon calculator, values varying +/- 5% from the average has been applied.

Carbon losses for the Proposed Development are summarised from the online calculator in **Table 10.12** Development Carbon Losses (predicted). The carbon calculator has been based on a worst-case scenario where no floating tracks have been implemented.

10.5.3.3 Forestry

Forests and trees are stores for carbon therefore when they are felled this carbon dioxide is released back into the atmosphere. This element of the calculation accounts for the loss of carbon storage potential of the forests that is removed during the construction of access tracks, hardstandings, turbine foundations and other site infrastructure.

[78] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1126284/subnational_electricity_and_gas_consumption_summary_report_2021.pdf Accessed - 30/01/2024

No felling is required to accommodate the Proposed Development. As such, no losses for the removal of forestry have been calculated at this stage.

10.5.3.4 Carbon Losses Summary

The carbon losses due to turbine life occur from multiple phases. The carbon losses from the wind turbine itself comes from the raw materials used to construct the turbine during the manufacturing phase. Carbon losses from construction and decommissioning arise from the transportation and machinery used.

Dissolved and particulate organic carbon (DOC and POC) are important components in the carbon cycle and serve as a primary food source for aquatic food webs. Carbon losses can arise if leaching of DOC and POC into groundwater occurs.

Carbon losses for the Proposed Development are summarised from the online calculator in Table 10.12 below.

Table 10.12 - Development Carbon Losses (Predicted)

Activity	tCO_2 eq. (30 year lifetime)
Losses due to turbine life (e.g., manufacture, construction, decommissioning)	30,000
Losses due to backup	11,250
Losses due to reduced carbon fixing potential	790
Losses from soil organic matter	1,250
Losses due to DOC & POC leaching	0
Losses due to felling forestry	0
Total losses	**43,290**

10.5.3.5 Other Polluting Gas Emission Savings

Other gas emissions resulting from fossil fuel-sourced electricity generation are sulphur dioxide (SO_2) and nitrogen dioxide (NO_2), both responsible for acid rains. Emissions savings relating to the project can be calculated using the Renewable UK guidance. This suggests that the SO_2 and NO_2 emissions savings are, respectively, 10 and 3kg per MWh. This translates to emissions factors of 0.01 and 0.003 [tonnes/MWh] respectively.

Table 10.13 - Other Pollution Gas Emission Savings

Project total emission savings of:	
Sulphur dioxide SO_2*	~7,416 tonnes /40yr
Nitrogen dioxide NO_2*	~2,224 tonnes /40yr

**Values rounded to two significant figures*

10.6 Summary of Carbon Balance

The following table summarises the carbon balance of the development over its 30-year lifetime. It is based upon the grid mix counterfactual, which represents a conservative estimate.

Table 10.14 - Predicted Overall Carbon Emissions

Element:	Predicted lifetime emissions (tCO_2)
Carbon Dioxide savings:	
Projected CO_2 savings compared to grid mix*	185,400
Carbon Dioxide Losses:	
Production, transportation, erection, operation and decommissioning	30,000
Requirement for backup power generation	23,000
Forestry Losses	0
Peat Losses	1,250
Net Emission Savings*	**131,150**

**Values rounded to two significant figures*

Table 10.14 - Predicted overall carbon emissions, above shows that over its 30-year lifetime the project is expected to result in a CO_2 saving of **~131,150 tonnes**. The carbon payback time is an estimate of how long it will take a renewable energy project to offset the carbon emissions emitted as a result of its construction, operation and decommissioning[79].

10.7 Cumulative Effects

The Scottish and UK Governments have set ambitious and strict targets for reducing GHG emissions by 2045 and 2050 respectively. The Proposed Development will positively impact carbon emissions and help contribute to meeting these targets as evidenced by the calculated carbon savings in **Section 10.6.** When the Proposed Development is considered with other Scottish and UK Renewable Projects it will have a positive and significant impact on GHG emissions.

The Digest of UK Energy Statistics (DUKES) 2023 found that renewable energy generation increased by 10% in 2022 to a new record of 135 TWh for the UK. The main driver for this new record was new capacity and improvement in weather conditions compared to previous years. The capacity for onshore wind continues to grow evidenced by output increasing by 21% in 2022. With more favourable weather conditions it is anticipated that onshore wind will continue to positively impact carbon emissions in line with targets and legislation. In particular it will help to reach the Scottish Government target of 20GW of onshore wind by 2030.

The Proposed Development will contribute up to 6.9MW installed capacity. This is considered to be a **moderate**, beneficial, cumulative environmental effect under the EIA Regulations and will contribute to the region's emission reduction targets.

10.8 Mitigation

An iterative design approach was taken for the layout of the Proposed Development therefore turbines and associated infrastructure were placed to avoid the worst areas of peat and avoid watercourses. **Chapter 8 - Hydrology and Hydrogeology** outlines the measures to be taken to mitigate water pollution and flood risk during construction activities. The Proposed Development will integrate flood resilience measures to mitigate damage and expedite recovery in case of flooding. Measures designed to safeguard the Proposed Development during operation have been identified for implementation during the construction stage. Further details regarding these measures are available in the operation section below.

[79] https://www.iema.net/articles/calculating-carbon-payback-for-wind-farms#:~:text=The%20carbon%20payback%20period%20is,%E2%80%9Cthe%20carbon%20saving%E2%80%9D). Accessed - 30/01/2024

To mitigate potential effects during the construction phase, a comprehensive Construction Environmental Management Plan (CEMP) framework will be prepared and implemented ahead of the commencement of construction. This framework will outline a range of optimal practices, encompassing environmental best practices such as the efficient processing and reuse of all reclaimed materials on-site whenever feasible. By incorporating training and contractual obligations, the project aims to uphold the highest standards of environmental protection and water management throughout the construction phase. This approach underscores the Proposed Development's commitment to minimising its environmental impact and ensuring responsible construction practices.

Wind turbines are meticulously engineered to harness the power of wind for energy generation. As a result, they are constructed with the ability to endure even the harshest climatic conditions. These turbines are strategically placed in areas exposed to strong and consistent winds. However, it's important to recognise that wind energy projects may still be influenced by substantial shifts in climatic factors. Other mitigation measures will include the management of wind turbines during their operation to maintain efficiency during their lifetime.

10.9 Summary of Effects

Table 10.15 - Summary of Effects

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Vulnerability of development to climate change				
Wind turbines	Change in frequency and severity of extreme events (e.g storms) which could damage components and/or affect efficiency.	Negligible, no significant effects	Embedded mitigation as turbines have storm control which prevent operation in extreme wind conditions	None
Wind turbines	Increased temperatures in both summer and winter months affecting efficiency.	Negligible, no significant effects	Embedded mitigation as turbines work intermittently as wind is inherently variable. Turbines built to withstand extreme temperatures.	None
Wind turbines and associated infrastructure	Increased precipitation creating potential for floodings of infrastructure and control buildings.	Minor, no significant effects	Embedded mitigation through watercourse buffer locations. Access tracks, hardstandings and associated infrastructure are designed in line with a best practice with a CEMP implemented during construction.	None
Influence of the development on climate change				
Climate - future baseline conditions as a result of GHG emissions.	Reduction in greenhouse gas emission as offsetting from a fossil fuel grid mix	Moderate effect (Proposed Development), Major effect (considered cumulatively)	None, embedded mitigation helps reduce the payback period and maximise the beneficial impact	Significant contribution cumulatively to Aberdeenshire, Scottish Government and UK Government renewable energy generation targets.

10.10 Conclusion

The predicted future climate conditions are highly unlikely to significantly affect the operation of the Proposed Development. The Proposed Development will have a beneficial effect on carbon savings when considered cumulatively with other Scottish and UK renewable projects. It is anticipated that the carbon expended in creating the Proposed Development will be offset in approximately 20-months. Therefore, the Proposed Development will have a beneficial effect on climate change in terms of EIA Regulations. No additional effects beyond those already outlined in this EIA chapter are foreseen due to climate change during the operational phase of the Proposed Development.

The assessment demonstrates that the Proposed Development would make a positive contribution to the ambitious targets set out in the Climate Change (Scotland) Act 2009 whilst contributing to the wider national target of achieving net zero by 2045.

The outputs related to climate change resilience affirm that the impacts stemming from higher average summer and winter temperatures and alterations in precipitation patterns have been considered alongside the Proposed Development. Due to the extensive levels of mitigation resilience, Minor/Negligible or Negligible impacts are expected for the Proposed Development's lifespan.

11 Shadow Flicker

11.1 Introduction

This section of the report assesses possible shadow flicker impacts as a result of the proposed extension wind turbines at Greenside Wind Farm (The Proposed Development).

Tall structures such as wind turbines cast shadows. The shadows vary in length according to the sun's altitude and azimuthal position. Under certain combinations of geographical position and time of day, the sun may pass behind the rotor of a wind turbine and cast a moving shadow over neighbouring properties. Where this shadow passes over a narrow opening such as a window, the light levels within the room affected will decrease and increase as the blades rotate, hence the shadow causes internal light levels to 'flicker' - an effect commonly known as 'shadow flicker'.

Whilst the moving shadow can occur outside, the shadow flicker effect is only considered for indoor receptors where the shadow passes over a window opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the site. A single window in a single building is likely to be affected for a few minutes at certain times of the day for short periods of the year. The likelihood of this occurring and the duration of such an effect depend upon:

- The direction of the residence relative to the turbine(s);
- The distance from the turbine(s);
- The turbine hub-height and rotor diameter;
- The time of year;
- The proportion of time in which the turbine operates;
- The frequency of bright sunshine and cloudless skies (particularly at low elevations above the horizon); and
- The prevailing wind direction.

The further the observer is from the turbine the less pronounced the effect will be. There are several reasons for this:

- There are fewer times when the sun is low enough to cast a long shadow;
- When the sun is low it is more likely to be obscured by either cloud on the horizon or intervening buildings and vegetation; and,
- The centre of the rotor's shadow passes more quickly over the land reducing the duration of the effect.

At a distance, the blades do not cover the sun but only partly mask it, substantially weakening the shadow. This effect occurs first with the shadow from the blade tip, the tips being thinner in section than the rest of the blade. The shadows from the tips extend the furthest and so only a weak effect is observed at a distance from the turbines.

11.2 Legislation, Policy and Guidance

The Scottish Government's online planning guidance for renewable energy[80], specifically the 'Onshore Wind Turbines' note last updated in October 2012, states that:

"*Where this (shadow flicker) could be a problem, developers should provide calculations to quantify the effect. In most cases however, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), "shadow flicker" should not be a problem…"*

This has been appraised by ClimateXChange (2017)[81] on behalf of the Scottish Government in the 'Review of Light and Shadow Effects from Wind Turbines in Scotland', which concluded that the guidance is still relevant.

Supplementary Planning Guidance from Aberdeenshire Council[82] states that the assessment of potential shadow flicker should be provided for all dwellings within a 1000m radius of each proposed turbine. This guidance has been used to define the study used within the assessment.

Department of Environment and Climate Change (DECC)[83] studies have shown that even in UK latitudes, shadows from wind turbines can only be cast approximately 130 degrees either side of north relative to the turbine due to the orientation of the earth's axis and the positioning of the sun. This equates to a region between 50 degrees either side of due south where a wind turbine will not cast a shadow. Properties within this region will not experience shadow flicker effects, regardless of their distance from the turbine. While DECC was replaced by the Department for Business, Energy and Industrial Strategy (BEIS) and subsequently replaced again by the Department for Energy Security and Net Zero (DESNZ), which does not provide guidance on shadow flicker, these findings are still considered relevant.

11.3 Methodology

11.3.1 Candidate Turbine

The Proposed Development consists of three turbines with a tip height of 100m. For the purposes of conducting a shadow flicker impact assessment the candidate turbine model selected was the Enercon E82 with a tip height of 100m and a rotor diameter of 82m. This configuration has been selected to assess the maximum potential impacts.

11.3.1.1 Cumulative Assessment

Where a property falls within the study area of both the Proposed Development and a third-party wind development, a cumulative impact assessment is conducted.

11.3.2 ReSoft WindFarm software

ReSoft Windfarm software has been used to model the shadow flicker effects of the Proposed Development. The program uses simple geometric considerations: the position of the sun at a given date and time; the size and orientation of the windows that may be affected; and the size of the turbine that may cast the shadows. The model assesses the maximum possible impact by assuming that:

- Turbines are facing the sun at all times of the day;

[80] Scottish Government (2014) *Online renewables advice*, https://beta.gov.scot/publications/onshore-wind-turbines-planning-advice/ – Accessed 12/01/2024

[81] Review of Light and Shadow Effects from Wind Turbines, by ClimateXChange, commissioned by Scottish Government, 2017 – Accessed 12/01/2024

[82] https://www.aberdeenshire.gov.uk/media/5945/wind_developers06.pdf– Accessed 12/01/2024

[83] Update of UK Shadow Flicker Evidence Base, by PB Power, commissioned by DECC, 2011 – Accessed 12/01/2024http://www.decc.gov.uk/assets/decc/What%20we%20do/UK%20energy%20supply/Energy%20mix/Renewable%20energy/ORED/1416-update-uk-shadow-flicker-evidence-base.pdf – Accessed 12/01/2024

- It is always sunny;
- The turbines are always operating; and
- There is no local screening.

11.3.3 Modelling of Façades

Given that the glazed area is not known at every property, windows were modelled conservatively. The size and orientation of each modelled window is provided in Table 11.2 in Section 11.4.

The orientation of each façade is included in the model, measured in terms of degrees from north. This means, for example, that if a window faces due south, it is 180 degrees from north.

11.3.4 Modifying Factors

The degree of shadow flicker impact that will typically occur in practice is always much less than the theoretical maximum flicker calculated by the model. Modifying factors take into account actual annual hours of sunlight for the area and hours of turbine operation. These factors have been applied to the modelling results in order to reach an adjusted scenario of shadow flicker impact that better reflects likely shadow impacts than an unmodified calculation.

The modifying factors are derived from the following:

- The average sunlight hours for the local area have been taken as 1401 hours, based on meteorological data for Fraserburgh (13km north- of the development)[84]. Therefore, on average, it is sunny for ~31% of the daylight hours.
- The rotor of a modern wind turbine can be expected to turn approximately 90% of the time.
- No adjustment has been made in regard to wind direction and it has been assumed that the turbines are always yawed such that flicker is possible.

Therefore, the realistic hours of flicker were estimated to be <28% of the theoretical maximum (0.31 x 0.90 = 0.28).

Table 11.1 - Average Monthly Sunshine Hours

Month	Daylight Hours	Total Hours	Percentage
Jan	43	227	19%
Feb	74	262	28%
Mar	119	365	33%
Apr	154	429	36%
May	208	515	40%
Jun	167	539	31%
Jul	166	538	31%
Aug	163	475	34%
Sep	133	386	35%
Oct	85	322	27%
Nov	53	242	22%
Dec	35	207	17%
Total	1401	4506	31%

[84] https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcv7wm5dw – Accessed 12/01/2024

11.3.5 Assessment of the Impact

There is currently no standard UK Guidance on acceptable levels of exposure to shadow flicker. The only guidance that provides suggested levels is Northern Ireland's Best Practice Guidance to Renewable Energy[85], which recommends that shadow flicker at neighbouring offices and dwellings within 500m should not exceed 30 hours per year.

This document also comments that at distances greater than 10 rotor diameters, the potential for shadow flicker is very low. This position is based on research[86] by Predac, a European Union sponsored organisation promoting best practice in energy use and supply which draws on experience from Belgium, Denmark, France, the Netherlands and Germany. In 2017, this research was reviewed by ClimateXChange[87] and remains an industry standard. This is further supported by the online planning advice from the Scottish Government, which conclude that at a separation distance of 10 rotor diameters, shadow flicker is not likely to be an issue.

Aberdeenshire Council Supplementary Guidance require a 1000m radius from each proposed turbine as an appropriate study area. All receptors noted to fall within this radius are to be assessed for potential shadow flicker. This guidance has been used to define the study used within the assessment.

As a 10-rotor diameter separation from the candidate turbine would equate to 820m (10x 82m), the use of 1000m to define the study area in this case is a conservative measure. Based on the information provided in Northern Irelands Best Practice Guidance to Renewable Energy and Scottish Government online planning advice, it is expected that shadow flicker from the Proposed Development at properties located between 820m and 1000m will be low.

11.4 Baseline

Based on the guidance referenced above, a study area of 1000m around the proposed turbines has been considered. Four residential properties have been identified within the shadow flicker study area as detailed in **Table 11.2** below and shown in **Figure 11.1**.

11.4.1 Sensitive Receptors

Table 11.2 - Potentially Sensitive Receptors Located within the Study Area

Property Name	ID	Easting	Northing	Orientation of Façade 1 (degrees from north)	Window Dimensions	Orientation of Façade 2 (degrees from north)	Window Dimensions	Distance from development (m)
Tillyduff	H1	406562	855927	170	4x4	260	4x4	744
Tophead	H2	407261	855353	270	4x4	180	4x4	672
Thornfield	H3	407270	854768	280	4x4	190	4x4	765
Three Acres	H4	405109	855046	125	4x4	215	4x4	897

[85] Best Practice Guidance to Planning Policy Statement 18: Renewable Energy, Department of the Environment (Northern Ireland), (2009). https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/Best%20Practice%20Guidance%20to%20PPS%2018%20-%20Renewable%20Energy_0.pdf – Accessed 12/01/2024

[86] Predac (undated) Spatial Planning of Wind Turbines Guidelines and Comparison of European Experiences. This publication is part of the PREDAC project with support from EU Commission, 2002-2004. – Accessed 12/01/2024

[87] Review of Light and Shadow Effects from Wind Turbines, by ClimateXChange, commissioned by Scottish Government, 2017. Available at: https://www.climatexchange.org.uk/media/2075/light_and_shadow_effects_from_wind_turbines_in_scotland_stages_1_and_2.pdf – Accessed 12/01/2024

11.5 Potential Effects

The results are presented for the theoretical maximum as well as for an adjusted scenario, where more realistic climatic and operating conditions are considered. These are defined as follows:

Table 11.3 - Modelling Scenarios

Scenario	Description
Theoretical maximum	Total hours per year assuming the sun is always shining, the turbine is always operational and always yawed in a direction conducive to shadow flicker.
Adjusted scenario	Total hours per year assuming average sunlight hours and lack of windiness as discussed in **Section 11.3.4**. In this scenario, it is still assumed that the turbine is yawed such that flicker is possible.

The adjusted scenario is provided to give a real-world estimate of the number of hours of flicker likely to be experienced over a year and to determine whether any flicker is potentially significant.

11.5.1 Proposed Development

Shadow flicker results for the Proposed Development are given in **Table 11.4.**

Table 11.4 - Predicted Shadow Flicker Impacts

Property Name	ID	Theoretical maximum (hh:mm)	Adjusted Scenario (hh:mm)
Tullyduff	H1	34:43	06:04
Tophead	H2	25:58	07:29
Thornfield	H3	34:21	10:21
Three Acres	H4	10:58	03:28

11.5.2 Summary of Potential Effects

Two locations, H1 and H3, are predicted to have theoretical potential of more than 30 hours of flicker per year.

Once realistic climatic and operational conditions are considered, all receptors are predicted to receive less than 11 hours per year of shadow flicker effects; well below the 30 hours of shadow flicker threshold of significance.

11.5.3 Cumulative Effects

Cumulative shadow flicker exists when an affected dwelling is found to lie in an overlapping study area of two or more wind farms.

It was identified that three receptors (H2, H3 & H4) were found to lie within the study area of the Existing Development and therefore subject to potential cumulative shadow flicker. All remaining properties lie outside the study area and are therefore not subject to cumulative shadow flicker effects.

Table 11.5 lists the details of the Existing Development that includes turbines located within the study area of the assessed dwellings. **Figure 11.2** shows the cumulative turbines in relation to the Proposed Development and receptors.

Table 11.5 - Cumulative Developments

Name	Status	Council	App ref.	Tip Height (m)	No. of Turbines	Rotor Diameter (m)
Greenside	Operational	Aberdeenshire	APP/2011/1024	99.5	4	70

Cumulative shadow flicker results for H2, H3 & H4 are presented in **Table 11.6**

Table 11.6 - Predicted Cumulative Shadow Flicker Effects

Property Name	ID	Theoretical maximum (hh:mm)	Adjusted Scenario (hh:mm)
Tophead	H2	48:28	11:12
Thornfield	H3	61:49	18:01
Three Acres	H4	28:38	8:28

11.5.4 Summary of Cumulative Effects

Results from Table 11.6 show that cumulative shadow flicker at all receptors has the theoretical potential to exceed 30 hours of shadow flicker a year. However, once realistic climatic and operational conditions are considered, the potential shadow flicker from the existing Greenside Wind Farm and the Proposed Development remain below the recommended threshold of 30 hours of flicker per year.

11.6 Mitigation

Shadow flicker was calculated assuming window sizes of 4m x 4m at each property. This is likely to be an overestimate in the majority, if not all, cases. In practice, smaller window sizes will lead to a lower probability of shadow flicker occurring than modelled here.

Where shadow flicker is predicted to occur for short periods of time, it is likely that no mitigation will be required as the magnitude of resulting impacts will be low. At all properties, it has been demonstrated that predicted shadow flicker from the Proposed Development will be below the recommended threshold of 30 hours of flicker per year. As such, no mitigation for the Proposed Development is proposed for these locations.

11.7 Conclusions

Four properties were assessed within the shadow flicker study area. Once realistic meteorological and operational factors were considered, H3 (Thornfield) was noted to have the largest impact with an expectation of around 10 hours of shadow flicker per year, which is comfortably below the 30 hours threshold of significance.

A cumulative assessment was carried out to identify the potential for cumulative shadow flicker effects as a result of operational and proposed turbines in the surrounding area. The cumulative assessment identified H2, H3 & H4 had the potential to be influenced by cumulative shadow flicker from the existing Greenside Wind Farm. Results from the cumulative assessment found that the maximum expected realistic hours of flicker per year at each location was around 18 hours per year, remaining below the 30-hour threshold.

As such, shadow flicker is expected to have a low and not significant impact on nearby sensitive receptors.

A review of Aberdeenshire Council Planning Portal has revealed that no complaints regarding shadow flicker from the Existing Development have been recorded since the site became operational in 2011. In addition, with the results shown in Table 11.6, it is therefore unlikely that the additional turbines from the Proposed Development would give rise to complaints.

Should shadow flicker become problematic in practice, individual turbines from the Proposed Development can be programmed to reduce flicker. Operational flicker impacts can therefore be controlled via a suitably worded planning condition.

12 Other Issues

12.1 Introduction

This chapter sets out the approach to any other assessment topics to be considered within the EIA Report. Topics covered include:

- Socio-Economics
- Aviation and Radar
- Telecommunications
- Safety

12.2 Socio-Economics

12.2.1 Introduction

This section considers the potential effects of the Proposed Development on socio-economics. It makes use of the Renewable UK study 'Onshore Wind: Economic Impacts in 2014'[88]. This study has been used to calculate:

- The local, regional, and national spend per annum;
- The estimated job opportunities; and
- The Gross Value Added (GVA) contribution to the local, regional, national, and overseas economy.

These socio-economic indicators will be calculated for both the construction and operational phases of the Proposed Development.

This assessment has been undertaken on the basis of the Proposed Development consisting of three wind turbines, with a tip height of up to 100m, and a potential generating capacity of up to 7.05MW.

12.2.2 Construction Phase Impacts

The Renewable UK study estimates that the weighted average cost of an onshore wind farm during construction would be approximately £1.32 million per MW installed capacity per annum. The study also estimated that 36% of construction expenditure typically occurs within Scotland and 12% within the local authority area. These calculations have been used to inform **Table 12.1** based on three turbines with a potential generating capacity of 7.05MW.

Table 12.1 - Estimated Spend During the Construction Phase (Green Cat Renewables Calculation Based on RenewableUK Assumptions)

	Percentage of Total Construction Spend (%)	BiGGAR Averages Weighted Spend per MW (£)	Greenside Extension Calculated Spend (£)
Aberdeenshire	12	158,501	1,117,400
Scotland	36	480,182	3,385,300

[88] RenewableUK. (2015) 'Onshore Wind: Economic Impacts in 2014' Accessed - 30/01/2024

	Percentage of Total Construction Spend (%)	BiGGAR Averages Weighted Spend per MW (£)	Greenside Extension Calculated Spend (£)
UK	47	613,312	4,323,800
Outside UK	53	705,563	4,974,200
Total (UK Plus Overseas)	100	1,318,875	9,298,100

Table 12.1 shows that the total estimated spend during the construction phase within the UK is £4.3 million, of which £3.3 million is expected to be spent within Scotland and up to £1.1 million is expected to be spent in Aberdeenshire.

Renewable UK estimated that the three main areas of construction spend are for the turbine, grid connection and 'balance of plant' which accounts for all the facilities/infrastructure of a wind turbine installation except for the turbine itself. The majority of spend within Aberdeenshire would fall within the 'balance of plant' and would compromise:

- Contracts being placed with construction companies, contractors, and civil engineers and consultancies in terms of:
    - Concrete production;
    - Civils Contractor;
    - Electrical Contractor;
    - Haulage and storage of abnormal loads; and
    - Hire of physical plant including cranes.
- Accommodation and subsistence costs for work crews.

Research conducted by RenewableUK also indicates that, on average, there is one employee for every £137,942 in turnover and a Gross Value Added (GVA) turnover rate of 0.432. Using the assumptions from Table 12.1 the employment rate and GVA turnover can be estimated. This is set out in Table 12.2.

Table 12.2 - Estimated Job Creation and GVA during the Construction Phase (Green Cat Renewables calculations based on RenewableUK assumptions)

Geographical Region	Estimated Turnover (£)	Estimated Job Generation (no)	GVA (£)
Aberdeenshire	1,117,400	Up to 8	482,700
Scotland	3,385,300	Up to 24	1,462,400
UK	4,323,800	Up to 31	1,867,900
Outside UK	4,974,200	Up to 36	2,148,900
Total (UK plus overseas)	9,298,100	Up to 67	4,016,800

As shown in Table 12.2, it is estimated that the Proposed Development will create up to 8 jobs and contribute up to £482,000 in GVA in Aberdeenshire during the construction phase. It is also estimated that up to 24 jobs will be created across Scotland with a gross GVA contribution of up to £1.4 million.

12.2.3 Operational Phase Impacts

Table 12.3 shows the calculated average spend during the operational and maintenance phase of the Proposed Development, as taken from the same Renewable UK study.

Table 12.3 - Estimated spend during the Operational Phase (Green Cat Renewables calculation based on RenewableUK assumptions)

Geographical Region	Percentage of Total Operation & Maintenance Spend (%)	BiGGAR Averages Weighted Spend per MW (£)	Greenside Calculated Spend (£)
Aberdeenshire	42	25,244	178,000
Scotland	58	34,587	243,800
UK	87	51,992	366,500
Outside UK	13	7,875	55,500
Total (UK plus overseas)	100	59,867	422,100

Table 12.3 shows that 87% of operational expenditure tends to occur within the UK, with 42% spent in the local area. This indicates that over £243,000 of the operational spend will be spent within the Scottish economy and over £178,000 will be spent in Aberdeenshire.

Research generated by RenewableUK also indicates that, on average, there is one employee for every £121,935 in turnover and a Gross Value Added (GVA) turnover rate of 0.43. Using the assumptions from Table 12.3 on operational spend, the employment rate and GVA turnover can be estimated. This is set out in Table 12.4.

Table 12.4 - Estimated job creation and GVA during the Operational Phase (Green Cat Renewables calculation based on RenewableUK assumptions)

Geographical Region	Estimated Turnover (£)	Estimated Job Generation (no)	GVA (£)
Aberdeenshire	178,000	Up to 1	76,500
Scotland	243,800	Up to 1	104,800
UK	366,500	Up to 3	157,600
Outside UK	55,500	0	23,900
Total (UK plus overseas)	422,100	Up to 3	181,500

As shown in Table 12.4, it is estimated that the Proposed Development will create up to 3 jobs and contribute over £181,000 in GVA during the operational phase. It is also estimated that over £76,000 of this will be generated in Aberdeenshire.

12.2.4 Summary and Conclusion

The Proposed Development would consist of three wind turbines with a generating capacity of up to 7.05MW that will generate electricity for the local electricity network. This section has shown that the Proposed Development will provide a range of positive opportunities for the local, regional, national, and overseas economies. Of

particular interest to this assessment are those which will benefit the local economy in Aberdeenshire. It is estimated that over the duration of the construction and operational phase of the Proposed Development that:

- Up to £1.2 million will be spent within the local economy across the construction and operational phases;
- Up to 9 jobs will be created across Aberdeenshire, with up to 25 estimated for Scotland as a whole;
- Up to £600,000 in GVA will be contributed to the local economy.

Overall, it is estimated that the significance of effect is estimated to be **minor** and **beneficial** locally during both the construction and operational phases, as there will be small but noticeable impacts on the local economy in the form of increased GVA contributions and project spend per annum. As such, there is expected to be a **minor, beneficial** effect locally on socio-economic receptors as a result of the Proposed Development.

12.3 Aviation and Radar

12.3.1 Introduction

This section considers the potential impacts on aviation and radar as a result of the Proposed Development during the construction, operation and decommissioning phases.

Wind turbines have the potential to affect civil and military aviation during operation. These impacts include but are not limited to:

- Physical obstructions;
- Generation of unwanted returns on Primary Surveillance Radar (PSR); and
- Adverse effects on overall performance of Communications, Navigation and Surveillance (CNS) equipment

12.3.2 Guidance

Guidance and relevant publications for assessing potential impact of wind turbines on aviation activities is given in:

- Renewable UK (2002) 'Wind Energy and Aviation Interim Guidelines';
- Civil Aviation Authority (2010) 'CAP 793- Safety Standards at Unlicensed Aerodromes (Including Helicopter Landing Sites and Aerodromes Used for Flying Training)';
- Civil Aviation Authority (2010) 'Lighting of En-Route Obstacles and Onshore Wind Turbines';
- Civil Aviation Authority (2016) 'CAP 764 – Policy and Guidelines on Wind Turbines';
- Renewable UK (2013) 'Guidance on Low Flying Aircraft and Onshore Tall Structures Including Anemometer Masts and Wind Turbines';
- Department of Environment and Climate Change (2015) 'Aviation Plan – 2015 Update';
- Airspace and Safety Initiative Windfarm Working Group (2013) 'Managing the Impact of Wind Turbines on Aviation'; and
- Met Office (2012) 'Guidelines for Wind Farm Developers: Meteorological Radar and Other Technical Sites used for Meteorology'.

12.3.3 Methodology

A desk-based assessment has been undertaken using online portals and self-assessment tools in order to determine potential impacts on aviation interests, as well as identify any necessary mitigation measures in order to minimise potential impacts on these.

12.3.4 Assessment of the Predicted Impacts and Effects

NATS

According to NATS Wind Farm Self-Assessment Data[89], The Proposed Development will not be visible to the NATS Primary Surveillance Radar, as visibility at the Site is only possible at heights of over 120m. An objection from NATS is unlikely, as the four operational Greenside Wind Farm turbines on Site were judged to pose no issues to the radars at Perwinnes and Alanshill, and the Proposed Development is of similar design with turbines no larger in tip height.

MoD

The Proposed Development is located within a low priority military low flying area[90] in which a total of just 3 hours of low flying was conducted in 2021 and 2022 combined. As a result, mitigation is unlikely to be required for low flying aircraft.

Because the turbines are under 150m tall, there is no statutory requirement for night-time aviation obstacle lighting. In such cases the MoD typically request that turbines are fitted with either low intensity red aviation obstruction lights, or infra-red lights. In order to minimise visual impact, the turbines will use infra-red lighting only, using MoD approved lights.

The MoD have been consulted regarding the Proposed Development and a response is being awaited.

Aberdeen Airport

The Proposed Development is located 45km away from Aberdeen Airport and is therefore located outside the designated safeguarding zone[91]. It is anticipated that there will be no impacts on current infrastructure.

Met Office

The Proposed Development is located marginally inside the 30km buffer for the Hill of Dudwick safeguarding zone[92]. The Met Office requires consultation in respect of any structure exceeding 91.4m above ground level in this location, however as the Proposed Development is not within 10km, mitigation is possible. As such, no significant impacts are anticipated.

12.3.5 Summary and Conclusion

Independent assessment has identified no significant aviation impacts are likely as a result of the Proposed Development. It should be noted that the MoD, NATS, Aberdeen Airport and the Met Office all had no objections to the original Greenside Wind Farm application.

It is likely that the MoD will request that turbines are marked with aviation lights. In order to minimise visual impact the turbines will use infra-red lighting only, using MoD approved lights.

No other mitigation requirements are predicted at present.

[89] NATS. 'Wind Farm Self-Assessment Maps'. Available at: https://www.nats.aero/services-products/catalogue/n/wind-farms-self-assessment-maps/ – Accessed 12/01/2024

[90] UK Government. (2023) 'The pattern of military low flying across the UK: index'. Available at: https://www.gov.uk/government/collections/the-pattern-of-military-low-flying-across-the-uk-index – Accessed 12/01/2024

[91] Aberdeen City Council. (2013) 'Aerodrome Safeguarding Map Aberdeen Airport'. Available at: https://committees.aberdeencity.gov.uk/documents/s49034/Map%20D%20AIA%20Safeguarding%20Map.pdf – Accessed 12/01/2024

[92] Met Office. (2015) 'Hill of Dudwick Met Office Planning Map'. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/services/industry/energy/safeguarding/dudwick_map.compressed.pdf – Accessed 12/01/2024

12.4 Telecommunications

12.4.1 Introduction

This chapter will consider the potential effects of the Proposed Development on telecommunications infrastructure. Wind turbines have the potential to affect television reception, fixed telecommunication links and utilities during operation. These impacts include but are not limited to:

- Physical obstructions;
- Adverse effects on overall performance of Communications, Navigation and Surveillance (CNS) equipment; and
- Interfere with electro-magnetic signals and potentially affecting television reception and fixed telecommunication links.

12.4.2 Policy and Legislation

Guidance for assessing the potential impact of wind turbines on infrastructure is given in:

- Scottish Government (2014) 'Scottish Planning Policy, Subject Policy: Development Management';
- Ofcom (2009) 'Tall Structures and their Impact on Broadcast and other Wireless Systems;
- BBC & Ofcom (2006) 'The Impact of Large buildings and Structures, including Wind Farms, on Terrestrial Television Reception';
- Health and Safety Executive – GS 6 (2012) 'Avoiding Danger from Overhead Powerlines';
- Health and Safety Executive – HSG 47 (2014) 'Avoiding Danger from Underground Services'; and
- Energy Networks Accociation (ENA) (Issue 1:2012) 'separation between Wind Turbines and Overhead Lines – Principles of Good Pracitice'.

12.4.3 Methodology

The Linesearchbeforeudig[93] service and online Ofcom Spectrum Portal[94] were used in order to identify the relevant stakeholders with telecommunications infrastructure in the area and identify potential impacts. A list of identified stakeholders is provided in Table 12.5 below:

Table 12.5 - Utilities/Services

Utility/Service	Response	Date of Consultation	Date of Response
National Gas Transmission	Identified NHP Mains pipelines	05/12/2023	05/12/2023
SSEN Transmission	Identified transmission line	05/12/2023	05/12/2023
Scottish & Southern Energy Networks	Identified minor 11kv line	05/12/2023	05/12/2023
Scotia Gas Networks	No objection/infrastructure	05/12/2023	05/12/2023

[93] Linesearchbeforeudig. Available at: https://lsbud.co.uk/ – Accessed 12/01/2024
[94] Ofcom. 'Spectrum Information Portal'. Available at: https://www.ofcom.org.uk/spectrum/information/spectrum-information-system-sis/spectrum-information-portal – Accessed 12/01/2024

12.4.4 Assessment of the Predicted Impacts and Effects

12.4.4.1 Telecommunications

Ofcom has primary responsibility for regulating broadcasting, telecommunications, and postal industries in the UK. The Ofcom Spectrum Information Portal identified two fixed links in the vicinity of the development site: one located 600m south of the nearest proposed turbine operated by Telefonica, and another located 650m north of the nearest proposed turbine operated by the Joint Radio Company (JRC). JRC were contacted regarding their infrastructure and a response is being awaited.

12.4.4.2 Television

A 2009 Ofcom report states that: *"Technologies such as analogue television are quite seriously affected by signal reflections, which can give rise to an effect known as 'ghosting'. Ghosting (or delayed image interference) is where a pale shadow or shadows appear to the right of the main picture on viewers' television screens."* And that *"Digital television signals are much better at coping with signal reflections, and digital television pictures do not suffer from ghosting."* Therefore, any potential impacts are considered to be significantly reduced.

12.4.4.3 Other Infrastructure

A services search was undertaken using a utilities and asset search service. This provides a single point of contact for all enquiries relating to the apparatus owned and/or operated by the Asset Owners protected by the facilitator, including underground and overhead transmission/distribution electricity networks, transmission/distribution gas networks, oil pipelines, and fibre optic networks.

While the site falls within the operational boundaries for Scotia Gas Networks (SGN), subsequent consultation revealed no assets within the development site.

An SSEN Transmission line was identified running across the western edge of the Site Boundary. An appropriate buffer was applied to this, and as the operational Greenside Wind Farm turbines sit between this line and the proposed turbines, it is not anticipated that this line will have any impact on the Proposed Development.

Furthermore, a minor 11kV SSEN Distribution line was identified approximately 180m north of the nearest proposed turbine. No impacts are anticipated from this due to its small scale, but if it is still installed at the time of construction, mitigation is available through re-routing of the line underground if this is judged to be required.

12.4.5 Mitigation

As it has been identified that the nearest operational fixed links to the proposed turbines are over 600m away, no mitigation measures are required at this stage.

The Proposed Development complies with the ENA guidance within the Site Boundary as appropriate separation distances have been applied.

12.4.6 Summary and Conclusion

The Applicant will work closely with telecommunications operators to ensure that there are no unacceptable impacts on any fixed links.

No impacts are currently anticipated on television infrastructure or on the identified SSEN Transmission and Distribution lines.

12.5 Safety

12.5.1 Introduction

This section outlines the procedures that will be put in place and followed to ensure the safety of the workforce and the public, specifically in relation to the following:

- Approach to safe operation and maintenance;
- Turbine safety;
- Safe operation;
- Safety during adverse weather conditions; and
- Public safety.

12.5.2 Policy and Legislation

The construction of the Proposed Development must comply with the requirements of the Construction (Design and Management) Regulations 2015. These regulations oblige the developer to notify the Health and Safety Executive (HSE) of the project, and to establish a safety management system encompassing risk assessment, design measures and management instructions to ensure the safety of construction (and operational) staff and the public. Best practice health and safety guidelines published by Renewable UK (2010), will be adhered to and speed limits will be put in place to regulate traffic flow.

SNH have also provided a Good Practice Guide to good practice in wind farm construction.

As for any mechanical or electrical installation, wind turbines could pose a safety risk if not managed and maintained correctly. The Construction (Design and Management) Regulations 2015 (CDM) are now well established as the key legislation that is applicable to the development and construction of onshore and offshore renewable energy projects within the jurisdiction of Great Britain. It is important to comply with this legislation to avoid enforcement action and possible prosecution.

Detailed risk analysis and avoidance limitation measures are required for every facet of the development and operation of a wind project. The measures would be contained in the Health and Safety file for the wind development site which would be open to inspection by the Health and Safety Executive. All site personnel would have full safety training to ensure risk of accident occurring is minimised.

Safety of the public and contractors are of paramount importance to the developer. During construction and subsequent operation of the development, site safety procedures will be strictly enforced and followed.

12.5.3 Assessment of Predicted Impacts

12.5.3.1 Best Practice Guidelines for Energy Health and Safety

During the construction, decommissioning and operational phases of the project, relevant guidance, legislation and standards as well as 'good and best practices' will be adopted to maintain site safety and protect the interests of ecology, hydrology and cultural heritage.

All personnel working on the site would undergo an induction covering topics including health and safety, environmental protection and pollution prevention control and response.

A Construction Method Statement (CMS) will be developed post consent to ensure a coordinated approach. This plan would highlight the health, safety and environmental considerations related to the proposed works and define the controls to be implemented to ensure a safe system of work.

12.5.3.2 Operational Safety

Modern wind turbines incorporate sophisticated supervisory control systems that continually interrogate the operational status and safe working of the key components of each turbine and allow an operator to remotely monitor the turbines via satellite link. Under fault conditions, affected turbines automatically shut down and send an alarm to the maintenance engineer. For safety-critical faults, turbines do not re-start until the maintenance engineer has diagnosed and rectified the problem.

In terms of general safety during operation, the turbines would be supported by the manufacturer's operational and maintenance safety manuals, which would be available on site. These manuals would form the basis of the regular safety checks that would be undertaken throughout the life of the development.

The Proposed Development wind turbines, in compliance with relevant safety regulations, would display appropriate warning signs concerning restricted areas on the site, including the substation enclosure and control building. Authorised personnel and persons under their supervision who visit the restricted areas of the site during its operation would operate under site-specific safety rules established by the owner and operator. Electrical installation is conducted in accordance with standards and recognised codes of practice, with adequate signage and protection.

It is considered that there will be **no effect (not significant)** due to the safe operation of the proposal.

12.5.3.3 Turbine Safety

The final wind turbine model will have full certification from a recognised authority against internationally recognised standards, and a proven track record of safe operation. The main certification agencies have well developed and proven certification procedures. A mature suite of safety and testing standards developed over many years by the International Electrotechnical Commission are now in place and are widely accepted. Working in parallel, these standards and certification procedures have ensured that wind turbines adhering to them have high levels of intrinsic safety.

As stated in PAN 45 Annex 2: 'Spatial Frameworks and Supplementary Planning Guidance for Wind Farms', many blades are composite structures with no bolts or other separate components. Even for blades with separate control surfaces on or comprising the tips of the blade, separation is most unlikely" (Para 48, SEDD, 2002). Although PAN 45 has now been superseded, this advice remains relevant. The highest risk of damage is in extreme wind speed conditions (>100mph) when the likelihood of anyone being on site is remote. Even under these conditions the risk of damage is small (for example, the Wigton Wind Farm in Jamaica which RES constructed and commissioned in 2004 did not incur any significant damage by Hurricane Ivan which caused devastation throughout the island on 10th September that year). The turbines proposed for the site would be certified to withstand appropriately extreme conditions and are already proven to perform well and operate safely in the UK.

It is considered that there will be **no effect (not significant)** in relation to the safe operation of the wind turbines over the lifetime of the development.

12.5.3.4 Public Safety

During the construction phase, the site will be clearly marked with appropriate warning signage, and where appropriate diversions may be put in place to stop members of the public accessing the immediate site.

Once commissioned, there would be no immediate risk to members of the public through the day-to-day operation of the wind turbines. All turbines are locked so access to control systems and electrical components are restricted.

The plant, equipment and their enclosures are designed to incorporate the best available technology and access to the proposed wind project site should pose no danger to the public.

Wind turbine technology is mature and has been extensively safety tested across the globe. Wind turbines are fitted with many safety features as standard that force the turbine to shut down in the event of an adverse weather event or potential malfunction. As per industry requirements, there is no potential risk to public safety during the operation of the wind turbines.

During routine maintenance operations 'warning' signs would be erected. At the main entrance to the site, signs would be deployed giving basic safety information, including speed limits, appropriate personal protective equipment and also giving details of whom to contact in an emergency. Emergency contact information would also be posted at the local police station and with the local power distribution company, SSEN.

Given the current use of the site and the limited available access by members of the public it is considered that there is likely to be **no effect (not significant)** with regards to public safety during the construction and operation of the wind farm.

12.5.3.5 Safety During Adverse Weather Events

Although the possibility of attracting lightning strikes applies to all tall structures, wind turbines have specific protection requirements due to their size and nature. Specific design features are required to ensure safety and to ensure that the turbines can operate during lightning storms without damage and without impact on reliability. Specific features are incorporated into the blades to ensure strikes are conducted harmlessly past the sensitive parts of the nacelle and down the tower into the earth. Protection also includes a buried Earthing mat around each turbine foundation and/or a deeply sunk lightning conduction cable which is sunk to a substantial depth into the earth, sufficient to ensure appropriate conduction to ground.

In some countries, icing of wind turbine blades presents a potential risk that must be managed. In the more temperate climates of the UK, icing has not been a major problem to date, but at higher elevations and at locations further north, the risk will be greater and needs to be suitably assessed.

Generally, there is no inherent danger in operating a wind turbine at low temperatures, and there is no particular risk simply because it is frosty or snowing. However, under certain atmospheric conditions, such as freezing fog which specifically involve low temperatures and high humidity, hard ice can form on the blades (this can also happen either when rain freezes on contact with a blade or should the turbine be operating in low cloud). Enercon turbines, which are proposed at the site, have an ice detection system which will shut down the turbine if a build-up of ice is detected; thus, reducing the risk of ice throw. Turbines would not restart until the sensor detects the ice has melted.

Based on this information, the location for the development site and limited potential for members of the public to be present on site it is considered that there will be **no effect (not significant)** during construction and operation of the proposed wind farm.

12.5.4 Summary and Conclusion

Modern wind turbines have a proven track record for safety, and the turbines proposed will be constructed and operated in accordance with relevant health and safety legislation. Commercial sized turbines are particularly reliable, requiring minimal intervention and maintenance during operation. They are designed to cope with extreme wind and weather conditions.

Only turbines with a proven record of safety and reliability will be selected for this site.

The risk of ice throw (ice falling or being thrown from a turbine during particular circumstances) is also low. An ice detection system on the turbines will ensure they are deactivated if there is a risk of ice throw. As a further safety measure, notices at access points alerting members of the public of potential risks under certain conditions will be provided.

The development site is an area of open agricultural land with scattered farmsteads. In terms of access, the potential for interaction between members of the public and the development are low. The site's location has been given detailed consideration throughout the design process and appropriate separation has been included between all infrastructure elements and the nearest residential receptors, paths, public rights of way and any other access points to the development site.

The assessment undertaken shows that there are no likely significant effects on human health through the safe operation of the Proposed Development, Greenside Extension Wind Farm.

13 Summary of Mitigation

This chapter provides a summary of the proposed mitigation presented within the Environmental Impact Assessment Report (EIA Report). Table 13.1 outlines the mitigation measures and commitments for the Proposed Development and at which phase of the project these would apply. For more details, please refer to the corresponding chapter.

Table 13.1 – Summary of Mitigation

Chapter	Features	Mitigation
Landscape and Visual impact	Potential impact on residential properties. Potential impacts during construction phases.	Several of the residential properties are screened by vegetation and shrubbery. During the construction phase, land clearance and occupation will be limited to the minimum necessary for the works, any vegetation removal will be minimised as far as possible to ensure existing screening is maintained and any valued features, such as historic features and field boundaries will be protected by temporary fencing which will be used to define such areas and to avoid accidental damage.
Cultural Heritage and Archaeology	Potential impacts on heritage asset HER01.	This feature will be fenced off and no works will take place within this area. There are no additional known features within the ground-breaking area however in the event that archaeological features are encountered, a suitable program of archaeological works will be implemented to the satisfaction of the planning authority.
Noise	No significant impact noted.	No mitigation required.
Ecology	Potential loss of habitat and connectivity to the habitat for protected species.	Pre-construction surveys to inform construction methodology.
Ornithology	Potential impacts on ornithology interests.	Breeding bird protection measures during breeding season of April-July inclusive including provision of a Breeding Bird Plan.
Hydrology and Hydrogeology	Impact on the quality of groundwater and surface water. Increase in water run off. Impact on flow paths and flood risks. Potential direct impacts to sensitive areas and sensitive habitats.	Sustainable Drainage Systems will be implemented to capture runoff from all access tracks and hardstandings, which will then be appropriately treated to remove suspended sediment or contaminants prior to discharge into the natural environment. Operational best practice procedures will continue to be adopted, with the risk of water pollution from such activities considered to be negligible. Where infrastructure lies in close proximity to sensitive hydrological features such as watercourses, runoff will be diverted into a settlement pond to remove any potential contaminants prior to discharge into the environment.

		The proposed layout has been designed to avoid sensitive areas wherever possible however avoidance of impacts on sensitive areas with micrositing allowances. Further details of how impacts on sensitive areas and habitats will be managed shall be provided within a Construction Method Statement (CMS) prior to construction of the proposed project. Mitigating measures will include: using an irrigation sprinkler head to maintain moisture in the upper soil horizons of nearby GWDTE; and, keeping the foundation construction duration as short as possible. This will maintain a continuous water supply to sensitive habitats and minimise the overall impact of dewatering.

14 Ecology

14.1 Introduction

This chapter forms an Ecological Impact Assessment (EcIA), which considers the likely significant effects of the Greenside Extension Wind Farm (hereafter referred to as 'the Proposed Development'), as described in **Chapter 3 – Project Description** on the ecological features, habitats, and fauna present at the Site. It details likely significant effects associated with the construction, operation, and decommissioning phases of the Proposed Development.

Analysis and assessment of the baseline ecological data have enabled the identification of appropriate mitigation and compensation measures to prevent, reduce, or offset potential adverse ecological effects, as well as provide enhancement, where possible. The specific objectives of the chapter are to:

- Describe the ecological baseline of the Site and in the immediate surrounding area;
- Describe the assessment methodology and significance criteria used in completing the impact assessment;
- Describe the likely significant effects, including direct, indirect and cumulative effects;
- Describe the mitigation measures proposed to address any likely significant effects; and
- Assess the residual effects remaining following the implementation of mitigation.

The assessment has been carried out by IMTeco Ltd and in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) Code of Professional Conduct[95].

The effects on hydrology are addressed in **Chapter 8 - Hydrology & Hydrogeology**. Chapter 8 also considers the hydrological impacts on Groundwater Dependent Terrestrial Ecosystems (GWDTEs) identified in the ecology assessment.

This chapter of the EIA Report is supported by the following Technical Appendices:

- **Appendix 14.1:** Habitat Survey and National Vegetation Classification;
- **Appendix 14.2**: Protected Species Surveys.
- **Appendix 14.3**: Bat Surveys.

The **Figures** are referenced within the text, where relevant, and are located within **Appendix 14.1 – 14.3**.

For the purposes of this assessment, the following definitions are made:

- The Proposed Development: the turbines and all associated infrastructure required for Greensides Extension Wind Farm;
- The Zone of Influence (ZoI): this is 'the area over which ecological features may be subject to significant effects as a result of the Proposed Development or associated activities' (CIEEM, 2018);
- The Site: is the area within which all new infrastructure shall be contained, as described in **Chapter 3 - Project Description;**
- The Ecological Survey Area (ESA): is the area in which ecological surveys were undertaken (as displayed in the corresponding maps in **Appendix 14.1-14.3**).

95CIEEM Code of Professional Conduct (Accessed 04/01/2024).

Ecological effects are often related to effects on ornithology, hydrology, and geology. This chapter should, therefore, be read in conjunction with **Chapter 15 - Ornithology; Chapter 8 – Hydrology & Hydrogeology.**

14.2 Legislation, Policy, and Guidance

The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017[96] establish in broad terms what is to be considered when determining the effects of development proposals on local receptors. The following key industry guidance, policy, legislation, and information sources have been considered in carrying out this assessment, as set out in the following sections.

Guidance for assessing the potential impact of the Proposed Development on the ecological features of the development site will be based on the following statutory, general, and national guidance listed in **Table 14.1**. Any appropriate local policy and guidance will also be considered.

Table 14.1 - Policy, Legislation & Guidance

	Legislation or Guidance Document
Legislation	Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011[97], which transpose the EIA Directive into Scottish law; Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (The Habitats Directive)[98]; Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (Water Framework Directive)[99]; The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposes the Habitats Directive into UK law[100]; Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive)[101]; The Water Environment and Water Services (Scotland) Act 2003 (WEWS)[102]; The Water Environment (Controlled Activities) (Scotland) Regulations 2011[103][104], Amendment Regulations 2021[105]; The Wildlife and Countryside Act 1981 (as amended)[106]; Nature Conservation (Scotland) Act 2004 (as amended)[107]; The Wildlife and Natural Environment (Scotland) Act 2011[108] The Protection of Badgers Act 1992[109]
Policy	Aberdeenshire Local Development Plan (2023)[110]; National Planning Framework 4 (NPF4) (2023)[111]; UK Post-2010 Biodiversity Framework (2012)[112];

[96] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (Accessed 04/01/2024).
[97] Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (Accessed 04/01/2024).
[98] European Commission (1992) Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (The Habitats Directive) (Accessed 04/01/2024).
[99] Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (Water Framework Directive) (Accessed 04/01/2024).
[100] The Conservation (Natural Habitats, &c.) Regulations 1994 (Accessed 04/01/2024).
[101] Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive) (Accessed 04/01/2024).
[102] The Water Environment and Water Services (Scotland) Act 2003 (WEWS) (Accessed 04/01/2024).
[103] The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (Accessed 04/01/2024).
[104] The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (Accessed 04/01/2024).
[105] The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2021 (Accessed 04/01/2024).
[106] The Wildlife and Countryside Act 1981 (as amended); UK Government (1981) Wildlife and Countryside Act 1981, Chapter 69. Part 1 (Accessed 04/01/2024).
[107] Nature Conservation (Scotland) Act 2004 (Accessed 04/01/2024).
[108] The Wildlife and Natural Environment (Scotland) Act 2011 (Accessed 04/01/2024).
[109] The Protection of Badgers Act 1992 (Accessed 04/01/2024).
[110] https://www.aberdeenshire.gov.uk/planning/plans-and-policies/ldp-2023/
[111] National Planning Framework 4 (Accessed 04/01/2024).
[112] UK Post-2010 Biodiversity Framework (2012) (Accessed 04/01/2024).

	Legislation or Guidance Document
	Scottish Biodiversity Strategy: It's in Your Hands (2004)/2020 Challenge for Scotland's Biodiversity (2013)[113]; Scottish Government (2017). Planning Advice Note 1/2013-Environmental Impact Assessment, Revision 1.0[114]; PAN 51: Planning, Environmental Protection and Regulation (revised 2006)[115]; PAN 60: Planning for Natural Heritage (Scottish Government, 2000)[116]; and Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives: Scottish Executive Circular 6/1995 as amended (June 2000)[117]
Guidance	Averis et al., (2014). An Illustrated Guide to British Upland Vegetation. Joint Nature Conservation Committee. Peterborough; Bang and Dahlstrøm. (2001). Animal Tracks and Signs. Oxford University Press, Oxford; Chanin (2003a) Monitoring the Otter (*Lutra lutra*). Conserving Natura 2000 Rivers: Monitoring Series No. 10. English Nature, Peterborough; Chanin (2003b). Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough; CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.[118]; Collins, J.(ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn)[119]; Cresswell et al., (2012). UK BAP Mammals Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation. Published by The Mammal Society; European Commission (2011). EU Biodiversity Strategy[120]; Gurnell et al., (2009). Practical Techniques for Surveying and Monitoring Squirrels. Forestry Commission Scotland, Edinburgh; Harris S., Cresswell P and Jefferies D., (1989). Surveying Badgers. The Mammal Society, London; Harris and Yalden. (2008). Mammals of the British Isles: Handbook. , 4th Edition. The Mammal Society, Southampton; Hundt (2012). Bat Surveys: Good Practice Guidelines (2nd Edition), BCT, London; UK Habitat Classification System[121] Joint Nature Conservation Committee (2010). Handbook for Phase 1 Habitat survey: a technique for environmental audit; Joint Nature Conservation Committee (2013). Guidelines for selection of biological Sites of Special Scientific Interest (SSSI); Joint Nature Conservation Committee (2004) Common Standards Monitoring Guidance for Reptiles and Amphibians, Version February 2004. JNCC, Peterborough; Rodwell (2006). National Vegetation Classification: Users' handbook; Scottish Government (2013). Scottish Biodiversity List[122]; Scottish Executive (2001) (updated 2006). European Protected Species, Development Sites and the Planning System: Interim guidance for local authorities on licensing arrangements; Scottish Executive Rural Affairs Department (SERAD) (2000). Habitats and Birds Directives, Nature Conservation: Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and

[113] UK Post-2010 Biodiversity Framework (2012) (Accessed 04/01/2024).
[114] Scottish Government (2017). Planning Advice Note 1/2013-Environmental Impact Assessment (Accessed 04/01/2024).
[115] PAN 51: Planning, Environmental Protection and Regulation (Accessed 04/01/2024).
[116] PAN 60: Planning for Natural Heritage (Accessed 04/01/2024).
[117] Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives (Accessed 04/01/2024).
[118] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (Accessed 04/01/2024).
[119] Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good practice Guidelines (3rd edition). The Bat Conservation Trust, London.
[120] EU Biodiversity Strategy (Accessed 04/01/2024).
[121] UK Habitat Classification System (Accessed 04/01/2024).
[122] Scottish Biodiversity List (Accessed 05/01/2024).

	Legislation or Guidance Document
	of Wild Flora and Fauna and the Conservation of Wild Birds (''The Habitats and Birds Directives''). Revised Guidance Updating Scottish Office Circular No 6/1995; Scottish Environment Protection Agency (SEPA) (2017). Guidance Note 31 - Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (Version 3)[123]; 'Managing Natura 2000 Sites' (European Commission[124]), NatureScot: 'Management of European sites'[125] NatureScot (updated Aug 2021), Bats and onshore wind turbines - survey, assessment and mitigation[126]; Scottish Natural Heritage (Version 2, 2016). Planning for Development: What to consider and include in Habitat Management Plans[127]; NatureScot: Habitats Regulations Appraisal (HRA)[128]; Scottish Natural Heritage (2003). Best Practice Guidance - Badger Surveys. Inverness Badger Survey 2003. Commissioned Report No. 096; Scottish Natural Heritage (2018). Environmental Impact Assessment Handbook – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland[129]; Strachan et al., (2011). The Water Vole Conservation Handbook; The Herpetological Conservation Trust (2007). National Amphibian and Reptile Recording Scheme, Habitat Recording Guide; BS 42020:2013 Biodiversity: Code of Practice for Planning and Development: BSI Standards Publication. Developing with Nature guidance: Guidance on securing positive effects for biodiversity from local development to support NPF4 policy 3(c)[130] Scottish Government Draft Planning Guidance: Biodiversity (2023)[131]

14.3 Assessment Methodology and Significance Criteria

The assessment of the potential impact of the Proposed Development on ecology was undertaken by the general method described in the following sub-sections.

14.3.1 Scope of Assessment

The scope of the Ecological Impact Assessment (EcIA) includes the following elements:

- Identification of designated sites of nature conservation interest located up to 5 kilometres (km) from the Site;
- Identification of historical records of rare, notable or protected species or habitat located up to 2km from the Site;
- Consideration of the likely significant effects on ecological features arising due to the Proposed Development;

[123] SEPA Guidance Note 31 (Accessed 05/01/2024).
[124] Managing and Protecting Natura 2000 Sites (Accessed 05/01/2024).
[125] Management of European Sites (Accessed 05/01/2024).
[126] Bats and onshore wind turbines - survey, assessment and mitigation (Accessed 05/01/2024).
[127] Planning for Development: What to consider and include in Habitat Management Plans (Accessed 05/01/2024).
[128] Habitats Regulations Appraisal (Accessed 05/01/2024).
[129] Environmental Impact Assessment Handbook. Guidance for competent authorities, consultation bodies and others in involved in the Environmental Impact Assessment process in Scotland (Accessed 05/01/2024).
[130] Developing with Nature guidance: Guidance on securing positive effects for biodiversity from local development to support NPF4 policy 3c (Accessed 05/01/2024).
[131] Scottish Government Draft Planning Guidance: Biodiversity (Accessed 05/01/2024).

- Description of measures required to mitigate adverse effects on ecological features within or adjacent to the Site, with the aim to avoid, reduce or compensate for the effect, or offer an opportunity for enhancement; and
- Identification of residual effects on ecological features, including those considered to be significant, taking into account the above mitigation.

The principal ecological issues considered in this EcIA include:

- Potential effects on sites designated for nature conservation;
- The harm and disturbance, both direct and indirect, to habitats and species arising from the construction, operation and decommissioning of the Proposed Development; and
- The potential legal implications of the above impacts.

14.3.2 Baseline Survey Areas

The area within which the desk-based research and field surveys were undertaken varies depending on the ecological feature and its search/survey requirements. Details of the extent of each ESA are described in the relevant 'Baseline Conditions' section of this chapter and associated **Appendices 14.1 - 14.3** and illustrated on their respective figures.

14.3.3 Desk Study Assessment Methodology

A desk study was undertaken to collate relevant public domain survey data, scientific publications, grey literature, and to obtain historical records of protected and relevant species of conservation interest and species and habitats protected by Scottish and European legislation from within the Site and surrounding environment.

The Desk Study Area (DSA) comprised of the following areas around the Site:

- A radius of 5km from the Site was searched for internationally designated statutory sites for nature conservation (e.g. SAC or Ramsar sites) and nationally designated statutory sites (e.g. SSSIs);
- A radius of 2km from the Site was searched for non-statutory sites;
- A radius of 2km from the Site was searched for records of notable or protected species;
- A radius of 2km from the Site was searched for records of invasive, non-native species.

The purpose of the desk-based review was to provide background information on the habitats and species potentially present, to help inform and guide the baseline ecological field surveys and to provide context to their results. Combined with the results of the ecological field surveys, this information has been utilised to provide a comprehensive ecological baseline on which to base the EcIA.

14.3.4 Statutory & Non-Statutory Designated Sites

A search was conducted for the presence of any designated sites with ecological qualifying features within 5km of the Proposed Development, using NatureScot's SiteLink[132] website and the Joint Nature Conservation Committee (JNCC) website. This was undertaken to identify and provide information on statutory designated sites of nature conservation, located within 5 km of the Site. These included Special Areas of Conservation (SACs) and Sites of Special Scientific Interest (SSSIs). Non-statutory designated sites included Local Nature Reserves (LNR), Local Wildlife Sites (LWS), Local Biodiversity Sites (LBS), Ancient Woodland Inventory (AWI) and Native Woodland Survey

[132] SiteLink (Accessed 05/01/2024).

Scotland (NWSS). Sites designated solely for ornithological interests and of relevance to the Proposed Development are considered separately in **Chapter 15: Ornithology**.

14.3.5 Protected Species and Habitats

Records of UK protected mammal species, invertebrates, birds, habitats and plant species within 2km of the proposed Planning Application Boundary were considered via biological records from The North East Scotland Biological Records Centre (NESBReC)[133]. Further data searches were undertaken to include 2km beyond the boundary of the Site survey area.

14.3.6 Field Survey Methodology

Detailed field survey methodologies and results are included within **Appendices 14.1 - 14.3**. The following section summarises the baseline methods and results, as identified during these surveys.

14.3.6.1 Habitats and Botanical Surveys

Habitat surveys for the Proposed Development followed the National Vegetation Classification (NVC) scheme (Rodwell et al., 1991-2000[134]) using standard methods (Rodwell, 2006[135]). Surveys were undertaken within the ESA as detailed in **Figures 1** to **Figure 19** in **Appendix 14.1**. The habitat ESA extended up to 250m beyond the wind farm infrastructure and ensured it covered the 100m for the track locations, as a consequence of the requirement to ensure sufficient buffer areas were surveyed to account for the presence of potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs), in line with Scottish Environment Protection Agency (SEPA) guidance[136].

(a) Phase 1 Habitat Classification Surveys

Habitat field surveys were undertaken in May 2023 to January 2024. The habitat survey centred on the Phase 1 habitat survey approach (Joint Nature Conservation Committee 2010). This involves the following elements.

- Habitat mapping using a set of standard colour codes to indicate habitat types on a Phase 1 Habitat map.
- Description of features of possible ecological or nature conservation interest in notes relating to numbered locations on the Phase 1 Habitat map, called 'target notes'.

Phase 1 habitat survey methods are described in Joint Nature Conservation Committee (JNCC 2010) and target notes are included.

Plant nomenclature in this EIA Report follows Stace (2010) for native and naturalised species of vascular plant. Plant names in the text are given with the common name first, followed by the scientific name in brackets.

The Phase 1 characterisation has been utilised to allow a broader visual representation of the habitats within the study area. The NVC data should be referred to for further detail in any specific area.

In addition, the survey aimed to identify wetland habitats in accordance with the habitat's descriptions given in 'A Functional Wetland Typology for Scotland' guidance[137]. Where wetland habitats were identified, further detailed surveys were undertaken for the identification of vegetation communities with potential groundwater dependency in accordance with SEPA guidance. The full methods are presented in **Appendix 14.1**.

[133] The North East Scotland Biological Records Centre https://nesbrec.org.uk/ (Accessed 05/01/2024).
[134] Rodwell, J. S (ed.) (1991 et seq.). British Plant Communities. Vol 1–5. Cambridge University Press
[135] National Vegetation Classification: Users' handbook (Accessed 05/01/2024).
[136] SEPA Guidance Note 4 (Accessed 05/01/2024).

[137] SNIFFER (2009) WFD95: A Functional Wetland Typology for Scotland – Field Survey Manual. Version 1

In addition to habitat characterisation, any signs of protected mammal species and potential bat roosts, as well as an assessment of habitat suitability for other protected species (including herptiles) were recorded. Additional records included details of vegetation and habitats of conservation interest if present.

Mapping was subsequently undertaken by use of Geographic Information Systems (GIS) software.

(b) National Vegetation Classification Survey

A National Vegetation Classification (NVC) survey was undertaken on all wetlands and habitats of conservation value. The NVC survey involved mapping distinct areas of homogenous vegetation and recording detailed descriptions of the vegetation communities, with reference to published community descriptions [138][139]. The NVC data was cross-referenced to the Phase 1 Classification system to provide a broader characterisation of habitats. The full methods are presented in **Appendix 14.1**.

14.3.6.2 Protected Species Survey

Protected Species Surveys were undertaken in 2023 (**Appendix 14.2 and 14.3**) and encompassed all land within the Site in line with NatureScot guidance[140].

During the protected mammal surveys the following species were specifically targeted, with species-specific buffers included for the surveys, according to survey guidelines and best practise and termed ESA:

- Badger (*Meles meles*): Suitable habitats within the Site and extending up to 100m from the Site[141].
- Otter (*Lutra lutra*): Suitable habitats to be surveyed within the Site, extending up to 200m of suitable habitats potentially impacted by the Proposed Development[142][143][144].
- Water Vole (*Arvicola amphibious*): The survey area included all suitable habitat within the Site, and within a 200m buffer to be surveyed where possible (access permitting) and extending up to 50m up and downstream of any watercourses or ditch systems potentially impacted by the Proposed Development[145][146].
- Red Squirrel (Sciurus vulgaris): Suitable habitats to be surveyed within the Site, involving visual surveys and transects, with distances as per Gurnell, J. and P.W.W. Lurz (2012, page 9)[147].
- Brown Hare (*Lepus europaeus*): Suitable habitats within the Site and extending up to 200m from the Site, following methodology set out in Cresswell et al. (2012)[148].
- Pine Marten: Suitable habitats within the Site and extending up to 100m from Site.
- Reptiles & Amphibians: No specific surveys undertaken, records obtained when on Site during other survey work.
- Further species included watching brief surveys of Deer.

[138] Averis et al., (2014) An Illustrated Guide to British Upland Vegetation. Joint Nature Conservation Committee. Peterborough
[139] Elkington, T., Dayton, N., Jackson, D. L. and Strachan, I. M. (2001). National Vegetation Classification: Field Guide to Mires and Heaths. Joins Nature Conservation Committee, Peterborough
[140] Planning and development: protected species (Accessed 05/01/2024).
[141] Scotland's Wildlife: Badgers and Development (Accessed 05/01/2024).
[142] Chanin (2003a) Monitoring the Otter (Lutra lutra). Conserving Natura 2000 Rivers: Monitoring Series No. 10. English Nature, Peterborough
[143] Chanin (2003b) Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough
[144] Protected Species Advice for Developers: Otter (Accessed 05/01/2024).
[145] Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). Eds Fiona Mathews and Paul Chanin. The Mammal Society, London
[146] Strachan, R., Moorhouse, T. & Gelling, M. (2011). The Water Vole Conservation Handbook. Third Edition. Wildlife Conservation Research Unit, University of Oxford, Abingdon
[147] Gurnell, J. and P.W.W. Lurz (2012, page 9) Red Squirrel. In: Cresswell, W.J., Birks, J.D.S., Dean, M., Pacheco, M., Trewhella, W.J., Wells, D. and Wray, S. (2012). UK BAP Mammals: Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation. The Mammal Society, Southampton.
[148] Wheeler, P., Wray, S. and Yalden, D. (2012) Brown Hare and Mountain Hare. In: Cresswell, W.J., Birks, J.D.S., Dean, M., Pacheco, M., Trewhella, W.J., Wells, D. and Wray, S. (2012). UK BAP Mammals: Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation. The Mammal Society, Southampton.

Any evidence of the presence of protected mammals was recorded onto 1:10,000 scale survey maps in the field. The location of all signs was recorded using a handheld GPS unit and photographs were taken to visually catalogue each record.

(a) Badger Surveys

The surveys consisted of a walkover of the Site and a 100m buffer (access permitting) to visually inspect and assess the Site for its potential to support badgers. All potential access routes were surveyed and, where possible, within dense plantations. Badger surveys were undertaken according to recommended guidelines (full details are provided in Appendix 14.2).

(b) Otter Surveys

The surveys consisted of walkovers of the Site and a 200m buffer to visually inspect and assess the Site for its potential to support otters. Otter surveys were undertaken according to recommended guidelines. All suitable watercourses and waterbodies located within the Site, and where accessible (access permitting), within the ESA buffer of the Site were surveyed (full details are provided in Appendix 14.2).

(c) Water Vole Surveys

The surveys consisted of walkovers of the Site and a 200m buffer to visually inspect and assess the Site for its potential to support water vole. Water vole surveys were undertaken according to recommended guidelines. The survey area included all suitable habitat within the ESA buffer which was surveyed where possible (access permitting). This extended up to 50m up and downstream of any watercourse or ditch system potentially impacted by the Proposed Development (full details are provided in Appendix 14.2).

(d) Red Squirrel Surveys

An initial assessment was undertaken to identify suitable habitat and the presence of red squirrel on site. The methodology included identifying field signs, as follows;

- Dreys that are constructed of compacted twigs in a tree fork, are spherical (approx. 30cm in diameter). They are usually located above 6m and exceptionally below 3m, are close to the main trunk of a conifer and are lined with soft hair, moss, and dried grass.
- Identification of feeding remains, such as, stripped cores and scattered scales of cones, hazel shells split neatly in two with a small chip at the apex, husks of acorns.
- Bark stripping and footprints which are only visible in soft ground or snow. They have a distinctive pattern of smaller fore prints (4 toes) behind larger hind prints (5 toes) and are approximately 60mm or smaller in diameter. (full details are provided in Appendix 14.2).

(e) Brown Hare

A survey, following methodology set out in Cresswell et al. (2012)[149], of all areas within the Site, and extending up to 200m from the Site, including vegetated boundaries and fence lines was undertaken to make direct observations of hare activity and to search for the field evidence of hare including:

- Forms (resting places);
- Foraging evidence (often distinctive from rabbit and vole);
- Hare droppings (generally larger and longer than that of rabbit); and

[149] Wheeler, P., Wray, S. and Yalden, D. (2012) Brown Hare and Mountain Hare. In: Cresswell, W.J., Birks, J.D.S., Dean, M., Pacheco, M., Trewhella, W.J., Wells, D. and Wray, S. (2012). UK BAP Mammals: Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation. The Mammal Society, Southampton.

- Multiple transects, all of approximately 300-350m apart (searching within 5m either side of the transect). Each taking from approximately 60 to 120 minutes to complete over varied ground and terrain. (full details are provided in Appendix 14.2).

(f) Pine Marten

The survey included a systematic search for signs of pine marten presence and potential den sites within 100m of the Site (where accessible) and determining habitat suitability for pine marten, following methodology set out in Cresswell et al. (2012).

(g) Bat Surveys

Bat surveys were undertaken with reference to NatureScot guidelines for 'Bats and onshore wind turbines - survey, assessment and mitigation' (updates noted in August 2021[150]), between April and September 2023 (the Survey Season). This survey work was undertaken by GLM Ecology. The bat roost suitability on Site was determined to be negligible over the modified grassland fields and in the conifer plantations. The habitat on site, which is mainly an open arable farmland of modified grassland, with small conifer plantations to the west, was quantified mainly as low-quality foraging habitat. The initial risk assessment for the Site was of low risk to bats. This was established with consideration of the site risk assessment criteria as presented within NatureScot survey guidelines[151] (full details are provided in Appendix 14.3).

(h) Other Field Observations

Records of all and other species (such as, reptiles, amphibians and deer), if observed during all survey times and site walkovers, were noted (full details are provided in Appendix 14.2).

14.3.7 Methodology for the Assessment of Effects

The approach taken to impact assessment follows the CIEEM guidance for EcIA[152], which sets out the process for assessment broadly through the following stages:

- Determining importance of baseline ecological features, including identification of Important Ecological Features (IEFs);
- Identification, assessment and characterisation of ecological effects;
- Incorporation of measures to mitigate identified effects;
- Assessment of significance of residual effects following mitigation;
- Identification of appropriate compensation to offset significant residual effects; and
- Identification of opportunities for ecological enhancement.

14.3.7.1 Determining Important Ecological Receptors (IEFs)

One of the key challenges in EcIA is to decide which ecological features are important and should be subject to detailed assessment. Such ecological features will be those that are considered to be most important and potentially affected by the project. In EcIA, 'importance' of an ecological feature is synonymous with 'sensitivity' and is defined within a geographical context. Some examples of the criteria used to determine importance are defined in Table 14.2.

[150] Bats and onshore wind turbines - survey, assessment and mitigation (Accessed 05/01/2024).
[151] Bats and onshore wind turbines - survey, assessment and mitigation , NatureScot 2021 see Table 3a: Stage 1 - Initial site risk assessment (Accessed 05/01/2024).
[152] CIEEM (2018; Version 1.1 - Updated September 2019). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 3rd edition. Chartered Institute of Ecology and Environmental Management, Winchester

Designations are normally indicative of an importance level; for example, a SAC designated under the Habitats Directive is explicitly of European (International) importance. Where a site is offered more than one designation, it is the one of higher level (within the geographic frame of reference) considered of overriding importance. Ecological features of interest should be valued accordingly, with ecological features unrelated to the site designation assessed and evaluated according to their intrinsic importance.

Upon the identification of the potential direct and indirect effects from the Proposed Development, it was necessary to undertake a systematic assessment of importance to determine the Important Ecological Features (IEFs). IEFs are ecological features that could be 'significantly' affected by the Proposed Development, both negatively and positively.

In this EcIA, only ecological features with regional importance and above (as defined in Table 14.2 below) were considered sufficiently important to be determined as IEFs, and in accordance with CIEEM guidance, only these IEFs required assessment for potential significant effects.

Table 14.2 - Geographical context of Important Ecological Features and their evaluation.

Level of Importance of Receptor/Sensitivity	Qualifying Criteria
International **(e.g. Europe)** **Very High Importance**	The Ecological Survey Area (ESA) is considered of international ecological value when it supports: • An internationally designated site or candidate site (SPA, pSPA, SAC, cSAC, pSAC, Ramsar site, Biosphere Reserve or an area which NatureScot has determined meets the published selection criteria for such designations, irrespective of whether or not it has yet been notified. • A viable area of a habitat type listed in Annex 1 of the Habitats Directive, or smaller areas of such habitat which are essential to maintain the viability of that ecological resource on an international scale. • >1% of the European resource of an internationally important species, i.e. those listed in Annex 1, 2 or 4 of the Habitats Directive.
UK/National **(i.e. Scotland)** **High Importance**	An ESA is considered of National ecological value when it supports: • A nationally designated site (SSSI, NNR) or a discrete area which NatureScot has determined meets the published selection criteria for national designation irrespective of whether or not it has yet been notified. • A viable area of a priority habitat identified in the UK Biodiversity Action Plan (BAP), or smaller areas of such habitat which are essential to maintain the viability of that ecological resource at a national scale. • >1% of the National Resource of a regularly occurring population of a nationally important species, i.e. a priority species listed in the UK BAP and/or Schedules 1, 5 (S9 (1, 4a, 4b)) or 8 of the Wildlife and Countryside Act.
County **Medium Sensitivity**	An ESA is considered of County ecological value when it supports: • County sites and other sites which the designating authority has determined meet the published ecological selection criteria for designation, e.g. Local Nature Reserves. • Viable areas of legally protected habitat/habitat identified in Council BAP or smaller areas of such habitats that are essential to maintaining the viability of the resource at a county scale. • Any regularly occurring population of an internationally/nationally important species or a species in a relevant UK/Council BAP which is important for the maintenance of the regional meta-population. • Semi-natural ancient woodland greater than 0.25ha.

Level of Importance of Receptor/Sensitivity	Qualifying Criteria
	• Networks of species-rich hedgerows.
Local **(e.g. local community council areas, Local Nature Reserves)** **Low Sensitivity**	An ESA is considered of Local ecological value when it supports: • Semi-natural ancient woodland smaller than 0.25ha. • Commonplace and widespread semi-natural habitats, e.g. scrub, poor semi-improved grassland, coniferous plantation woodland, intensive arable farmland etc. which, despite their ubiquity, contribute to the ecological function of the local area (habitat networks etc.); • Very small, but viable, populations of internationally/nationally important species or a species in a relevant UK/Council BAP which is important for the maintenance of the local meta-population. • Networks of linear features, including species-poor hedgerows
Less than Local Importance **(Site Wide)** **Negligible Sensitivity**	A Site Wide area is considered of site ecological value when it supports: • Habitats of limited ecological value, e.g. amenity grassland, but which contribute to the overall function of the application site's ecological function.

Habitats and species of nature conservation importance are identified through policies and legislation. For example, habitats and species of international importance are listed on Annex I of the Habitats Directive. Where these are considered of principal importance for biodiversity in Scotland, these features are also listed in the Nature Conservation (Scotland) Act. Other features of importance may be listed on the Scottish Biodiversity List, or as LBAP priorities. These elements provided a crucial starting point for the identification of IEFs requiring consideration in EcIA; however, they did not solely determine the level of importance assigned, (with the exception of Internationally designated Natura 2000 sites).

Application of professional judgement was applied to determine the level of importance and to identify IEFs (ecologically coherent population/habitat network) against which likely significant effects can be assessed (refer to the 'Determining Significance of Potential Ecological Effects' section below).

When determining the importance in the context of EcIA, contextual information regarding the value of the site to the species as well as the distribution and abundance of a given species was considered. For example, an uncommon species is recorded, but it is known to be widespread and common locally, and its range is regionally and nationally stable (regional importance as per. Table 14.2), but habitats on Site are of low value to the species, the local population may be determined to be of local importance, or potentially less than local.

Alternatively, a population of an uncommon species is improving regionally and nationally (local importance as per Table 14.2), but habitats on Site are of high value and relatively rare regionally, the species is likely to constitute a notable proportion of a regional population, and therefore the local population may be considered to be of at least regional importance.

Additionally, in accordance with CIEEM guidance, where a legally protected species was present within the Zone of Influence and there is potential for a breach of legislation, such species was considered to be an IEF. When valuing ecological receptors, professional judgement must be made on the basis of an objective assessment of the best information available: in circumstances of reasonable doubt, a precautionary approach has been adopted.

14.3.7.2 Characterising Potential Impacts on Receptors

In line with the CIEEM EcIA guidance, where possible, consideration is given to the following characteristics when identifying potential effects of the Proposed Development on IEFs:

- Nature of impact: whether it is positive (beneficial) to IEFs, e.g. by increasing species diversity or extending habitat, or negative (detrimental), e.g. by loss of, or displacement from, suitable habitat;
- Extent: the spatial or geographical area over which the impact may occur;
- Duration: the duration of an effect as defined in relation to ornithological characteristics (such as a species' life cycle) as well as human timeframes. It should also be noted that the duration of an activity may differ from the duration of the resulting impact, e.g. if short-term construction activities cause disturbance to breeding birds, there may be long-term implications from failure to reproduce that season;
- Frequency: the number of times an activity occurs may influence the resulting impact; and
- Timing: this may result in an impact on an ecological feature if it coincides with critical life stages or seasons.

When characterising ecological impacts, it is essential to consider the likelihood that a change/activity will occur as predicted, with a degree of confidence in the impact assessment (in relation to the impact on ecological structure and function). Where possible, the degree of confidence should be predicted quantitatively. Where this is not possible, a more qualitative approach is taken; particularly where the confidence level can only be based on expert judgement. Within this EcIA, the confidence in the assessment when predicting impacts to ecological receptors are as follows:

- Certain/near certain: probability estimated at 95% chance or higher;
- Probable: probability estimated above 50% but below 95%;
- Unlikely: probability estimated at above 5% but less than 50%; and
- Extremely unlikely: probability estimated at less than 5%.

14.3.7.3 Determining Magnitude of Impact

The magnitude of potential impacts will be identified through consideration of the above impact characteristics, to determine the degree of change to baseline conditions predicted as a result of the Proposed Development. The criteria used in the EcIA for assessing the magnitude of an impact are summarised in Table 14.3.

Table 14.3 - Framework for determining magnitude of impact

Magnitude of Impact	Definition
High/Substantial	A fundamental change to the baseline condition of the asset, leading to total loss or major alteration of character.
Medium	A material, partial loss or alteration of character.
Low	A slight, detectable, alteration of the baseline condition of the asset.
Negligible/No change	A barely distinguishable change from baseline conditions.

14.3.7.4 Determining Significance of Effect

Significance is a concept related to the weight that should be attached to effects when decisions are made. A significant effect is simply an effect that is sufficiently important to require that the decision maker is adequately

informed of the environmental consequences of permitting a project. A significant effect does not necessarily equate to an effect so severe that consent for the project should be refused planning permission.

To determine significance in other chapters within this EIA Report a matrix approach has been used. This is widely used in EIA to provide consistency across all the topics and clarity to decision makers. However, in accordance with CIEEM guidelines (CIEEM, 2018), a matrix system has not been employed for the determination of effect significance, as this method often places adverse impacts to IEFs of local importance into a 'low significance' category, misleadingly downplaying local values of biodiversity.

For the purposes of the EcIA, the significance of effect was defined as an effect that either supports or undermines biodiversity conservation objectives for IEFs, or for biodiversity in general. Conservation objectives may be specific, broad or wide-ranging; therefore, effects can be considered as significant at a wide range of geographic scales.

For defined sites or ecosystems, significant effects encompass impacts on the structure and function of such systems. For designated sites, it is necessary to assess whether or not an impact will affect the integrity of a site or ecosystem (and is therefore significant). This is achieved through understanding whether the changes arising from the Proposed Development are likely to move the baseline conditions closer to, or further from, the condition which constitutes integrity for that specific system.

For habitats and species, consideration of conservation status is required to determine whether or not an effect on a habitat or species is likely to be significant. For habitats, conservation status is determined by the sum of influences acting on the habitat that may affect its extent, structure and functions, in addition to its distribution and typical species composition within a given geographical area. For species, conservation status is determined by the sum of influences acting on the species concerned, which may affect its abundance and distribution within a given geographical area. When assessing likely significant effects on conservation status, the known or likely background trends and variations in status are considered. Estimation is also given to the level of ecological resilience or conditions that would allow the population of a species or area of habitat to continue to exist at a given level, such as to increase along an existing trend or to reduce a decreasing trend.

The mitigation hierarchy should be applied to significant impacts on IEFs, in line with guidance derived from policies relevant to the geographic scale of the IEF importance (as per policies outlined above). Any remaining significant impacts following the application of mitigation (i.e. residual impacts), together with an assessment of the likelihood of mitigation success, should be considered against relevant legislation, policy, and development control.

Where identified, the significant effects should be qualified with reference to an appropriate geographic scale. It is important to note that the geographic scale of the significant effect, may not be the same as the geographic scale in which the feature is considered important. This enables consistency in scale when determining appropriate mitigation or compensation solutions.

Significance of the likely effects on each identified IEF is determined through professional judgement, by considering both the nature conservation importance of each feature and the degree to which it may be affected (the impact magnitude) by the Proposed Development.

14.3.7.5 Cumulative Effects

Cumulative effects can result from individually insignificant, but collectively significant actions, taking place over a period of time or concentrated in a location. Within EcIA, cumulative effects are particularly important as many ecological features are exposed to background levels of threat or pressure and may be close to reaching critical thresholds where further impact could cause irreversible decline. It is recognised that different actions can cause cumulative effects as follows:

- Additive/incremental effects: multiple activities/projects may give rise to a significant effect due to their proximity in time and space. These may be additive or synergistic effects; and
- Ancillary: ancillary developments may include different aspects of the project which may be authorised under different consent processes, these will be included as part of the cumulative assessment.

14.3.7.6 Requirements for Mitigation

Best practice guidance e.g. CIEEM (2018[153]; 2019[154], 2021[155]) identifies a hierarchy of mitigation for potential impacts that seeks to:

- Avoid adverse ecological impacts, especially those that could be significant to important receptors;
- Minimise adverse impacts that could not be avoided; and
- Compensate for any remaining significant residual impacts.

Embedded mitigation is that considered in the design layout for the Proposed Development. Where likely significant adverse effects are predicted regardless of design layout, further mitigation is separately identified as per CIEEM guidance.

14.3.7.7 Residual Effects

Following the assessment of likely significant effects, including incorporation of embedded mitigation, all attempts will be made to avoid and mitigate significant effects. Where significant effects are predicted, further specific, applied mitigation is detailed. Follow the application of this mitigation, an assessment of residual effects will be undertaken to determine the final significance of effects. Where residual effects remain significant or require application of compensatory measures, these will be considered against the relevant policy and legal objectives to determine the outcome of the application.

14.3.7.8 Embedded Mitigation & Good Practice

Application of the 'mitigation hierarchy' has been achieved throughout the Proposed Development design process, with the identification and incorporation of methods for the avoidance of impacts and application of embedded mitigation. Measures to avoid or reduce potential ecological effects has been incorporated into the design of the Proposed Development ('embedded mitigation'). This includes 'mitigation by design' whereby aspects of the Proposed Development have been re-designed to avoid or reduce ecological effects. This type of mitigation is particularly beneficial for ecological resources as there is greater certainty that it will be delivered (CIEEM, 2018; 2019).

Mitigation by 'good practice' is the active implementation of widely used good practice measures during the Proposed Development process. Although not 'embedded mitigation' by definition, mitigation by good practice forms an integral part of the development process.

As mitigation is only applied to prevent, reduce, or offset any specific significant adverse effects on IEFs, mitigation by good practice is introduced to ensure the safeguarding or the wider natural environment, including features that may have not been included in the EIA process, either as they were absent, and/or not considered of sufficiently important at the time.

[153] CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. CIEEM, Winchester.
[154] Biodiversity Net Gain: Good practice principles for development. A Practical Guide (Accessed 05/01/2024).
[155] https://cieem.net/resource/good-practice-guidance-for-habitats-and-species/

Embedded mitigation, including the implementation of good practice, is taken into consideration when undertaking the assessment of significant effects. If significant effects are predicted further mitigation is required to be detailed.

Part of a new access track is proposed to traverse through S28 swamp habitat and embedded mitigation is required to include reduction of impact on habitat loss, water flow control and pollution control measures.

14.3.7.9 Mitigation by Design

Ecological features have been considered at all stages of the Proposed Development design, from initial feasibility to final layout. This has helped to avoid or greatly reduce impacts on IEFs and other ecological features.

The sensitive designs (e.g. of watercourse crossing and culverts) presented in Chapter 3 - Project Description of this EIA Report have been developed to safeguard the water environment and will also help effectively mitigate construction-related direct and indirect impacts to aquatic features.

Good practice design mitigation measures will be adopted to minimise the risk of bats colliding with operational turbines, in accordance with NatureScot published guidance.

14.3.7.10 Mitigation by Good Practice:

(a) Construction

In addition to the incorporation of effective mitigation through the Proposed Development design, the following sections outline mitigation of the Proposed Development impacts through practice, particularly with the aim of safeguarding of protected species during the Proposed Development construction and operation. It is anticipated that these elements will be included in a Species Protection Plans (SPPs), as part of the wider environmental management of the Proposed Development construction and operation, in accordance with NatureScot guidance[156].

(b) Ecological Clerk of Works

A suitably qualified and experienced Ecological Clerk of Works (ECoW) will be appointed to provide ecological and environmental advice during construction, including the monitoring of compliance with the recommendations of this EIA Report and subsequent planning conditions. Before construction begins, the ECoW and the project hydrologist will undertake a review of design and drainage plans to inform the requirement for micro-siting, to minimise the potential for effects to habitats of conservation concern. Where possible, the ECoW will advise on the drainage design to minimise hydrological disruption and reduce the risk of scour and erosion. The ECoW will also monitor and advise on the implementation of pollution prevention and good working practices throughout construction, to protect both terrestrial and aquatic ecosystems from accidental pollution.

(c) Construction Phase Mitigation

Pre-construction surveys for protected species, such as otter, pine marten, water vole and reptiles (e.g. common lizard) will be undertaken to provide up-to-date information about the distribution and abundance of the protected species. The results of the surveys will inform the need for and scope of Species Protection Plans and associated mitigation and licencing requirements, all of which will be developed in line with NatureScot guidance.

[156] Planning for development: what to consider and include in habitat management plans (Accessed 05/01/2024).

(d) Construction Phase Mitigation for GWDTEs

Good practice design and construction and measures that will be outlined in the Construction Environmental Management Plan (CEMP) will minimise potential indirect effects of the Proposed Development on any GWDTEs during construction phase. The CEMP will be provided prior to constructional work commencing.

Further information on the embedded hydrological migration measures are detailed in **Chapter 8 – Hydrology & Hydrogeology**.

(e) Construction Phase Mitigation for Aquatic Habitats

Mitigation presented within **Chapter 8 – Hydrology & Hydrogeology** of this EIA Report to safeguard the water environment, will effectively mitigate construction-related impacts to any aquatic species, such as the direct and indirect effect of pollution and sedimentation from instream works and surface water run-off. Water quality monitoring is recommended to ensure the safeguarding of the water environment and important aquatic features (see **Chapter 8 – Hydrology & Hydrogeology**).

14.3.7.11 Mitigation by Practice: Operation

To minimise the risk of bats colliding with operational turbines, Natural England good practice guidance [157] (adopted by NatureScot) recommends a minimum 50m stand-off distance between blade tips and high value bat habitat (see **Section 14.3.7.9: Mitigation by Design above**).

14.3.7.12 Mitigation by Practice: Decommissioning

Decommissioning activities are anticipated to be of a similar character to those of the Proposed Development construction and so the construction phase embedded mitigation outlined above is considered appropriate to the decommissioning phase.

14.3.7.13 Compensation

Where there are significant residual adverse ecological effects despite the mitigation proposed, these should, under EcIA guidelines (CIEEM, 2018; 2019), be offset by appropriate compensatory measures.

14.3.7.14 Biodiversity Enhancement

There is a growing body of policy and guidance that ensures development plans should not just aim to avoid causing likely significant effects. Measures required to protect a diverse range of species and habitats are set out in the document 'Scotland's Biodiversity: It's in Your Hands - A strategy for the conservation and enhancement of biodiversity in Scotland' (Scottish Executive, 2004). Biodiversity Targets are outlined in the 'Strategic Plan for Biodiversity 2011-2020' (Scottish Government, 2013). The two documents together comprise the Scottish Biodiversity Strategy.

Securing positive effects for biodiversity is one of six statutory outcomes for the National Planning Framework introduced by the Planning (Scotland) Act 2019. Improving biodiversity is a cross-cutting theme which runs throughout the NPF4 (for example within Policy 5: Soil). NPF4 Policy 3 plays a critical role in ensuring that development will secure positive effects for biodiversity.

Based on the published report 'Research into Approaches to Measuring Biodiversity in Scotland', (September 2023) it is considered that the Natural England Biodiversity Metric can be adapted for planning and development use in Scotland. According to the recently published Scottish Government Draft Planning Guidance: Biodiversity (November 2023) NatureScot will develop an adapted biodiversity metric suitable for use in supporting the

[157] Mitchell-Jones, T, Carlin, C (2014) Natural England Technical Information Note TIN051 - Bats and onshore wind turbines Interim guidance (3rd Edition), Natural England 2014, ISBN 978-1-78354-095-2

delivery of NPF4 policy 3b. Biodiversity Net Gain is an evolving discipline within Scotland. NatureScot's 'Developing with Nature' guidance includes examples of widely applicable measures which can contribute to the overall enhancement of biodiversity.

Where there are significant residual adverse ecological effects despite the mitigation proposed, these should, under EcIA guidelines (CIEEM, 2018; 2019), be offset by appropriate compensatory measures.

14.3.7.15 Biodiversity Enhancement and Habitat Management Plan

The Applicant has committed to the provision of a Habitat Management and Monitoring Plan (HMMP) to reduce adverse environmental effects and to provide significant enhancements for important ecological features and biodiversity enhancement at the Proposed Development, and as a requirement in line with Policy 3 of National Planning Framework 4. Biodiversity Net Gain is an evolving discipline within Scotland.

Biodiversity enhancements must be identified in proportion to the opportunities on site, scale of the development and informed by the ecological baseline survey. Biodiversity enhancements will be delivered within the Land Ownership Boundary and the ESA as surveyed in Appendix 14.1.

The assessment of the biodiversity baseline investigates distinctive habitat types such as terrestrial habitats, linear features (hedgerows), and watercourses. The proposal for enhancement has therefore included defined objectives according to two of the habitat types located within the Proposed Development ESA and include Terrestrial Habitats and Watercourse Habitats.

(a) Enhancement of Watercourse Habitats

Objective 1: Management of Bank Side Vegetation, via riparian planting in appropriate areas within the Site to deliver benefits to species and macro-invertebrates, including the casting of shade, maintenance of cool water temperatures, provision of cover and sources of food from infalling litter and insects, and to deliver opportunities for other wildlife, including foraging and commuting bats, terrestrial mammals (including otter), birds and reptiles. This objective can be met in sections along the Un-named watercourse, or the small section of the Black Water.

Objective 2: Riparian Planting, to include both continuous and discontinuous shrub and tree-dominated planting of broad-leaved species of local provenance, to provide cover for commuting or mobile species, and potentially rest site opportunities in denser areas of planting. Benefits for other biodiversity including birds, amphibians will benefit bats by potentially increasing food resources.

(a) Enhancement of Terrestrial Habitats

Objective 1: Hedge and tree planting, to include both species-rich hedges and trees (broad-leaved species) planting along the field margins of species of local provenance, in an area noted for biodiversity enhancement in the survey extent. This will provide commuting corridors for badgers and other species, such as birds and bats, and increase insects and nesting potential for birds. It will also provide shelter for other species such as brown hare.

Objective 2: Planting of wildflower edges/corridors along the agricultural field in the east. This will provide bees and other pollinating insects with food, shelter and places to breed. An increase in pollinating insects within a farmland environment assists in the pollination of arable crops.

The appropriateness of any specific measures proposed to achieve the aims and objectives, methods to be used and suitable locations within the Site for implementation, will be determined in consultation with the landowners, NatureScot, Aberdeenshire Council and the Applicant, post-consent. Prescriptive measures will be included in the HMMP to be agreed with NatureScot, Aberdeenshire Council, and additional relevant stakeholders, and to be secured by appropriate planning condition. The success of management prescriptions and habitat creation in achieving the aims and objectives of the HMMP will be monitored, with the results reported to an advisory group,

in accordance with timings and protocols to be agreed with NatureScot and Aberdeenshire Council. The HMMP, once finalised, will be a live document, with the habitat management measures implemented being adaptive throughout the lifetime of the Proposed Development in response to the findings of ongoing monitoring.

Additional biodiversity measures have been included in **Appendix 14.1** and the measures follows the guidance within the Developing with Nature guidance[158] : Guidance on securing positive effects for biodiversity from local development to support NPF4 policy 3c.

14.3.8 Baseline Description

14.3.8.1 Desk Study Results

(a) Statutory & Non-Statutory Designated Sites

There are three statutory designated sites located within 5km of the ESA boundary that have ecological qualifying features (**Table 14.4**).

There are multiple woodlands designated in the Ancient Woodland Inventory, Native Woodland Survey of Scotland (NWSS) within 2km of the Planning Application Boundary **(Table 14.5).** There are conifer plantations listed within the National Forestry Inventory within the 2km buffer that borders the Site to the west.

There are no local biodiversity sites within the 2km buffer of the Site., however there are three Local Biodiversity Sites (LBS) within 5km of the Site and are Rora Moss LBS, Strathbeg to Rattray LBS and Rattray Head to Peterhead LBS.

Table 14.4 - Statutory Designated Sites within 5km of the Site.

Site of Interest	Distance from Site (approx.)	Description/Qualifying Features of Interest only	Condition (at last assessed date)
Sites of Special Scientific Interest			
Rora Moss SSSI[159]	2.3km	Wetlands: Raised bog	Unfavourable No change 21 Jun 2012
Loch of Strathbeg SSSI[160]	3km	*Multiple features: Relevant biological features listed only.*	Loch of Strathbeg SSSI[161]
		Eutrophic loch	Unfavourable No change 20 Aug 2009
		Fen meadow	Favourable Recovered 19 Sept 2013
		Open water transition fen	Unfavourable No change 19 Sept 2013
		Saltmarsh	Favourable Maintained 13 Jun 2011
		Sand dunes	Favourable Maintained

[158] Developing with Nature guidance. https://www.nature.scot/doc/developing-nature-guidance
[159] https://sitelink.nature.scot/site/1371
[160] https://sitelink.nature.scot/site/1040
[161] https://sitelink.nature.scot/site/1040

Site of Interest	Distance from Site (approx.)	Description/Qualifying Features of Interest only	Condition (at last assessed date)
			31 Jul 2013
Kirkhill SSSI[162]	5km	Geological: Quaternary of Scotland	Favourable Maintained 7 Jul 2010
Special Areas of Conservation			
Loch of Strathbeg SPA[163]	3km	Bird assemblage: breeding & non-breeding	Various condition and dates from 2009-2014
RAMSAR			
Loch of Strathbeg RAMSAR[164]	3km	Eutrophic loch	Unfavourable No change 20 Aug 2009

Table 14.5 - Non-Statutory Designated Sites within 2km of the Site.

Site of Interest	Distance from Site (approx.)	Description/Qualifying Features of Interest only
Native Woodland Survey Scotland (main ones listed only)		
Native woodland	1.0km	Young pole immature
	1.3km, 1.7km & 2.0km	Established regenerating
		Established regenerating
Nearly-native woodland	1.8km	Lowland mixed deciduous woodland, shrub
Ancient Woodland Inventory		
Crimond	645m	2b: Long-Established (of plantation origin)
Crimond Belts	1.0km	2b: Long-Established (of plantation origin)
Greenmyre Wood	1.6km	2b: Long-Established (of plantation origin)
Crimond / St. Fergus	1.8km	2b: Long-Established (of plantation origin)

(a) Protected and Notable Species

The biological records obtained via NESBReC of legally protected species are summarised in Table 14.6 (summarised data set).

[162] https://sitelink.nature.scot/site/872
[163] https://sitelink.nature.scot/site/8537
[164] https://sitelink.nature.scot/site/8443

Table 14.6 - Protected Species records within 2 km of the Site.

Taxon group	Scientific Name	Common Name	Key Conservation/Legal Status	Number of records	Last recorded
Amphibian	*Bufo bufo*	Common Toad	WCA5/9.5a, LBAP, UKBAP, SBL, Bern3	3	2015
	Rana temporaria	Common Frog	WCA5/9.5a	1	2021
Reptile	*Zootoca vivipara*	Common Lizard	WCA5/9.1k/l, WCA5/9.5a	1	2006
	Vipera berus	Adder	WCA5/9.1k/l, WCA5/9.5a	1	1992
Terrestrial mammal	*Lepus europpaeus*	Brown Hare	HabRegs4, SBL, LBAP, UKBAP	15	2022
	Meles meles	Eurasian Badger	PBA	7	2015
	Lutra lutra	Eurasian Otter	HabRegs2, WCA5/9.4b, WCA5/9.4c, WCA5/9.5a, SBL, LBAP, UKBAP	6	2021
	Erinaceus europaeus	West European Hedgehog	HabRegs2, WCA5/9.4b, WCA5/9.4c, WCA5/9.5a, LBAP, SBL	4	2022
	Martes martes	Pine Marten	WCA5/9.5a, SBL, LBAP, UKBAP	3	2022
	Arvicola amphibius	European Water Vole	WCA5/9.4.a, WCA5/9.4b, WCA5/9.4c, SBL, LBAP, UKBAP	1	2008
Plants	*Hyacinthoides non-scripta*	Bluebell	WCA8, LBAP	3	2019

Table Key	
LBAP (AYR-LBAP, DGLBAP09)	Local Biodiversity Action Plan
HabRegs	The Conservation (Natural Habitats, &c.) Regulations 1994 (HabRegs2, 4, 5)
WCA	Wildlife and Countryside Act 1981
Bern 1, 2 or 3	Bern Convention Appendix 1, 2 or 3
CMS_EUROBATS-A1	Convention on Migratory Species - EUROBATS Annex 1
SBL	Scottish Biodiversity List
UKBAP	UK Biodiversity Action Plan priority species
PBA	Protection of Badgers Act 1992
RLGB	GB Red LIst
VU, EN, Lr(NT), CR, DD	Vulnerable, Endangered, Lower Risk (Near Threatened), Critically Endangered, IUCN (1994) - Data Deficient

14.3.8.2 Baseline Field Survey Results

(a) Phase 1 Classification Overview

A total of seventeen Phase One habitats were recorded within the survey area. The habitats found within the ESA of the Proposed Development site were mainly dominated by modified grassland, conifer plantation, mire and swamp, ponds, running water, ditch systems and low species diversity hedges.

The Phase 1 habitat types recorded within the ESA are listed in Table 14.7.

A Phase 1 map is provided in Appendix 14.1 - Figure 5.

Table 14.7 - The Phase 1 Habitat Classifications within the ESA of the Proposed Development.

Phase 1 code	Description
A1.1.2	Broadleaved woodland - plantation
A1.2.2	Coniferous woodland - plantation
A1.3.2	Mixed woodland - plantation
A2.2	Scrub -scattered
A3.1	Broadleaved scattered trees
B2.2	Neutral grassland - semi-improved
B4	Improved grassland
B5	Marsh/marshy grassland
F1	Swamp
G1	Standing water
G2	Running water & ditch systems
I2.4	Refuse tip and stone pile
J1.1	Cultivated land - arable
J2.1.2	Intact hedge – species poor
J2.2.2	Defunct hedge – species poor
J2.3.2	Hedge with trees – species poor
J3.6	Buildings

(a) Calculated Phase 1 Area

The area and percentage of habitat, within the Ecological Survey Area, was calculated and is provided in **Table 14.8**. The habitat area calculations are rounded up (to the second decimal point), and with overlapping of habitats, mosaics and the three-dimensional nature of habitats, the areas given are approximations. Habitat area calculations are based on the total area of land within the Habitat Survey Area as 89.16ha.

Table 14.8 - Summary of calculated areas of Phase 1 habitat types within the ESA.

Phase 1 habitat type	Area (ha)	% of Habitat in main Study Area
Broadleaved woodland - semi-natural	0.93	1.05
Coniferous woodland - plantation	10.08	11.30
Mixed woodland - plantation	0.80	0.90
Scrub -scattered	0.05	0.05
Broadleaved scattered trees	0.69	0.77
Neutral grassland - semi-improved	2.05	2.30
Improved grassland	63.79	71.54
Marsh/marshy grassland	1.25	1.40
Swamp	0.94	1.05
Standing water	0.81	0.90
Refuse tip and stone pile	0.07	0.08
Cultivated land - arable	7.29	8.18
Intact hedge – species poor	0.06	0.07
Hedge with trees – species poor	0.02	0.02
Buildings	0.34	0.38
Total	***89.16***	***100***

(b) NVC Survey Results

A total of four NVC vegetation types, with three non-NVC types, were located in this survey, these National Vegetation Communities are presented in Table 14.9. The full details of the National Vegetation Classification & Habitats Survey are within Appendix 14.1. The habitats that the new access tracks and turbine infrastructure will mainly impact will modified grassland, conifer plantation and a small section of swamp habitat.

Table 14.9 - National Vegetation Classification types recorded within the ESA.

NVC type	Description
MG6	*Lolium perenne-Cynosurus cristatus* grassland
MG10a	*Holcus lanatus-Juncus effusus* rush-pasture, typical sub-community
M27	*Filipendula ulmaria-Angelica sylvestris* mire
S28	*Phalaris arundinacea* tall-herb fen
BP	Non NVC type - Broadleaved Plantation
CP	Non NVC type - Coniferous Plantation
Other	Non-NVC types (watercourses, ditches, ponds, fences, refuse & stone piles and buildings)

(c) GWDTE Assessment Results

Table 14.10 summarises the habitats found in the survey and following the Scottish Environmental Protection Agency Guidance (SEPA, 2017a; 2017b), are classed as Groundwater Dependent Terrestrial Ecosystems (GWDTE).

- MG10 and M27 have moderate groundwater dependency (Class 2 GWDTE).
- S28 have low groundwater dependency (Class 3 GWDTE)

MG10 was located in modified grassland fields utilised for grazing and along the edges of ditches was designated as not being true GWDTE but were formed due to water impediment within the MG6 field and water flow through

from the ditches. M27 formed mainly around one of the ponds in the north section of the ESA and in a waterlogged section of an enclosed field.

A Figure illustrating the potential GWDTE recorded is presented in **Appendix 14.1: Figures 9.** An evaluation of site-specific groundwater dependency is detailed in **Appendix 14.1.**

Table 14.10 - NVC communities and their GWDTE score (1= Strong dependency upon groundwater, 2= likely to be some dependency, 3= slight or no dependency: site fed by other water sources)

NVC Community	GWDTE score (1, 2, or 3)
MG10a *Holcus lanatus-Juncus effusus* rush-pasture, typical sub-community	2*
M27 *Filipendula ulmaria-Angelica sylvestris* mire	2
S28 *Phalaris arundinacea* tall-herb fen	3
MG6 *Lolium perenne-Cynosurus cristatus* grassland	No classification
* GWDTE Score Scotland or may vary for different hydroecological settings. ∞ Country Occurrence: Scotland only – Not in England & Wales *Explanation of GWDTE scores:* *1 – Strong dependency upon groundwater discharge.* *2 – Likely to be some dependency on groundwater discharge.* *3 – Groundwater discharge usually irrelevant: site fed by other water sources.*	

The available water capacity of the soil is listed as 147.78mm to 480.26mm. This is in the low to high-value range, with low values indicative of a water deficiency, and high values indicating a potential water excess.

Soil water holding capacity is a fundamental ecosystem service and the type of soil is related to the ability of water to percolate through the soil and how it is stored and redistributed across flow paths to groundwater and surface water bodies. Consequently, the properties of both terrestrial and freshwater aquatic life depend on the hydrologic processes in soil. This impacts the type of botanical communities found on site, on species dependent on water availability, and on the watercourses on site.

14.3.8.3 Protected Species Survey Results

The Site provides suitable habitat for water vole, brown hare, badger, pine marten and roe reer, and suitable foraging habitat for Bats, albeit to varying degrees. A summary of the results of the protected species field surveys are listed below, with the full Protected Species Survey results in Appendix 14.2 and Appendix 14.3.

(a) Badger

No signs of Badger were confirmed within the ESA. The Site is considered to be sub-optimal in providing shelter and foraging for Badgers. However, there are numerous opportunities for foraging, shelter and commuting in the surrounding habitats[165]. Badgers are most associated with woodland, arable farmland and intensive grassland and they are known to be in the general area.

(b) Otter

The Site is sub-optimal suitable for foraging and commuting for otter. No signs of otter were recorded within the ESA, and they are known to be in the general area.

(c) Water Vole

No signs of water vole were recorded within the ESA, and they are known to be in the general area.

(d) Red Squirrel

No field signs of Red Squirrel or their dreys were recorded within the ESA. The Site does provide limited suitable habitat for Red Squirrel, such as the conifer plantation.

(e) Brown Hare

Brown hare were recorded during the survey period in small numbers both in open field and within plantations. It was noted that brown hares have been recorded within 2km of the site (NESBReC data).

(f) Pine Marten

No signs of Pine Marten were recorded within the ESA.

(g) Roe Deer

Deer prints were evident on wet mammal paths and indicated that the habitat is used by Deer. Small numbers of Roe Deer were noted infrequently (<4). There are no impassable fences in the wider area so the Deer can roam widely and freely.

(h) Reptiles & Amphibians

The habitat present on Site provides good reptile and amphibian habitat (grassland, ponds, wetland habitats, stone refuse piles). Habitats were suitable for amphibians, such as, Common Frog in the wetter areas of vegetation (such as Soft-Rush and Sharp Flowered Rush) and were noted occasionally during surveys.

(i) Bats

A summary of the Bat Survey results is presented below. Full survey results and supporting data are provided in Appendix 14.3.

Two buildings are within 500m of turbine locations. These were surveyed for Potential Roost Features and underwent targeted bat activity surveys. No bat roosts were present.

[165] Rainey, E., Butler, A., Bierman, S., and Roberts, A.M.I. (2009) Scottish Badger Distribution Survey 2006 – 2009: estimating the distribution and density of badger main setts in Scotland. Scottish Badgers and Biomathematics and Statistics Scotland.

Preliminary Roost Assessment of the trees in the commercial conifer plantation, within the planning application footprint, were categorized as having negligible bat roost potential.

One confirmed species of bats were identified from the walked transect survey (common pipistrelle). Two species, common pipistrelle, soprano pipistrelle, were recorded on the static recorders.

There was a very low number of bats recorded over the majority of the Site. Activity was focused on the minor tracks and plantation edges which are used as both commuting pathways and a foraging habitat. Bat activity calculated as a Bat Activity Index (BAI) over the Site was very low at 0.17 overall. In general, weather conditions over the survey sessions for the static recorders were relatively suitable for foraging bats.

Given the low BAI, lack of high-quality foraging areas on site and limited bat roost potential at the Proposed Development Site was classed within the low activity/risk category.

14.3.8.4 Overall Site Assessment

The main habitats of the Proposed Development are as follows;

- The habitat is dominated by modified grassland which is utilised for sheep and cattle grazing (NVC: MG6), with rush grassland, swamp and mire (MG10a, M27 & S28) dispersed throughout.
- Conifer plantations are located to the west of the Site. There are no Ancient Woodland and Native Woodland located within the Site.
- One enclosed grassland field has scattered and dominant areas of *Juncus effusus*. This grades from MG10a to M27 with associated impeded field drainage.
- There is an un-named watercourses within the ESA. The Un-named watercourse has hydrological connectivity with the Black Water to the east off site.
- The Black Water watercourses is located along the existing access track to the Site and within the ESA.
- The Proposed Development is on the following soil types;
  - Class 0: This soil type is mainly mineral soil. Two turbines, associated access tracks are proposed in this section. The vegetation classifications are wet modified grassland and patches of rush and swamp grassland. All are impacted by grazing and drainage.
  - Class 5: Consists of peat soil with no peatland vegetation. The soil information takes precedence over vegetation data and no peatland habitat is recorded. The habitat in this section consists mainly of conifer plantation.
- The NVC classification indicates that these align with mostly low GWDTE classification, with swamp (S28) and mire (M27) that have moderate GWDTE.
- The geology of the Argyll Group is noted as a low productivity aquifer (2C) that is generally of low permeability.
- There are no NVC communities within the ESA that correlates directly with an Annex I type habitat.
- The habitat is suitable to varying degrees for water vole, red squirrel, roe deer, badger, brown hare, pine marten, amphibians and reptiles.
- Mitigation is proposed for protected species such as water vole, badger, otter, pine marten and brown hare, as they may occur within the area.

14.4 Determination of Important Ecological Features

Error! Reference source not found. evaluates the importance of ecological features associated with the Proposed Development, and determines which ecological features, based on both their intrinsic value and their potential to be affected by the project, are considered to be IEFs.

Each ecological feature has been assigned a level of importance in accordance with the geographical scale outlined in Table 14.2. Features of Local or Less than Local importance, and those to which impacts can be categorically ruled out, are scoped out of further assessment. However, if impacts to such features – even if not significant in terms of EcIA – may result in legal offences then suitable safeguards will be presented in Section Error! Reference source not found..

15 Ornithology

15.1 Introduction

This chapter of the EIA Report will consider the likely significant effects associated with ornithology and designated sites as a result of the proposed three turbine Greenside Extension Wind Farm during the construction, operation and decommissioning phases.

Generally, ornithological surveys on and around the Site are required to assess potential effects on birds throughout the year, which could arise due to:

- Potential loss, fragmentation and degradation of bird habitats arising from the construction of turbine bases, crane pads, access tracks, a sub-station and temporary construction compounds and power lines;
- Potential displacement of hunting or migrating birds through avoidance of turbines, work staff and machinery;
- Potential disturbance to birds due to noise from operating turbines;
- Potential disturbance to nesting birds (for example, displacement of birds from breeding habitats) resulting from the construction activities; and
- Potential for birds to collide with turbine blades and power lines.

The assessment has been carried out by GLM Ecology and in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) Code of Professional Conduct[166].

15.1.1 Scope of the Assessment

Likely significant effects associated with ornithology identified during the review of desk-based information and field survey data are assessed, as follows:

- Collision risk mortality from birds colliding with turbine blades;
- Displacement of birds due to proposed turbines and infrastructure; and
- Direct habitat loss to construction of the development.

15.1.2 Assessment Aims

The aims of this ornithological assessment are:

- To assess the potential ornithological constraints to any development on the Site;
- To assess the ornithological value of the Site;
- To carry out appropriate survey work; and
- To recommend further survey work if required.

Important issues that are considered in the overall assessment are:

- If the Proposed Development would have a detrimental impact on bird species included in Annex I of the Council Directive 2009/147/EC on the Conservation of Wild Birds;
- If the Proposed Development would have a detrimental impact on species protected under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended);

[166] CIEEM Code of Professional Conduct (Accessed 04/01/2024)

- Species classed as red listed Birds of Conservation Concern (BoCC);
- If the Proposed Development would have a detrimental impact on bird species on sites designated for ornithological interests within the zone of interest as specified by Nature Scot; and
- If the Proposed Development would give rise to likely significant effects on ornithology receptors.

15.2 Legislation, Policy and Guidance

This report has been undertaken in accordance with the '*Guidelines for Ecological Impact Assessment in the UK*' (Chartered Institute of Ecology and Environmental Management (CIEEM), 2018).

The ornithological baseline surveys have considered the following relevant legislative instruments, planning policies, and guidance:

Table 15.1 - Policy, Legislation & Guidance

Legislation	Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011[167], which transpose the EIA Direction into the Scottish planning system; Directive 2009/147/EC on the Conservation of Wild Birds; The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposes the Habitats Directive into UK law[168]; Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive)[169]; The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017[170]: The Wildlife and Countryside Act 1981 (as amended)[171]; Nature Conservation (Scotland) Act 2004 (as amended)[172]; and The Wildlife and Natural Environment (Scotland) Act 2011[173]
Policy	National Planning Framework 4 (NPF4) (2023)[174]; Aberdeen Council: Local Development Plan 2 (2019); UK Post-2010 Biodiversity Framework (2012)[175]; Scottish Biodiversity Strategy: It's in Your Hands (2004)/2020 Challenge for Scotland's Biodiversity (2013)[176]; Scottish Government (2017). Planning Advice Note 1/2013-Environmental Impact Assessment, Revision 1.0[177]; Planning Advice Note (PAN) 1/2013 – Environmental Impact Assessment (Scottish Government 2013)[178];

[167] Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011. (Accessed 05/01/2024)
[168] The Conservation (Natural Habitats, &c.) Regulations 1994. (Accessed 05/01/2024)
[169] Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive) (Accessed 05/01/2024)
[170] The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (Accessed 05/01/2024)
[171] The Wildlife and Countryside Act 1981 (as amended); UK Government (1981) Wildlife and Countryside Act 1981, Chapter 69. Part 1 (Accessed 05/01/2024)
[172] Nature Conservation (Scotland) Act 2004 (as amended) (Accessed 05/01/2024)
[173] The Wildlife and Natural Environment (Scotland) Act 2011 (Accessed 05/01/2024)
[174] National Planning Framework 4 (Accessed 05/01/2024)
[175] UK Post-2010 Biodiversity Framework (2012) (Accessed 05/01/2024)
[176] Scottish Biodiversity Strategy: It's in Your Hands (2004)/2020 Challenge for Scotland's Biodiversity (2013) (Accessed 05/01/2024)
[177] Scottish Government (2017). Planning Advice Note 1/2013-Environmental Impact Assessment, Revision 1.0 (Accessed 05/01/2024)
[178] Planning Advice Note 1/2013: Environmental Impact Assessment (Scottish Government 2013) (Accessed 05/01/2024)

	Planning Circular 3 2011: The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011; PAN 51: Planning, Environmental Protection and Regulation (revised 2006)[179]; PAN 60: Planning for Natural Heritage (Scottish Government, 2000)[180]; and Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives: Scottish Executive Circular 6/1995 as amended (June 2000)[181].
Guidance	Managing Natura 2000 Sites' (European Communities 2000), which gives guidance on the implementation of the Birds and Habitats Directives; Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater and Coastal (CIEEM 2018); Recommended bird survey methods to inform impact assessment of onshore wind farms (SNH 2010, SNH 2014 and 2017a[182]); Developing field and analytical methods to assess avian collision risk at wind farms (Band et al. 2007); Assessing significance of impacts from onshore windfarms on birds outwith designated areas: version 2 (SNH 2018a); Avoidance rates for the onshore SNH collision risk model (SNH 2017b); Assessing the cumulative impact of onshore wind energy developments (SNH 2018b); Assessing connectivity with Special Protection Areas (SPAs) (SNH 2016a); Environmental Statements and Annexes of Environmentally Sensitive Bird Information Guidance for Developers, Consultants and Consultees. Version 2 (SNH 2016b); Good Practice during Wind Farm Construction (Scottish Renewables et al. 2019) 4th edition; Birds of Conservation Concern (BoCC 5: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man (Eaton et al. 2021); Use of avoidance rates in the SNH wind farm collision risk model (SNH, 2010). Assessing the impact of small-scale wind energy proposals on the natural heritage: Scottish Natural Heritage (2016); Scottish Environment Protection Agency (SEPA) (2017) Guidance Note 4 - Planning guidance on on-shore windfarm developments; Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015). Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746; Gilbert, G., Gibbons, D.W., & Evans, J. (1998) Bird Monitoring Methods: A Manual of Techniques for UK Key Species. The Royal Society for the protection of Birds, Sandy, Bedfordshire, England. The UK Post-2010 Biodiversity Framework (Revised 2018); and The Scottish Biodiversity List (SBL).

[179] PAN 51: Planning, Environmental Protection and Regulation (Accessed 05/01/2024)

[180] PAN 60: Planning for Natural Heritage (Scottish Government, 2000) (Accessed 05/01/2024)

[181] Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives (Accessed 05/01/2024)

[182] Recommended bird survey methods to inform impact assessment of onshore wind farms (Accessed 05/01/2024)

15.3 Zone for Consideration for Ecological Features

The zone of sensitivity for ornithological features varies depending on the nature and behaviour of the species and the type of impact that may affect them. NatureScot guidelines (SNH 2016a) are present to ensure that development proposals do not have a significant impact on the qualifying interests of both International and National Designated Sites within accepted distances from the survey area.

These distances vary according to what protected species are present in the relevant Designated Sites and differ according to the level of protection accorded to a particular species i.e. whether the species is protected at an International, National or Local level. As a general rule in this assessment, the impacts on individual species are considered for the whole of the development area, plus the following distances shown in Table 15.2.

Table 15.2 - Zone of Impact from Planning Application Boundary of ornithological features

Ornithological Feature	Zone of Impact from Planning Application Boundary
International Designated Sites (SPA, SAC, Ramsar)	Within 10km
Nationally Designated Sites (SSSI, National Nature Reserves (NNR))	Within 5km
Locally Designated Sites (Local Nature Reserves (LNR), Wildlife Sites (WS), Sites of Importance for Nature Conservation (SINC's))	Within 1km

15.4 Evaluation Criteria

An initial desk-based search was carried out in September 2022. Designated sites and associated protected species at a local and regional level have been identified through that process. A description of the local area in relation to Designated Sites with ecological interests and the findings of an initial desk-based review of the area are presented in the context of the following sections. The following resources were used:

- RSPB;
- Aberdeenshire Council: Aberdeenshire Council Local Development Action Plan (2023)[183]; specifically, where the qualifying feature is related to birds;
- Aberdeenshire Council: Nature Conservation[184];
- Birds of Scotland (Forrester et al., 2007);
- Scottish Raptor Study Group[185];
- Birds of Conservation Concern (BoCC) 5;
- The Scottish Biodiversity List;
- Relevant ES from nearby consented Wind Farms where data available;
- Records from North East Scotland Biological Records Centre (NESBReC)[186]; and

[183] https://www.aberdeenshire.gov.uk/planning/plans-and-policies/ldp-2023/
[184] https://www.aberdeenshire.gov.uk/environment/natural-heritage/biodiversity/
[185] https://www.scottishraptorstudygroup.org/regional-projects/ (Accessed 05/01/2024)
[186] https://nesbrec.org.uk (Accessed 05/01/2024)

- Commissioned Report No 937 – A Survey of the Feeding Distribution of Geese around the Loch of Strathbeg SNH 2016.

15.5 Scope of Ornithological Assessments

Given the context of the above data, it was considered that the following bird species/groups would be target species:

- Geese, swans and wildfowl, in particular designated species for Loch Strathbeg SPA;
- Annex 1 and Schedule 1 species of raptors and owls; and
- Red listed Birds of Conservation Concern.

Given the evaluation criteria above the surveys undertaken are as follows. It was proposed to carry out surveys for 12 months (1 winter VP season and Breeding Bird Surveys) and then assess the data to determine if another 12 months surveys would be appropriate.

- Winter Vantage Point Surveys, October 2022- March 2023;
- Winter Walkovers; and
- Breeding Bird Surveys;

Table 15.3 - Ecologically designated sites within 10km of the Planning Application Boundary with ornithological interest only.

Designated Site	Distance from Site (approx.)	Description/Qualifying Features of Interest only	Latest Assessed Condition
Loch of Strathbeg RAMSAR[187]	3.5km	Non-Breeding Svalbard Barnacle Goose Whooper Swan Teal Waterfowl Assemblage Breeding Sandwich Tern	 Not Assessed Unfavourable Declining (2014) Favourable Maintained (2014) Not Assessed Favourable Maintained Not Assessed
Loch of Strathbeg SPA[188]	3.5 km	Non-Breeding Pink-footed Goose Greylag Goose Goldeneye Svalbard Barnacle Goose Whooper Swan	 Favourable Maintained (2009 Unfavourable No change (2009) Not Assessed Unfavourable Declining (2014) Favourable Maintained (2014) Favourable Maintained 2009

[187] https://sitelink.nature.scot/site/8443
[188] https://sitelink.nature.scot/site/8537#overview

Designated Site	Distance from Site (approx.)	Description/Qualifying Features of Interest only	Latest Assessed Condition
		Teal Waterfowl Assemblage Breeding Sandwich Tern	Favourable Declining (2014) Unfavourable No change (2013)
Loch of Strathbeg SSSI[189]	3km	Breeding bird assemblage Non-Breeding Goldeneye Greylag Goose Pink-footed Goose	Favourable Maintained 2004 Favourable Declining (2014) Unfavourable No change (2009) Favourable Maintained (2009)

15.6 Methodology for the Assessment of Effects

The approach taken to impact assessment follows the CIEEM guidance for Ecological Impact Assessment (EcIA)[190], which sets out the process for assessment broadly through the following stages:

- Determining the importance of baseline ecological features, including identification of Important Ornithological Features (IOFs);
- Identification, assessment and characterisation of ecological effects on ornithology;
- Incorporation of measures to mitigate identified effects;
- Assessment of significance of any residual effects following mitigation;
- Identification of appropriate compensation to offset significant residual effects; and
- Identification of opportunities for ecological and/or ornithological enhancement.

15.6.1 Determining Important Ornithological Features (IOFs)

One of the key challenges in EcIA is to decide which ornithological features are important and should be subject to detailed assessment. Such ecological features will be those that are considered to be most important and potentially affected by the Proposed Development. In EcIA, 'importance' of an ecological feature is synonymous with 'sensitivity' and is defined within a geographical context. Some examples of the criteria used to determine importance are defined in Table 15.4.

Designations are normally indicative of an importance level. For example, an SPA designated under the Birds Directive is explicitly of European (International) importance. Where a site is offered more than one designation, it is the one of higher level (within the geographic frame of reference) that is of overriding importance.

[189] https://sitelink.nature.scot/site/1040

[190] CIEEM (2018; Version 1.1 - Updated September 2019). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 3rd edition. Chartered Institute of Ecology and Environmental Management, Winchester

Ornithological features of interest should be valued accordingly, with ornithological features unrelated to the site designation assessed and evaluated according to their intrinsic importance.

Upon the identification of the potential direct and indirect effects from the Proposed Development, it was necessary to undertake a systematic assessment of importance to determine the Important Ornithological Features (IOFs). IOFs are ornithological features that could be 'significantly' affected by the Proposed Development, both negatively and positively.

In this EcIA, only ornithological features with regional importance and above (as defined in Table 15.4 below) were considered sufficiently important to be determined as Important Ornithological Features (IOFs), and in accordance with CIEEM guidance, only these IOFs required assessment for likely significant effects.

Habitats and species of nature conservation importance are identified through policies and legislation. For example, habitats and species of international importance are listed on Annex I of the Habitats Directive. Where these are considered of principal importance for biodiversity in Scotland, such features can be designated as forming part of Sites of Special Scientific Interest (SSSI) under the Nature Conservation (Scotland) Act 2004. Other features of importance may be listed on the Scottish Biodiversity List or as LBAP priorities. These elements provided a crucial starting point for the identification of IOFs requiring consideration in EcIA however, they did not solely determine the level of importance assigned, (with the exception of internationally designed Natura 2000 sites).

Application of professional judgement was applied to determine the level of importance and to identify IOFs against which effects on integrity can be assessed (refer to the 'Determining Significance of Potential Ecological Effects' section below).

Table 15.4 - Geographical context of Important Ecological Features and their evaluation

Level of Importance of Receptor/Sensitivity	Qualifying Criteria
International **(e.g. Europe)** **Very High Importance**	A study area is considered of international ecological value when it supports: • An internationally designated site or candidate site (SPA, pSPA, SAC, cSAC, pSAC, Ramsar site, Biosphere Reserve) or an area which NatureScot has determined meets the published selection criteria for such designations, irrespective of whether or not it has yet been notified; • A viable area of a habitat type listed in Annex 1 of the Habitats Directive, or smaller areas of such habitat which are essential to maintain the viability of that ecological resource on an international scale; and • >1% of the European resource of an internationally important species, i.e. those listed in Annex 1, 2 or 4 of the Habitats Directive.
UK/National **(i.e. Scotland)** **High Importance**	A study area is considered of National ecological value when it supports: • A nationally designated site (SSSI, NNR, Marine Nature Reserve) or a discrete area which NatureScot has determined meets the published selection criteria for national designation irrespective of whether or not it has yet been notified; • A viable area of a priority habitat identified in the UK BAP, or smaller areas of such habitat which are essential to maintain the viability of that ecological resource at a national scale; and • >1% of the National Resource of a regularly occurring population of a nationally important species, i.e. a priority species listed in the UK BAP and/or Schedules 1, 5 (S9 (1, 4a, 4b)) or 8 of the Wildlife and Countryside Act.

Level of Importance of Receptor/Sensitivity	Qualifying Criteria
County **Medium Sensitivity**	A study area is considered of County ecological value when it supports: • County sites and other sites which the designating authority has determined meet the published ecological selection criteria for designation, e.g. Local Nature Reserves; • Viable areas of legally protected habitat/habitat identified in Council BAP or smaller areas of such habitats that are essential to maintaining the viability of the resource at a county scale; • Any regularly occurring population of an internationally/nationally important species or a species in a relevant UK/Council BAP which is important for the maintenance of the regional meta-population; • Semi-natural ancient woodland smaller than 0.25ha; and • Networks of species-rich hedgerows.
Local **(e.g. local community council areas, Local Nature Reserves)** **Low Sensitivity**	A study area is considered of Local ecological value when it supports: • Commonplace and widespread semi-natural habitats, e.g. scrub, poor semi-improved grassland, coniferous plantation woodland, intensive arable farmland etc. which, despite their ubiquity, contribute to the ecological function of the local area (habitat networks etc.); • Very small, but viable, populations of internationally/nationally important species or a species in a relevant UK/Council BAP which is important for the maintenance of the local meta-population; and • Networks of linear features, including species-poor hedgerows.
Less than Local Importance **(Site Wide)** **Negligible Sensitivity**	A site wide area is considered of site ecological value when it supports: • Habitats of limited ecological value, e.g. amenity grassland, but which contribute to the overall function of the application site's ecological function.

15.6.2 Characterising Potential Impacts on Receptors

In line with the CIEEM EcIA guidance, where possible, consideration is given to the following characteristics when identifying potential impacts of the Proposed Development on IEFs:

- Nature of impact: whether it is positive (beneficial) to IEFs, e.g. by increasing species diversity or extending habitat, or negative (detrimental), e.g. by loss of, or displacement from, suitable habitat;
- Extent: the spatial or geographical area over which the impact may occur;
- Duration: the duration of an impact as defined in relation to ornithological characteristics (such as a species' life cycle) as well as human timeframes. It should also be noted that the duration of an activity may differ from the duration of the resulting effect; e.g. if short-term construction activities cause disturbance to breeding birds, there may be long-term implications from failure to reproduce that season;
- Frequency: the number of times an activity occurs may influence the resulting impact; and
- Timing: this may result in an impact on an ecological feature if it coincides with critical life stages or seasons.

When characterising ecological impacts, it is essential to consider the likelihood that a change/activity will occur as predicted, with a degree of confidence in the impact assessment (in relation to the impact on ecological

structure and function). Where possible, the degree of confidence should be predicted quantitatively. Where this is not possible, a more qualitative approach is taken; particularly where the confidence level can only be based on expert judgement. Within this EcIA, the confidence in the assessment when predicting impacts to ecological receptors are as follows:

- Certain/near certain: probability estimated at 95% chance or higher;
- Probable: probability estimated above 50% but below 95%;
- Unlikely: probability estimated at above 5% but less than 50%; and
- Extremely unlikely: probability estimated at less than 5%.

15.6.3 Determining Magnitude of Effect

The magnitude of potential impacts will be identified through consideration of the above impact characteristics, to determine the degree of change to baseline conditions predicted as a result of the Proposed Development. The criteria used in the EcIA for assessing the magnitude of an impact are summarised in Table 15.5.

Table 15.5 - Framework for determining magnitude of impact

Magnitude of Impact	Definition
High/Substantial	A fundamental change to the baseline condition of the asset, leading to total loss or major alteration of character.
Medium	A material, partial loss or alteration of character.
Low	A slight, detectable, alteration of the baseline condition of the asset.
Negligible/No change	A barely distinguishable change from baseline conditions.

15.6.4 Determining Significance of Effect

Significance is a concept related to the weight that should be attached to effects when decisions are made. A significant effect is simply an effect that is sufficiently important to require that the decision maker is adequately informed of the environmental consequences of permitting a project. A significant effect does not necessarily equate to an effect so severe that consent for the project should be refused planning permission.

To determine the significance in other chapters within this EIA Report, a matrix approach has been used. This is widely used in EIA to provide consistency across all the topics and clarity to decision makers. However, in accordance with CIEEM guidelines (CIEEM, 2018), a matrix system has not been employed for the determination of impact significance, as this method often places adverse effects to IEFs of local importance into a 'low significance' category, misleadingly downplaying local values of biodiversity.

For the purposes of the EcIA, the significance of effect was defined as an effect that either supports or undermines biodiversity conservation objectives for IEFs, or for biodiversity in general. Conservation objectives may be specific, broad, or wide-ranging therefore, effects can be considered as significant at a wide range of geographic scales.

For defined sites or ecosystems, significant effects encompass impacts on the structure and function of such systems. For designated sites, it is necessary to assess whether an impact will affect the integrity of a site or ecosystem (and is therefore significant). This is achieved through understanding whether the changes arising from the Proposed Development are likely to move the baseline conditions closer to, or further from, the condition which constitutes integrity for that specific system.

For habitats and species, consideration of conservation status is required to determine whether or not an effect on a habitat or species is likely to be significant. For habitats, conservation status is determined by the sum of influences acting on the habitat that may affect its extent, structure and functions, in addition to its distribution and typical species composition within a given geographical area. For species, conservation status is determined by the sum of influences acting on the species concerned, which may affect its abundance and distribution within a given geographical area. When assessing potential effects on conservation status, the known or likely background trends and variations in status are considered. Estimation is also given to the level of ecological resilience or conditions that would allow the population of a species or area of habitat to continue to exist at a given level, such as to increase along an existing trend or to reduce a decreasing trend.

The mitigation hierarchy should be applied to significant impacts on IEFs, in line with guidance derived from policies relevant to the geographic scale of the IEF importance (as per policies outlined above). Any remaining significant effects following the application of mitigation (i.e. residual effects), together with an assessment of the likelihood of mitigation success, should be considered against relevant legislation, policy and development control.

Where identified, the significant effects should be qualified with reference to an appropriate geographic scale. It is important to note that the geographic scale of the significant effect, may not be the same as the geographic scale in which the feature is considered important. This enables consistency in scale when determining appropriate mitigation or compensation solutions.

Significance of the likely effects on each identified IEF is determined through professional judgement, by considering both the nature conservation importance of each feature and the degree to which it may be affected (the impact magnitude) by the Proposed Development.

15.6.5 Cumulative Effects

Cumulative effects can result from individually insignificant, but collectively significant actions, taking place over a period of time or concentrated in a location. Within EcIA, cumulative effects are particularly important as many ecological features are exposed to background levels of threat or pressure and may be close to reaching critical thresholds where further impact could cause irreversible decline. It is recognised that different actions can cause cumulative effects, as follows:

- Additive/incremental effects: multiple activities/projects may give rise to a significant effect due to their proximity in time and space. These may be additive or synergistic effects; and
- Ancillary: ancillary developments may include different aspects of the project which may be authorised under different consent processes, these will be included as part of the cumulative assessment.

15.6.6 Residual Effects

Following the assessment of likely significant effects, including incorporation of mitigation (**Section 15.15.3**), all attempts will be made to avoid and mitigate significant effects. Where significant effects are predicted, further specific, applied mitigation is detailed. Follow the application of this mitigation, an assessment of residual effects will be undertaken to determine the final significance of effects. Where residual effects remain significant or require application of compensatory measures, these will be considered against the relevant policy and legal objectives to determine the outcome of the application.

15.7 Site Description

The Proposed Development site is located at Land located approximately 2-3km southeast of Crimond, Aberdeenshire, Scotland, AB43 8QH, at the approximate central location of NK 06285 55226, and c.3.9km from St Fergus, Aberdeenshire, Scotland.

An existing four turbine wind farm (Greenside Wind Farm) is located within the land holdings. The Proposed Developmentis an extension to Greenside Wind Farm. Within 5km of the site boundary, there is St Fergus wind farm (three turbines) which lies to the south within St Fergus Moss, and St Fergus Energy Park to the south-east (two turbines).

15.8 Vantage Point Surveys (VPS)

Data from Vantage Point Surveys (VPS) are utilised as part of the assessment of potential impacts including: species presence, density, distribution and behaviour. One Vantage Point at NK06475558 (Figure 1) was used as this gave a clear view of the Site, allowing all flights to be recorded in detail to 500m out with the proposed turbines, where possible. This is illustrated in **Figure 15.1**. Vantage Point Watches followed NatureScot guidance and were 6 hours per month per VP from October 2022 – March 2023.

The location, direction of flight and estimated height above the ground of each target species were recorded. The VP times typically covered a period of three hours and covered a range of times between the dawn and dusk periods. During the VP's, flight data for both primary and secondary target species were recorded. Details of species, number of birds, flight height (in bands), duration and direction were recorded. The following approximate height bands were used in the surveys: A- <18m, B- 18-100m, C- >100m. Any flights recorded at band B and within 500m of the proposed turbine location were classified as being within the Collision Risk Zone (CRZ).

Primary target species were identified as Designated species for Loch Strathbeg SPA, Schedule 1 raptors, BoCC and Red listed Birds of Conservation Concern.

15.9 Breeding Bird Surveys

The area surveyed was within a 500m radius of the Red Line Boundary (SNH 2016). The survey work was based on the adapted Brown & Shepard technique (Callendine 2009) where the survey area is walked, and the route varied for each survey. There were three single day visits between late April-June 2023.

15.10 Winter Walk Overs

Following guidance from SNH 2017 a fortnightly survey was undertaken between October 2022-March 2023 to determine if the Site was utilised by foraging geese or waterfowl. Fields were checked to determine if feeding geese were or had been present. Signs looked for included droppings and feathers and worn areas within fields. This survey included the fields proposed for the extension and also the existing Greensides Wind Farm.

15.11 Winter VP Survey Results October 2022-March 2023

In general, there is a large number of geese leaving Loch Strathbeg daily on a very broad front heading for foraging grounds in all directions. Pink footed geese were noted on most VPs flying high over the Site and particularly to the NE over St Fergus area. Only one target species (pink footed goose) was recorded over Site in the Collision Risk Zone on 11 occasions. Flights were more frequent in October then declined between November to January before increasing again in February and March. There is a foraging area within the existing Greensides Wind Farm that geese feed/loaf on regularly. A single peregrine was noted on one occasion in November passing over and around the Site. No whooper swans, barnacle geese or greylag geese were recorded over Site, but were noted in small numbers predominantly to the east of Site. No merlin, hen harrier or short eared owl were recorded. Small numbers of lapwing, curlew and golden plover were recorded at height heading south in October 2022 and north in March 2023. Buzzard, raven and sparrowhawk were noted most months. No common crane were recorded.

15.11.1 Collision Risk Modelling

Collision risk modeling (CRM) is used to predict the number of individuals per target species that might collide with the wind turbine rotors. Typically, following NatureScot (SNH) Guidance, the methodology is based on the Band et al., (2007) collision risk model. Birds that were recorded in height band B and within 500m of each of the turbine locations were considered to be in the Collision Risk Zone (CRZ).

Six months of VP's recorded eleven flights of pink footed goose (4100 individuals) to be in the CRZ. The full CRM workings are set out in Confidential Appendix 15.1.

Table 15.6 - VP times and dates October 2022-March 2023. PG Pink Footed Goose, PE Peregrine Falcon, L. Lapwing, CU Curlew, GP Golden Plover

Date	VP	Time	Hrs.	Species	Flights	Height Band	Map
20/10/22	1	08.30-11.30	3	PG	4	C	1
	1	12.45-15.45	3	PG	5	C/B	1
22/11/22	1	10.00-13.00	3	PE/PG	3	C/B	1
	1	14.00-17.00	3	PG	2	C	1
11/12/22	1	08.10-11.10	3	PG	4	C/B	2
	1	12.45-15.45	3	PG	2	C	
03/01/23	1	09.35-12.35	3				
	1	13.55-16.55	3				
20/02/23	1	08.10-11.10	3	PG	8	C/B	2
	1	12.20-15.20	3	PG	1	B	
10/03/23	1	07.50-10.50	3	PG	7	C/B	2
	1	12.55-15.55	3	PG	2	C	

15.12 Winter Walk Over Results

Where the turbines are proposed is close to barns where sheep are present. Shepherds are present daily switching sheep between fields. No geese or signs of geese were recorded foraging in the fields where two of the three turbines are proposed (one turbine is proposed in a plantation). There is a regular area on the existing Greensides Wind Farm (approximate center NK057542) to the south of two turbines that pink footed geese and occasionally grey lag geese utilize for foraging. This is a regular loafing area and geese normally flew in from roosts at Strathbeg early mornings. Numbers noted were from 20 geese to over 1000 geese present. No overnight roosting was recorded.

15.13 Breeding Bird Results

Thirteen species of birds designated as BoCC red or amber listed were recorded as breeding within the survey area. The open fields on the Site had occasional pairs of skylarks with yellowhammers in hedgerows. Common

passerines were recorded along plantation edges, including dunnock, wren, goldcrest, robin, willow warbler, mistle thrush, coal tit, chaffinch, song thrush, and blackbird. In the marsh and reed areas sedge warbler, reed bunting and grasshopper warbler were present. No lapwings, snipe or curlew were present within the survey area. A pair of oystercatcher were present but it would appear failed to breed. Buzzard, crows and sparrowhawk were noted regularly and expected to be breeding in plantations present within and without the Study Area. No hen harrier, merlin or short eared owl bred on Site. Specific survey dates and weather shown below.

Table 15.7 - Breeding bird species list (BoCC5 red or amber designation) for Greensides: April – June 2023.

(B = Breeding, PB = Possible Breeding)

Common Name	Species	Population Estimate - Pairs	Status
Dunnock	*P. modularis*	4+	B
Bullfinch	*P.pyrrula*	1	B
Willow Warbler	*P. trochilus*	6+	B
Song Thrush	*T. philomelos*	2+	B
Wood Pigeon	*C. palumbas*	5+	B
Reed Bunting	*E.schoeniclus*	2	B
Sedge Warbler	*A.schoenobaenu*	2	B
Oystercatcher	*H. ostralegus*	2	PB
Yellowhammer	*E. citrinella*	3	B
Skylark	*Alauda arvensis*	3+	B
Mistle Thrush	*T. vIscivorus*	1	B
Starling	*Sturnis vulgaris*	4	B
Grasshopper Warbler	*L. naevia*	1	B

Table 15.8 - Dates and weather of breeding bird surveys: April – June 2023

Surveys	Times	Weather
29/04/2023	07.45-11.00	SE1, 45.F, Cloudy
19/05/2023	06.55-10.30	SE2, 57.F, Partly Cloudy
06/06/2023	07.10-12.00	NE3, 52.F, Partly Cloudy

15.14 Discussion

The purpose of the surveys was to gain an understanding of the potential ornithological issues that may arise during any development at the Site. The surveys followed accepted and standard methodology for individual species.

The Proposed Development with three turbines is an extension of the Greensides Wind Farm which is situated in an area of farmland and grazing fields, with coniferous plantations around the periphery of the Site. Various wind farms (St Fergus Moss and St Fergus Energy Park) are located in close proximity to the Site. Three turbines are proposed on Site, two on modified grassland and one in a conifer plantation.

From an ornithological perspective, the size, habitat and locality of the Site rules out various Schedule 1 species e.g., peregrine falcon and hen harrier as breeding birds. Breeding birds of interest recorded in the survey area were limited. Birds recorded on the open fields were skylark and oystercatcher. No curlew, lapwing, snipe, hen harrier, merlin or short-eared owl breed on Site. Breeding birds in the nearby plantations are as expected and include goldcrest, bullfinch, wren, robin, chaffinch etc. In the marsh and reed areas sedge warbler, reed bunting and grasshopper warbler were present.

Standard mitigation is proposed that a pre-construction breeding bird survey be undertaken if construction work is carried out in the bird-breeding season of March- July inclusive.

The Site is approximately 3.5km distant from the southern tip of the Loch of Strathbeg SPA, designated for various geese, ducks and wildfowl assemblage. The species that could possibly be utilising the Site for foraging would be pink-footed goose, greylag goose, barnacle goose and whooper swan.

The majority of geese flights were recorded at height with flocks of geese heading to distant foraging grounds. The only designated species that was recorded over Site at Band B from Vantage Point surveys was pink-footed goose. The geese have traditionally used an area within the current windfarm area as a foraging/loafing area (approximate NK057542). This was recorded in survey work for the initial Greenside Wind Farm application in 2011 (ES Green Cat Renewables 2011).

Whilst most flights passed high over the Site, small numbers of flights came in to land on the traditional foraging area. Numbers in the foraging area ranged from approximately 30 birds to occasionally over a thousand geese present. This is not surprising as there is a wintering population at Loch of Strathbeg of approximately 20-25,000 birds.

The landowner has not identified the remains (carcases, feathers) of geese around the turbine locations since the Greenside Wind Farm started operating. During the surveys and Site walkovers, no geese carcass remains or feathers were identified. No mortality data was recorded due to collision mortality since the Greenside turbines started operating.

Current research on pink-footed goose and collision avoidance (Drachmann et al 2021) at a Danish onshore windfarm has shown that pink footed geese avoid turbines by flying further away, and that the avoidance rate for geese in CRM is now calculated as 99.8%.

Two current turbines are within 500m of the traditional foraging area and it is still used regularly by geese. The proposed two turbines in fields are approximately 900m and 1100m distant from the resting area and at a higher altitude and unsighted due to plantations. During the walkovers no signs of dead geese have been recorded on the current windfarm or the proposed extension

Survey work over the winter period has shown that the proposed Site is not used for foraging or roosting for designated SPA species and that the only species that needed Collision Risk Modelling was pink-footed goose. For the original work in 2011 a very high collision risk mortality of 114 birds per annum was calculated. The calculated

CRM for pink-footed goose for the proposed extension is significantly lower than for the 2011 data (CRM supplied as Confidential Annex)

Due to the small size of the Site, the habitat present and the ornithological survey results, it is considered that the integrity of qualifying species and habitats for designated sites (SPA) within the specified distances as recommended by NatureScot would not be impacted upon. No foraging areas for species designated for the SPA will be lost and connectivity between the SPA and existing foraging areas will not be impacted.

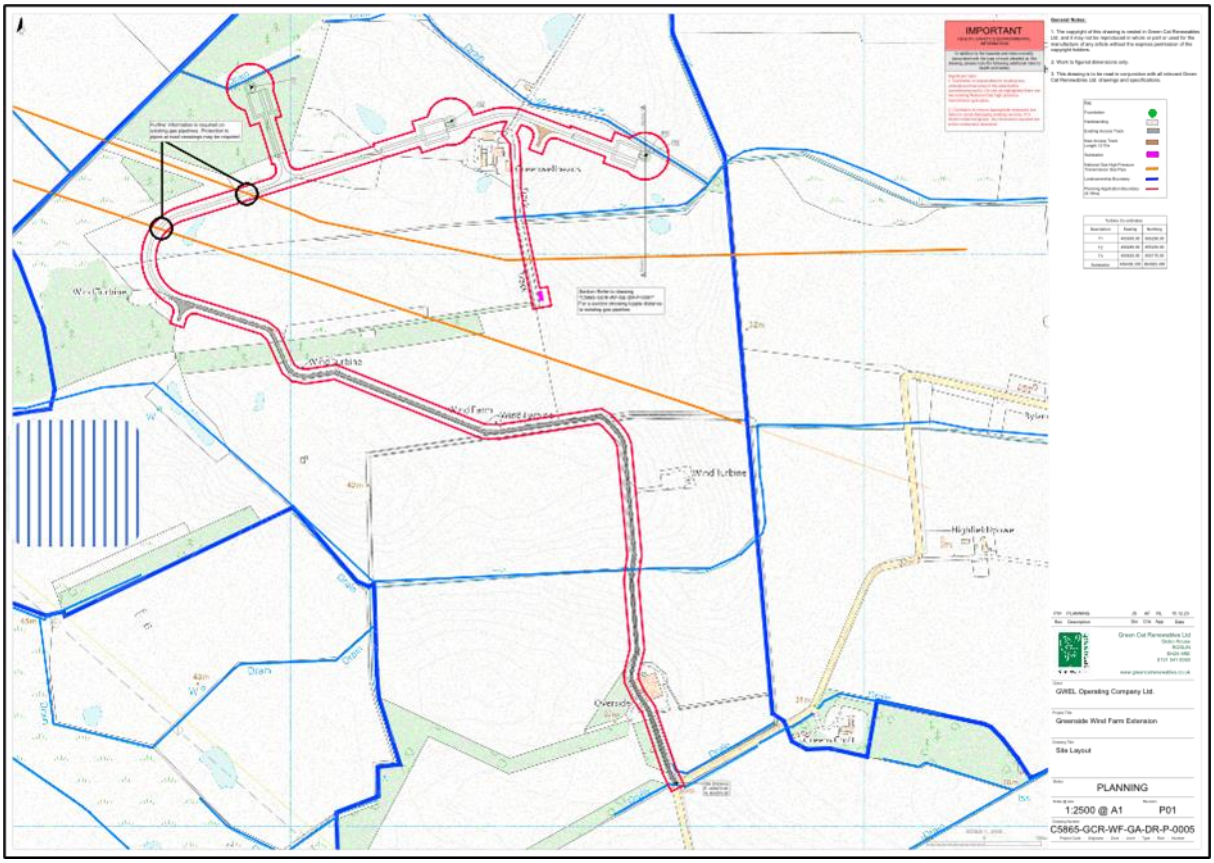

Figure 15.2 - Foraging and loafing area for pink footed goose on existing Greensides Wind Farm (hatched area)

15.15 Predicted Effects

15.15.1 Construction

Habitat loss, disturbance and displacement will be limited during construction given the small numbers of species present. Given the small amount of habitat that is on the Site and general area and that this habitat is common in Scotland, the effect will be short term and there are not likely to be any significant impacts on ornithology as a result of the construction of the Proposed Development. Standard mitigation (Section 15.15.3) undertaken by ECoW before and during construction will minimise any detrimental effects.

15.15.2 Operational Effects

Given the small number of bird species recorded within the Site in open fields and the avoidance of pink-footed goose to existing turbines, effects will be short term and there are not likely to be any significant impacts on ornithology as a result of the operational effects of the Proposed Development.

15.15.3 Mitigation

The following breeding bird protection measures would need to be implemented:

- That construction activities taking place within the bird-breeding season (1st March to 31st July inclusive) should be subject to a breeding bird survey by a suitably qualified ecologist or ECoW before construction commences.

Registered Office
Green Cat Renewables
Stobo House
Roslin
Midlothian
EH25 9RE

+44 (0) 131 541 0060

info@greencatrenewables.co.uk
www.greencatrenewables.co.uk