FORCE 9 ENERGY

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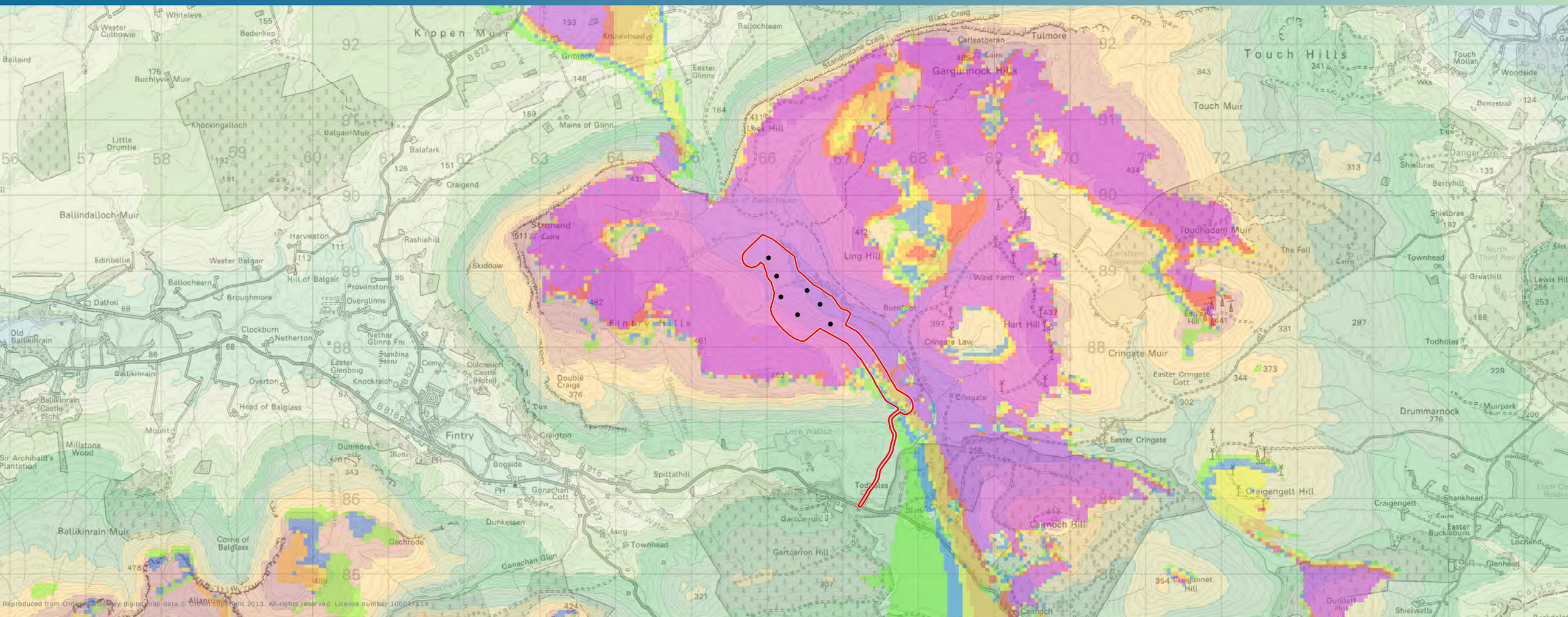
Craigton and Spittalhill Wind Farm Environmental Statement

Volume I: Main Text and Figures

November 2013



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Craigton and Spittalhill Wind Farm
Environmental Statement

Prepared by LUC
on behalf of
Force 9 Energy

November 2013

Preface

This Environmental Statement (ES) has been prepared in support of an application for planning permission to construct and operate the seven turbine Craigton and Spittalhill Wind Farm. The Development is located approximately 12km south-west of Stirling and 7.5km to the east of Balfron, and lies wholly within the Stirling Council area.

The ES comprises the following documents:

- Volume I: Main Text and Figures
- Volume II: Appendices

The ES has been prepared by LUC and supporting sub-consultants. In addition, the ES is accompanied by a Non-Technical Summary, Planning Statement, Design and Access Statement and Pre-Application Consultation (PAC) Report.

Copies of the full ES and accompanying documents, or further information on the Development may be obtained from:

Force 9 Energy LLP and EDF Energy ER

c/o 272 Bath Street

Glasgow

G2 4JR

The Non-Technical Summary is available free of charge. A hard copy of the ES and accompanying documents costs £250. In addition, all documents are available in an electronic format (as PDFs for screen viewing only) on CD/DVD for £2.

The ES and accompanying documents are available for viewing by the public during normal opening hours at the following locations:

Fintry Sports and Recreation Club
Kippen Road
Fintry
Glasgow
G63 OYA

Planning and Building Standards
Stirling Council
Municipal Buildings
8-10 Corn Exchange Road
Stirling
FK8 2HU

Howietown Fishery
Stirling
FK7 9QH

The documents will also be made available on-line at http://pabs.stirling.gov.uk/online-applications/

Comments in relation to the Planning Application should be forwarded to the Stirling Council Planning Environment Services department at the address above. Alternatively, comments can be made via Stirling Council's online planning portal.

Main Text

1. Introduction 1-1
Introduction 1-1
The Proposal 1-1
The Applicant 1-1
Legislative Requirements for Environmental Impact Assessment 1-1
Climate Change and Renewable Energy 1-1
Scotland's Wind Resource 1-2
Benefits of Wind Power 1-2
Environmental Statement 1-2

2. Approach to the EIA 2-1
Introduction 2-1
The EIA Process 2-1
Scope of the Environmental Statement 2-1
Identification of Effects 2-7
Consultation 2-8

3. Site Selection and Design 3-1
Introduction 3-1
Site Selection 3-1
The 'Do Nothing' Scenario 3-1
The Design Strategy 3-1
Scope of the Strategy 3-1
Outcome 3-2
Modifications to Scheme Design 3-3

4. Development Description 4-1
Introduction 4-1
Description of the Development Area and Surrounding Area 4-1
Project Components 4-1
Construction Details 4-3
Reinstatement 4-4
Environmental Management 4-4
Peat Management 4-4
Waste Management 4-5
Health and Safety 4-5
Operational Details 4-5
Decommissioning 4-5

5. Planning Policy Context 5-1
Introduction 5-1
Legislative Background 5-1
Planning and Regulatory Framework 5-1
Review of Development Plan Policy 5-1
Other Material Considerations 5-4

6. Landscape and Visual Amenity 6-1
Introduction 6-1
Assessment Methodology 6-3
Assessment Effects and Significance 6-4
Baseline Conditions (General) 6-8
Landscape Assessment 6-9
Visual Assessment 6-15
Cumulative Assessment 6-32
Implications for Designated Landscapes 6-38
Summary of Significant Effects 6-42
Statement of Significance 6-42
Summary of Effects 6-42

7. Noise 7-1
Introduction 7-1
Planning and Technical Guidance 7-1
Further Technical Considerations 7-2
Assessment Methodology 7-3
Wind Farm Layout Design Considerations 7-4
Effects Assessment 7-4
Construction Effects 7-4
Operational Effects 7-5
Cumulative Effects 7-6
Further Survey Requirements and Monitoring 7-7
Summary of Effects 7-7

8. Geology, Hydrology and Hydrogeology 8-1
Introduction 8-1
Assessment Methodology 8-1
Planning Policy 8-4
Existing Conditions 8-4
Wind Farm Layout Design Considerations 8-9
Effects Assessment 8-12
Construction Effects 8-12
Operational Effects 8-14
Cumulative Effects Assessment 8-15
Further Survey Requirements and Monitoring 8-15
Summary of Effects 8-16

9. Ecology 9-1
Introduction 9-1
Assessment Methodology 9-1
Cumulative Assessment 9-4
Habitats Regulations Appraisal Methodology 9-4
Limitations 9-4
Project Assumptions 9-4
Existing Conditions 9-4
Effects Assessment 9-6
Construction Effects 9-8
Operational Effects 9-9
Cumulative Effects Assessment 9-10
Summary of Effects 9-10

10. Ornithology 10-1
Introduction 10-1
Assessment Methodology 10-2
Planning Policy 10-4
Existing Conditions 10-4
Wind Farm Layout Design Considerations 10-6
Effects Assessment 10-6
Construction Effects 10-6
Operational Effects 10-8
Cumulative Effects Assessment 10-9
Further Survey Requirements and Monitoring 10-10

Summary of Effects 10-10

11. Archaeology and Cultural Heritage 11-1
Introduction 11-1
Assessment Methodology 11-1
Planning Policy 11-3
Existing Conditions 11-3
Wind Farm Layout Design Considerations 11-7
Effects Assessment 11-7
Construction Effects 11-7
Operational Effects 11-7
Cumulative Effects Assessment 11-8
Further Survey Requirements and Monitoring 11-9
Summary of Effects 11-9

12. Access, Traffic and Transport 12-1
Introduction 12-1
Assessment Methodology 12-1
Planning Policy 12-2
Existing Conditions 12-2
Effects Assessment 12-3
Construction Effects 12-3
Operational Effects 12-4
Cumulative Effects Assessment 12-4
Summary 12-4

13. Socio-Economics 13-1
Introduction 13-1
Assessment Methodology 13-1
Planning Policy 13-2
Existing Conditions 13-2
Wind Farm Layout Design Considerations 13-4
Effects Assessment 13-4
Construction Effects 13-4
Operational Effects 13-4
Cumulative Effects Assessment 13-5
Further Survey Requirements and Monitoring 13-5
Summary of Effects 13-5

14. Other Issues 14-1
Introduction 14-1
Assessment Methodology 14-2
Planning Policy 14-3
Existing Conditions 14-3
Wind Farm Layout Design Considerations 14-4
Effects Assessment 14-4
Construction Effects 14-4
Operational Effects 14-5
Carbon Balance 14-5
Cumulative Effects Assessment 14-5
Further Survey Requirements and Monitoring 14-5
Summary of Effects 14-5

Figures

Figure 1.1: Location Plan

Figure 3.1: Turbine Layout Evolution

Figure 4.1: Development Layout

Figure 4.1a: Site Layout: General Site Arrangement

Figure 4.2: Typical Wind Turbine

Figure 4.3: Typical Turbine Foundation/Crane Erection Platform

Figure 4.4: Typical Access Track Construction

Figure 4.5: Typical Control Building

Figure 4.6: Typical A80m Met Mast Detail

Figure 4.7: Typical Construction Compound

Figure 6.1: Zone of Theoretical Visibility (ZTV) to tip height showing the potential number of turbines visible

Figure 6.1a-i: Zone of Theoretical Visibility (ZTV) to tip height showing the potential number of turbines visible (1:100,000 scale base map)

Figure 6.2: Zone of Theoretical Visibility (ZTV) to hub height showing the potential number of turbines visible

Figure 6.3: LVIA Baseline Wind Farm Locations within 35km - Operational and Under Construction Wind Farms

Figure 6.4: Landscape Character Types within 35km

Figure 6.4a: Landscape Character Types within 15km on tip ZTV (to tip)

Figure 6.5: Designated Landscapes within 35km

Figure 6.5a: Designated Landscapes within 35km on ZTV (to tip)

Figure 6.6: LVIA Baseline Combined ZTV - 20km - Craigton & Spittalhill with Operational and Under Construction Wind Farms

Figure 6.7a: LVIA Baseline Paired ZTV - 20km - Craigton & Spittalhill with Earlsburn and Craigengelt

Figure 6.7b: LVIA Baseline Paired ZTV - 20km - Craigton & Spittalhill with Braes of Doune

Figure 6.8: Visual receptors within 35km on ZTV (to tip)

Figure 6.9: Viewpoint 1: Minor Road nr. Easter Cringate

Figure 6.10: Viewpoint 2: Sir John de Graham's Castle

Figure 6.11: Viewpoint 3: Carleatheran

Figure 6.12: Viewpoint 4: Meikle Bin

Figure 6.13: Viewpoint 5: B822 at Kippen Muir

Figure 6.14: Viewpoint 6: Tomtain

Figure 6.15: Viewpoint 7: B8034 at Arndale Park and Gardens

Figure 6.16: Viewpoint 8: A873 near Ruskie

Figure 6.17: Viewpoint 9: Rob Roy Way

Figure 6.18: Viewpoint 10: Ben Ledi

Figure 6.19: Viewpoint 11: Shield Hill

Figure 6.20: Viewpoint 12: Ben Cleuch

Figure 6.21: Viewpoint 13: Ben Vorlich

Figure 6.22: Viewpoint 14: Ben Lomond

Figure 6.23: Viewpoint 15: Meall an-t Seallaidh

Figure 6.24: CLVIA Baseline Wind Farm Locations within 35km - All Wind Farms (including Scoping)

Figure 6.25a: CLVIA Basline Combined ZTV - 35km - Craigton & Spittalhill with Operational, Consented and Proposed Wind Farms

Figure 6.25b: CLVIA Combined ZTV - 20km - Craigton & Spittalhill with Earlsburn, Craigengelt and Earlsburn North

Figure 6.25c: CLVIA Paired ZTV – 20km – Craigton and SPittalhill with Earlsburn North

Figure 6.26a-b: Cumulative Viewpoint 1: Minor Road nr. Easter Cringate

Figure 6.27: Cumulative Viewpoint 2: Sir. John de Graham Castle

Figure 6.28a-c: Cumulative Viewpoint 3: Carleatheran

Figure 6.29a-d: Cumulative Viewpoint 4: Meikle Bin

Figure 6.30a-f: Cumulative Viewpoint 5: B822 at Kippen Muir

Figure 6.31a-c: Cumulative Viewpoint 6: Tomtain

Figure 6.32a-e: Cumulative Viewpoint 7: B8034 nr. Arndale Park and Gardens

Figure 6.33a-e: Cumulative Viewpoint 8: A873 nr. Ruskie

Figure 6.34a: Cumulative Viewpoint 09: Rob Roy Way

Figure 6.35a-b: Cumulative Viewpoint 10: Ben Ledi

Figure 6.36a: Cumulative Viewpoint 12: Ben Cleuch

Figure 7.1: Noise contour plot (for a standardised of 10 metre height wind speed of 8m/s)

Figure 7.2: Cumulative noise contour plot including all nearby wind farm sites – operational, consented and in planning (for a standardised 10 metre height wind speed of 8m/s)

Figure 8.1: Hydrological Overview

Figure 8.2: Hydrology

Figure 8.3: Bedrock Geology

Figure 8.4: Superficial Geology

Figure 8.5: Elevation

Figure 8.6: Peat Depth

Figure 8.7: Soil and Water Constraints

Figure 8.8: Stream Crossings (CAR)

Figure 8.9: Small Watercourse Crossing (Non CAR)

Figure 8.9: Small Watercourse Crossing (Non CAR)

Figure 9.1: Extended Phase 1 survey results 2012
Figure 9.2a: NVC Survey Results 2012
Figure 9.2b: NVC Survey Results 2012
Figure 9.3: Protected Species Survey Results 2012

Figure 10.1: Site Area & Survey Boundaries
Figure 10.2: Designated Sites
Figure 10.3: Vantage Point Locations and Viewsheds
Figure 10.4: Collision Risk Analysis Area
Figure 10.5: Flight Lines - All March 2011 to August 2012
Figure 10.6: Flight Lines – Breeding Seasons 2011
Figure 10.7: Flight Lines at PCH Breeding Season 2011
Figure 10.8: Flight Lines Non-breeding Season 2011-2012
Figure 10.9: Flight Lines at PCH Non-breeding Season 2011 -2012
Figure 10.10: Flight Lines Breeding Season 2012
Figure 10.11: Flight Lines at PCH Breeding Season 2012
Figure 10.12: Breeding Bird Survey 2011
Figure 10.13: Breeding Bird Survey 2012
Figure 10.14: Scarce Breeding Bird Survey 2011
Figure 10.15: Scarce Breeding Bird Survey 2012
Figure 10.16: Black Grouse Survey 2012

Figure 11.1: Inner Study Area and relevant heritage assets
Figure 11.2: Middle Study Area and designated heritage assets
Figure 11.3: Designated heritage assets considered in the Outer Study Area
Figure 11.4: Stronend Cairn
Figure 11.5: Tod Holes Cairn
Figure 11.6: Gribloch House

Figure 12.1: Proposed Development Area and Route

Figure 13.1: Core Paths and Rights of Way (RoW)

Appendices

Appendix 4.1: Borrow Pit Assessment

Appendix 4.2: Outline Soil and Peat Management Plan

Appendix 6.1: Landscape Baseline

Appendix 6.2: Visualisation Methodology

Appendix 7.1 Noise Prediction Methodology

Appendix 7.2: Calculation of Confidence Level

Appendix 8.1: Geology, Hydrology and Hydrogeology of the Wind Farm Area

Appendix 8.2: Peat Stability Assessment

Appendix 9.1: Extended Phase 1 Habitat Survey

Appendix 9.2: NVC Survey

Appendix 9.3: Protected Species Survey

Appendix 9.4: Bat Report

Appendix 9.5: Electrofishing Survey

Appendix 10.1: Ornithological Study and Annex A: Legal Protection

Appendix 10.1 Annex B: Bird Survey Methodologies

Appendix 10.1 Annex C: Survey Effort and General Information and Annex D: Survey Results

Appendix 10.1 Annex E: Collision Risk Assessment

Appendix 11.1: Lists of Cultural Heritage Assets

Appendix 11.2: Aerial Photographs

Appendix 12.1: Site Access Route Review

Appendix 14.1: Carbon Report

Non-Technical Summary

Introduction

1.1 Force 9 Energy is applying to Stirling Council for planning permission to construct and operate Craigton and Spittalhill Wind Farm (hereinafter referred to as 'the Development'). The site, (hereinafter referred to as 'the Development Area' as shown on **Figure 1.1**) is located approximately 12km south-west of Stirling and approximately 7.5km to the east of Balfron.

1.2 As the Development will have a generating capacity of under 50 megawatts (MW), Force 9 Energy is applying to Stirling Council for planning permission under the Town and Country Planning (Scotland) Act 1997, as amended[i]. The application is categorised as a 'Major Development' under the Town and Country Planning (Hierarchy of Development) (Scotland) Regulations 2009[ii] on the basis that the capacity of the Development will be over 20MW.

1.3 Force 9 Energy is a dedicated wind farm development company with offices in Scotland and England and with a focus on the UK market. To date, Force 9 Energy has taken six developments through planning, four of which will have been consented without appeal or public inquiry, one of which was consented on appeal, and one of which was refused after public inquiry. Force 9 Energy is continuing to expand its wind farm development portfolio in response to the Government's targets for energy generation from renewable sources, and is currently awaiting determination of a further four wind farm planning applications.

1.4 Force 9 Energy has a joint development agreement with EDF Energy Renewables (EDF). Through the agreement, Force 9 Energy leads on the development process of wind farm proposals up to the start of construction. Should a wind farm be consented, EDF will take the lead during construction and subsequently own and operate the wind farm.

1.5 The application is accompanied by this Environmental Statement (ES) which has been undertaken in accordance with the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011[iii] ('the EIA Regulations'). The ES presents information on the identification and assessment of the likely environmental effects of the Development. Further details of the statutory requirements for Environmental Impact Assessment (EIA) are set out in **Chapter 2: Approach to the EIA** of the ES.

1.6 This Non-Technical Summary (NTS) summarises the findings and conclusions of the ES.

1.7 The ES has been prepared by LUC on behalf of Force 9 Energy. LUC produced the following ES chapters:

- Chapter 1: Introduction;
- Chapter 2: Approach to the EIA;
- Chapter 3: Site Selection and Design Strategy (with input from Force 9 Energy)
- Chapter 4: Development Description (with input from Grontmij and Force 9 Energy)
- Chapter 5: Planning Policy Context;
- Chapter 6: Landscape and Visual Amenity;
- Chapter 13: Socio-Economics;
- Chapter 14: Other Issues (with input from Mouchel and The Wind Consultancy Service)
- Chapter 15: Summary.

1.8 A number of sub-consultants undertook specialist assessments as follows:

- **Hayes McKenzie** undertook the noise assessment;
- **Mouchel** undertook the geology, hydrology and hydrogeology assessment, Borrow Pit Assessment, Peat Stability Assessment, outline Peat Management Plan and Carbon Balance Assessment;
- **MacArthur Green** undertook the ecology and ornithology assessments;
- **CgMs** undertook the archaeology and cultural heritage assessment;
- **Grontmij** undertook the access, traffic and transport assessment.

Environmental Impact Assessment

1.9 EIA involves the compilation, evaluation and presentation of any potentially significant environmental effects resulting from a proposed development, to assist the consenting authority, statutory consultees, and wider public in considering an application. Early identification of potentially adverse environmental effects also leads to the identification and incorporation of appropriate mitigation measures into the scheme design to avoid, reduce and, if possible, remedy potentially significant adverse environmental effects. The ES presents information on the identification and assessment of the likely environmental effects of the proposed Development. **Major** or **moderate** effects are considered to be significant in the context of the EIA Regulations[1].

1.10 The scope of the EIA was informed by the Scoping Opinion provided by Stirling Council in October 2012 and includes responses from Scottish Natural Heritage (SNH), the Scottish Environment Protection Agency (SEPA), Historic Scotland and Transport Scotland. These responses have been presented in **Chapter 2: Approach to the EIA**.

Site Selection and Design Strategy

1.11 The site at Craigton and Spittalhill was selected by Force 9 Energy for a number of reasons, including the following:

- it has a good wind resource and is available for wind energy development;
- there are no international or national natural heritage or landscape designations within the Development Area;
- the Development Area is at distance from the nearest residential receptors;
- there are no radar or other technical constraints associated with the Development Area;
- there are grid connection options available;
- there is good access to the Development Area for construction traffic and turbine deliveries; and
- the landscape is, in part, defined by the existence of the nearby Earlsburn Wind Farm.

1.12 Wind farm design must balance technical, economic and environmental considerations, with the iterative EIA process acting as a tool to further refine the design process to achieve the most appropriate balance. In addition the design of a wind farm is driven by the key objective of positioning turbines so that they capture the maximum energy possible within a suitable area determined by environmental and technical constraints.

1.13 The overall aim of the design strategy was to create a wind farm with a cohesive design that relates to the surrounding landscape, in line with appropriate published guidance[iv]. The inherent nature of wind turbines as tall, modern structures means that the form of the wind farm as a whole is important, and a clear design strategy is necessary. The strategy therefore considered the appearance of the wind farm as an object or composition in the landscape as the primary factor in generating the layout.

1.14 The objectives of the design strategy were as follows:

- to produce a layout that would relate well to its landscape setting and appear contained within its extents;
- to develop a layout that would appear cohesive and well considered from all aspects;
- to develop a layout that seeks to match the perceived scale of the turbines, and the scale of the overall Development, with the scale of the landscape;

[1] This is the case for all topic chapters with the exception of Access, Traffic and Transport, Noise and Other Issues.

- to develop a layout that relates to other wind farms in the local area as well as being coherent it its own right;
- to develop a layout that fulfils the above objectives whilst respecting other environmental constraints including ecological, hydrological and ground conditions (including peat) related constraints identified during the EIA process.

1.15 As a consequence of the EIA process, there have been a number of modifications to the initial design layout, to avoid or minimise environmental effects without compromising the overall design strategy. These modifications have been made as a result of the findings of the baseline survey work and consultation undertaken with consultees and the public and include:

- a reduction in the number of turbines and turbine grouping moved to the south-east of the Development Area to reduce landscape and visual effects. Visibility from the settlements of Kippen and Gargunnock removed as a consequence.
- minor adjustments (generally between 30m to 50m) to positions of all turbines following peat probing survey and hydrological walkover survey in order to establish an appropriate buffer in relation to watercourses and to avoid areas of potentially deeper peat.

1.16 These modifications have included the relocation and reduction in the number of turbines to:

- minimise the visual effects of the Development in views from the wider landscape;
- avoid construction activity in areas of potentially deeper peat; and
- minimise the number of watercourse crossings required and ensure appropriate buffer distances between surface waters and turbine bases and associated infrastructure.

1.17 Design changes made as a consequence of the key constraints to site design are considered to be mitigation which is 'embedded' in the design. Further details of the design strategy can be found in **Chapter 3: Site Selection and Design Strategy**.

Development Description

1.18 As shown on **Figure 4.1**, the main components of the proposed Development are:

- seven wind turbines (including external transformers) of up to 125m (to tip) height, with a maximum combined output of 21 megawatts (MW);
- crane hardstandings;
- onsite underground electrical cables;
- a control building;
- a permanent meteorological mast;
- a temporary site construction compound/laydown area;
- two areas from which rock for wind farm construction will be won (borrow pits);
- approximately 5km of onsite access tracks.

1.19 A single permanent freestanding meteorological mast will be erected to aid performance monitoring of the wind turbines and to gather meteorological data throughout the lifetime of the Development. The mast will be of a lattice design and will have a maximum height of 80m. The proposed location of the mast is shown on **Figure 4.1**.

1.20 It is proposed that the Development Area will be accessed via the existing Earlsburn Wind Farm access track which connects to the B818 road in the vicinity of Todholes to the south. Full details of the assessment of effects on the local road network are provided in **Chapter 12: Access, Traffic and Transport.**

1.21 A new access track will be constructed to facilitate access to the turbines and other infrastructure locations as shown on **Figure 4.1**. The new track will branch-off from the existing Earlsburn Wind Farm access track at a point just before it crosses the Endrick Water. In total, approximately 5km of new onsite access track will be constructed.

1.22 The Development will be connected to the national electricity grid. The grid connection will be subject to a separate consenting process and will be made via a new line, which would typically be a wooden pole type line running from the location of the control building to the grid connection point.

1.23 Electrical power from the turbine transformers will be transferred to the electricity distribution system through a switchgear unit, housed within the control building. The control building will be located in the north of the Development Area as shown on **Figure 4.1**.

1.24 Subject to the granting of planning permission, it is anticipated that the construction of the Development will take place over 12 months. The operational life of the Development is 25 years. At the end of the 25 year operational period, the Development will either be decommissioned, or an application made for consent to extend its operational life. It is estimated that decommissioning the Development, given its size, will take approximately 6 months.

Landscape and Visual Amenity

1.25 The landscape and visual amenity assessment considered the potential effects of the Development on the landscape and visual resources of the Development Area and the surrounding study area during construction, operation and decommissioning. More details on the assessment are provided in **Chapter 6: Landscape and Visual Amenity**.

1.26 The study area for the assessment was defined as 35km from the outermost turbines of the Development in all directions, as recommended in current guidance for turbines of 100 m to blade tip or higher[v] and in agreement with Scottish Natural Heritage (SNH), Stirlingshire Council and Loch Lomond and The Trossachs National Park Authority (LLTNPA). To consider cumulative effects of the Development in relation to other schemes in the wider area, wind farms within 35km of the Development have been included for the purposes of modelling and detailed assessment, as agreed with Stirling Council, SNH and LLTNPA. To assess the likely effect of the Development on visual amenity, fifteen viewpoints have been identified across the 35 km study area, and agreed through consultation with the local authorities covering the study area, SNH and LLTNPA.

1.27 The method for assessment included field survey, computer modelling, mapping and photography. Field survey work was carried out between May 2012 and October 2013, and records were made in the form of field notes and photographs. Evaluation of the theoretical extent to which the wind farm would be visible across the study area was undertaken by establishing a Zone of Theoretical Visibility (ZTV) using specific computer software designed to calculate the theoretical intervisibility between the wind farm and its surroundings. The ZTV was calculated to show the number of turbines visible to blade tip or hub height.

1.28 The study area includes many different Landscape Character Types (LCTs) from lowland and urban areas to high plateaux and hills. . The Development Area lies within a locally designated landscape, the Fintry, Gargunnock and Touch Hills Area of Great Landscape Value (AGLV, Stirling). The 35 km study area also contains three National Scenic Areas (NSAs) and a number of other local landscape designations. Settlements within 5km of the proposed Development are located within the low lying ground of the surrounding valleys, including Fintry and Kippen. Dispersed farmsteads and individual or small groups of residential properties are located close to roads within the Carron Valley to the south and the Forth Valley to the north of the Development Area.

1.29 During the construction phase, it is predicted that there will be a major landscape and visual effect on the Development Area relating to excavations and track construction, the presence of tall cranes and partially built towers whilst turbines are being erected. This effect, however, will be temporary and not significant following restoration and reinstatement measures.

1.30 Once operational, a major effect is predicted on the landscape resource of the Development Area itself, and a moderate landscape effect to the landscape character of the Fintry, Gargunnock and Touch Hills area of the Lowland Hills LCT. The Fintry, Gargunnock and Touch Hills AGLV locally designated landscape will experience change for the area around the Backside Burn, but the reasons for designation of the AGLV as a whole will not be affected. A significant (moderate) landscape effect on the Carse West of Stirling area of the Flat Valley Floor LCT within the Forth Valley to the north is anticipated. Moderate, and therefore significant visual effects are predicted for five of the 15 representative viewpoints during operation, all of which are located within approximately 10 km of the proposed Development. Minor or negligible visual effects are predicted for the remaining ten viewpoints. No significant visual effects are

predicted on views from settlements, users of local roads around the Development Area or on walkers and cyclists using the Rob Roy Way and National Cycle Network 7 during operation.

1.31 Significant (major) cumulative landscape effects have been identified for the Development Site and the Fintry, Gargunnock and Touch Hills area of the Lowland Hills LCT. No significant cumulative visual effects have been identified in the assessment.

1.32 Measures to reduce landscape and visual effects were predominantly achieved through the design of the Development, although effects during construction will be further minimised through site restoration measures in accordance with good practice.

Noise

1.33 Once operational, wind farms may emit two types of noise. Aerodynamic noise relates to the movement of the rotating blades through the air, and mechanical noise may emanate from components within the nacelle of a wind turbine, where the rotor blades meet. However, modern turbine designs have evolved to ensure that mechanical noise radiation from wind turbines is negligible. Aerodynamic noise is usually only perceived when wind speeds are fairly low; in higher winds, aerodynamic noise is generally masked by the normal sound of wind blowing through trees and around buildings.

1.34 Noise will also be generated during the construction phase of the Development from the operation of a range of construction plant and machinery and from construction traffic. This will be temporary in nature, during the 12 month construction period. Details of the noise assessment are provided in **Chapter 7: Noise**.

1.35 The study area for the assessment included residential dwellings located in the vicinity of both the Development and the proposed construction traffic routes. Due to the location of the Craigton and Spittalhill Wind Farm, and the consequent low levels of predicted turbine noise at the nearest residential properties, which are more than 1km from the Development, it was considered that, in accordance with government guidance, baseline noise measurements were not required. The assessment also considered the cumulative noise effects of the Development in combination with other nearby developments.

1.36 The noise assessment concluded that it is unlikely that noise levels at the nearest residential properties will exceed accepted limits during both the construction period and all operational conditions. Cumulative noise effects are either negligible or meet agreed cumulative noise limits.

1.37 Good practice measures will be implemented to minimise noise from construction activities and noise levels will be monitored during construction. A noise control plan will be prepared by the contractor for incorporation into the Environmental Management Plan (EMP).

Geology, Hydrology and Hydrogeology

1.38 The geology, hydrology and hydrogeology assessment has considered the potential effects of pollution incidents, erosion and sedimentation and modification of surface water drainage patterns, in addition to modification to groundwater levels and flows, compaction of soils and peat instability during construction and operation of the Development. More details on the assessment are provided in **Chapter 8: Geology, Hydrology and Hydrogeology**.

1.39 The study area for the assessment has been defined as the Development Area, and the surrounding area of the Fintry Hills and Ling Hill. In addition, using a catchment based study approach, the assessment has also considered downstream locations to the mouth of Endrick Water to Loch Lomond. The assessment was informed by consultation with Scottish Water and Stirling Council and field surveys, which were undertaken between October and December 2012.

1.40 Designations within 5km of the Development Area which relate to hydrology, geology and soils include Endrick Water Special Area of Conservation (SAC) and Special Site of Scientific Interest (SSSI) and Double Craigs SSSI. Endrick Water SAC and SSSI are located 5.1km downstream of the site, 1.2km south-west of the site at its nearest point, and are primarily designated for their fish populations and presence of nationally rare plant species. Double Craigs SSSI is located approximately 1.7km south-west of the Development Area and is designated for its volcanic geology and undisturbed upland plant species. The majority of the Development Area is covered by peat with a depth of 0.5 to 1.5m, although peat probing undertaken to inform the assessment identified that the average depth across the Development Area is less than 1m. The site lies in the upper catchment of the Endrick Water, with the Backside Burn and its tributaries draining the northern site area. The Development Area is not a source zone for public water supply, with the water supply in this area being sourced from the Carron Valley Reservoir.

1.41 The hydrology, hydrogeology and peat distribution within the Development Area influenced the design of the turbine and infrastructure layout to avoid and/or minimise potential effects on these receptors where possible. The application of a minimum distance for the location of infrastructure from watercourses is the principal means by which surface hydrology can be protected (and therefore any dependent ecology or water supplies). 50mbuffers were applied around water features shown on OS mapping 1:10,000 in addition to 20m buffers being applied to water features identified onsite. The presence of peat within the Development Area also formed a key design layout consideration. Informed by the peat probing survey, the design process minimised the location of turbines and infrastructure within areas of deeper peat, typically 1.5m or more. The design process also sought to minimise the number of watercourse crossings required.

1.42 During construction of the Development, it is predicted that there will be significant effects (moderate) in terms of erosion /loss of soil, sedimentation of surface waters and modifications to surface water drainage through peat failure. It is proposed that, to mitigate the effects of erosion and sedimentation, careful management and monitoring of construction activities, especially in zones close to watercourses, will be undertaken, to reduce the likelihood of erosion /soil loss and sedimentation of surface waters. On-going surveys will enable identification of key areas of peat stability concern. Where activities are close to key areas of concern, then further mitigation will be employed, including the avoidance of heavy loads on slopes. As a result of the implementation of these measures, residual effects of minor significance are predicted in relation to erosion and sedimentation and peat stability.

1.43 The Peat Stability Assessment highlighted 7 small areas of initial stability concern, with detailed assessment undertaken at these areas to gain more understanding of ground characteristics to inform appropriate mitigation measures including the avoidance of heavy loads on slopes. As a result of the implementation of these measures, residual effects of minor significance are predicted in relation to erosion and sedimentation and peat stability.

1.44 No significant operational or cumulative effects are predicted.

Ecology

1.45 The ecology assessment considered the potential effects of the Development on designated areas, terrestrial habitats, aquatic habitats and protected species. More details of the assessment are provided in **Chapter 9: Ecology**.

1.46 Desk studies were undertaken for the Development Area during summer 2012 with the aim of identifying statutory and non-statutory designations up to 5km from the Development Area. Field surveys were also carried out to establish habitat type and distributions and the presence of badgers, bats, fish, otter and water vole.

1.47 There are no designated sites of nature conservation within the Development Area. However, there are two designated sites within 5km of the Development Area, including Endrick Water SAC and SSSI and Double Craigs SSSI.

1.48 The Development Area covers a range of habitat types including modified bog, marshy grassland and semi-improved acid grassland. In relation to protected species, no signs of badger presence were recorded during field surveys, with the Development Area considered generally unsuitable for the species due to its general wetness and overall lack of suitable shelter/cover. No bat roosts were identified during surveying and as a result, the potential effects on bats were 'scoped out' of the assessment following consultation with SNH. Otter surveys identified two old otter spraints in the north-east of the Development Area. It is believed that otter utilise the Development Area for commuting and foraging purposes. No signs of water vole presence were recorded during surveying. Electrofishing was undertaken at four sites across the Development Area to establish the extent of the fish population. Four brown trout were recorded which represented a low density. No other fish species were recorded.

1.49 It is not anticipated that there will be significant effects on designated sites, habitats or protected species during construction and operation of the Development.

1.50 In order to mitigate further any non-significant effects on designated sites and protected species, a Species Protection Plan (SPP) is proposed during construction, and will be agreed with Stirling Council and SNH. The SPP will detail measures to protect otter and will include pre-construction surveys and good practice measures. Environmental Management and Pollution Prevention Plans (EM&PPP) will also serve to reduce effects caused by potential pollution incidents. To ensure compliance with the measures above, an Ecological Clerk of Works (ECoW) will be present onsite during construction. During operation of the Development, the SPP and EM&PPP will be implemented in full.

1.51 It is not considered likely that any significant cumulative effects shall arise.

Ornithology (Birds)

1.52 The assessment of potential effects on ornithology (birds) considered effects relating to direct habitat loss during construction, displacement of birds as a result of indirect habitat loss, habitat modification, death or injury through collision and cumulative effects. Particular attention has been paid to species of high or moderate conservation status ('target species') including greylag goose, osprey and black grouse. More details on the assessment are provided in **Chapter 10: Ornithology**.

1.53 The study area for the assessment comprised the Development Area and appropriate survey buffers as recommended by SNH Guidance[vi]. In addition, the assessment was also informed by a Collision Risk Analysis Area (CRAA) which comprised a survey buffer of 250m in all directions from each turbine. The purpose of the CRAA was to inform collision risk modelling. A desk study was undertaken to collate existing bird records and/or data, along with consultation with Stirling Council, SNH and the Central Raptor Study Group and field surveys. All field surveys were undertaken between March 2011 and August 2012.

1.54 There are no statutory nature conservation designations relating to ornithological interests within the Development Area. The nearest designation is the Lake of Menteith SSSI which is designated for pink-footed goose. Within 20km of the Development Area, there are 10 designated sites, most of which are designated for non-breeding birds.

1.55 Vantage point surveys identified that osprey was the most frequent target species recorded during the survey period; nine flights were recorded, of which seven passed through the CRAA. Greylag geese was the second most frequently recorded target species during vantage point surveys; seven flights were recorded during the survey period with all flights passing through the CRAA. The largest flock recorded consisted of 16 greylag geese. In addition, four osprey flights were recorded within 2km of the Development Area. No osprey nests were found within the Development Area or 2km survey buffer. Black grouse lek surveys identified a lek within the Development Area which contained four lekking males. In addition, a single black grouse observation was made during vantage point surveys and consisted of five birds. Breeding bird surveys recorded 16 species within a 500m buffer, most of which consisted of passerine (perching birds).

1.56 During construction, it is considered likely that activities will displace black grouse from foraging areas, and this is considered to represent an effect of moderate significance. It is proposed therefore that black grouse lekking surveys will be undertaken during the construction phase. If any leks are identified, it is proposed that a 500m disturbance buffer shall be implemented, and no work shall be undertaken in these areas for a period of one hour before or after dawn. Supplementary feeding will also occur during the construction period. It is predicted that the implementation of this mitigation shall result in a residual effect of minor significance.

1.57 During operation of the Development, pre-mitigation, it is predicted that an effect of moderate significance will occur in relation to black grouse collision and displacement. The implementation of mitigation measures, including a Habitat Management Plan (HMP) for black grouse and the planting of 30 hectares of scattered woodland for black grouse foraging, will reduce the significance of these effects to minor.

1.58 No significant effects are predicted for greylag geese, osprey and other non-target species during construction and operation of the Development.

1.59 Cumulative effects of the Development on birds have been predicted as negligible.

Archaeology and Cultural Heritage

1.60 An archaeology and cultural heritage assessment was carried out to investigate the potential physical and setting effects of the Development on archaeological and cultural heritage assets. More details on the assessment are provided in **Chapter 11: Archaeology and Cultural Heritage**.

1.61 Archaeology and cultural heritage assets include sites, features and areas with statutory and non-statutory designations, including Scheduled Monuments; Listed Buildings; Conservation Areas; Gardens and Designed Landscapes (Inventory and Non Inventory status); Non Statutory Register sites and other historic environment interests.

1.62 The assessment was based on three study areas; inner, middle and outer study areas, which consisted of the Development Area, 5km from the Development Area, and 10km from the Development Area respectively.

1.63 For the Development Area, data has been gathered to identify any potential physical effects on assets. Data has been gathered for the middle study area to identify potential setting effects on all designated assets within 5km of the Development Area. In addition, data has been gathered for the outer study area to identify potential setting effects on Inventory Battlefields, World Heritage Sites and Inventory Gardens and Designed Landscapes (IGDL).

1.64 The method of assessment included desk based data collection and field surveys. Field surveys of the inner study area were undertaken in November and December 2012. Assets with potential setting effects in the middle and outer study areas were visited during good visibility from October to December 2012.

1.65 There are no designated assets within the inner study area. Within the middle study area there are 19 Scheduled Monuments. There are also 19 Listed Buildings within the middle study, three of which are category 'A' listed, and three Conservation Areas; Fintry, Kippen West and Kippen. Moreover, there are three Inventory Gardens and Designed Landscapes within the outer study area.

1.66 During construction, an effect of moderate significance is predicted on an upstanding banked enclosure which lies approximately 5m from the proposed new access track. To prevent inadvertent damage to the asset during construction, the upstanding banked enclosure will be marked out prior to works commencing in its vicinity. Following the implementation of this mitigation, the significance of the effect will be reduced to negligible. Whilst there is a predicted effect of minor significance on sub-surface remains within the construction footprint, the implementation of mitigation measures will reduce this effect to negligible.

1.67 During operation of the Development, it is predicted that there will be residual effects of minor significance on the setting of two cairns at Stronend, a cairn at Carleatheran, two cairns at Todholes, a motte at Keir Knowe, a Category A Listed house at Gribloch, the Inventory Garden and Designed Landscape of Cardross House and the Priory of Inchmahome.

1.68 No significant cumulative effects are predicted.

Access, Traffic and Transport

1.69 The access, traffic and transport assessment considered the potential effects of construction and operational traffic, associated with the Development, on the local road network. It identified the likely volume of traffic that will be generated during construction and operation and the subsequent effect this will have on the local road network. More details on the assessment are provided in **Chapter 12: Access, Traffic and Transport**.

1.70 The study area for the assessment was defined as the public road network in the vicinity of the Development, which will be used as access routes by traffic bound for the Development, and includes the B818, A872 and the M9 motorway. The method of assessment included a combination of desk-based study, field surveys and consultation with statutory consultees.

1.71 Although the M9 motorway was included in the study area, the likely effects have not been considered within the assessment as it is not anticipated that the effect of the additional traffic generated by the Development on the M9 will be significant.

1.72 The B818 is a typical rural road which accommodates a two-way traffic flow; however, the width of the road narrows to single track in certain places and Heavy Goods Vehicles (HGVs) may need to slow to

pass each other. The B818 is generally well maintained and is not used by a large number of vehicles. The A872 runs along the western periphery of Denny and is a wide single carriageway which is considerably more trafficked that the B818 and is suitable for HGVs. The M9 motorway is a strategic route in Scotland and forms part of the Scottish Trunk Road Network.

1.73 During construction of the Development, turbine components and materials will be delivered to the Development Area. Some materials will be transported by HGVs and turbine components will need to be transported on vehicles capable of carrying 'abnormal loads' (vehicles longer than 17m and/or more than 4m wide). It is proposed that turbine components will arrive into Grangemouth Port and will then be transported north along the M9. The abnormal load vehicles will then follow the A872 towards Denny before following the B818 westwards to the Development Area. All abnormal loads will be escorted to the Development Area by police vehicles and will be timed to avoid peak traffic periods on the local road network. All other vehicles bound for the Development Area, including HGVs, are assumed to approach the A872 from the M9. It has been assumed that staff working at the development will accommodated locally in Denny or the surrounding area of Stirling, therefore, it has been assumed that 50% of staff cars and Light Goods Vehicles (LGVs) will affect the A872 and 100% the B818.

1.74 The assessment has determined that there will be no significant effects on the local road network during construction. However, a Traffic Management Plan (TMP) will be implemented, in agreement with the Police and Roads Authorities, for the construction works.

1.75 Once operational, wind farms typically generate very low levels of traffic. It is estimated that the Development will generate no more than two vehicle movements per week for the purposes of maintenance, repairs and servicing, and therefore this does not represent a significant effect.

1.76 No cumulative effects have been identified in terms of other construction projects that could run concurrently with the proposed development. Should such circumstances arise, liaison will take place between the contractors appointed for the affected project(s) and the police and the Roads Authority in the development of the construction TMP.

Socio Economics

1.77 This assessment considered the potential effects of construction and operation of the Development on direct employment and indirect economic benefits, public access and recreation and tourism. More details on the assessment are provided in **Chapter 13: Socio-Economics**.

1.78 With respect to potential effects of the Development on employment and indirect economic benefits and tourism, the assessment considered potential effects at the Stirling Council administrative level. In addition, the assessment focused on the Development Area in terms of direct effects on public access and the Development Area and surrounding area with regard to effects on recreation. The cumulative assessment of effects considered the socio-economic effects of the construction and operation of schemes within 35km of the Development Area, as identified in **Chapter 6: Landscape and Visual Amenity**.

1.79 The Stirling Council administrative area had an estimated population of 90,770 in 2011, which accounted for 1.7% of Scotland's population as a whole[vii]. The employment rate from July 2011 to June 2012 was 70.8% compared to 70.9% for Scotland as a whole[viii]. In addition, the sector which employed the highest proportion of workers in the Stirling Council area is 'Professional Occupations' (employing 22.5% of people aged 16+).

1.80 There are no Rights of Way (RoW) or Core Paths within the Development Area. Within 200m of the Development area, however, lies one RoW and one Core Path. Both the RoW and Core Path originate at the access to Cringate on the unclassified road which links the B818 and Easter Cringate and lie to the east of the Development Area.

1.81 The existing Earlsburn Wind Farm access track, which branches off the B818 in the vicinity of Todholes, is used by walkers to access the wind farm and surrounding hills. Approximately 1km of the Earlsburn Wind Farm access track is within the Development Area.

1.82 Visitor attractions within the vicinity of the Development Area include Culcreugh Castle and the villages of Fintry and Balfron which provide a base for visitors wishing to explore the surrounding countryside and hills. Tourist attractions in the wider area include historical landmarks such as Stirling Castle, the Wallace Monument, and the Bannockburn Heritage Centre.

1.83 During construction of the Development it is anticipated that 1-3 FTE (full-time equivalent) jobs will be created. This is considered to represent an effect of temporary minor (positive) significance.

1.84 It is likely that there will be some local employment generated as an indirect result of the construction of the Development. It is considered that indirect employment as a result of the Development will have a temporary effect of minor positive significance to the local economy.

1.85 It is anticipated that there will be no access to the Development Area for informal recreational purposes for the duration of the construction period, and the existing Earlsburn Wind Farm access track is likely to be closed to pedestrians for extended periods during the construction phase. Given the extensive scope for informal recreation in the surrounding area, and informal nature of recreational activity, it is not anticipated that there will be significant effects as a result of the temporary closure of the track, and the Development will not affect public access or recreational activity in the wider area. Users of the nearest RoW and Core Path may be adversely affected in terms of visual amenity, noise and dust nuisance during construction; however, this will be temporary and intermittent in nature and of temporary minor significance. The Development will not prevent visitors accessing the identified attractions and popular points of interest during construction or operation and effects on tourism will be negligible.

1.86 Once operational, the Development will require a small team of personnel to service, maintain and operate it. It is predicted that 1 FTE job will be created during the lifetime of the Development (25 years). It is likely that there will be some indirect economic benefits as an indirect result of the operation of the Development. This represents an effect of negligible (positive) significance.

1.87 The effect that changes in views will have on recreational activity will depend on the personal opinion of the viewer, however, there will be no restrictions on access to the Development Area during operation of the Development and public access via the Earlsburn Wind Farm access track will resume. Therefore, the effect on public access and recreation during operation is assessed as negligible.

1.88 No significant cumulative effects are predicted.

Other Issues

1.89 The assessment of the potential effects of the Development on aviation and defence, telecommunications, television reception and dust has been undertaken primarily through desk based study and consultation. Further details of the assessment are provided in **Chapter 14: Other Issues**.

Aviation and Defence

1.90 The Ministry of Defence (MOD) was consulted on the scoping stage wind farm design by Force 9 Energy in January 2011. The MOD responded confirming no objections to the project in February 2011. The Civil Aviation Authority (CAA) has raised no concerns about the Development and Glasgow Airport was consulted on the proposal on 20th August 2012. Although at the time of writing there has been no response to the consultation request from the airport, computer modelling has been used to establish if there is any line of sight between the Glasgow airport radar and any wind turbines on site. This has confirmed that turbines will not be in the scope of the Glasgow airport radar and should not therefore affect the radar. The predicted effect of the operation of the Development on radar is therefore considered not significant.

Telecommunications

1.91 There are no telecommunication links within the vicinity of the Development Area, and the predicted effect of operation of the Development on telecommunications is considered not significant.

Television Reception

1.92 The online BBC Wind Farm Tool suggests there are no properties which may experience interference to their television reception once the Development is operational. Effects on television reception will be confirmed following an onsite survey should issues arise. The installation of satellite television or upgrades of the current antenna systems would be the most appropriate and effective form of mitigation at these properties. The predicted effects of the Development on television reception are considered not significant.

Dust

1.93 The movement of vehicles as they transport equipment and goods to the Development Area is the most likely source of dust during the construction period. The level and distribution of emissions will vary according to factors such as the duration of dust-generating activity and weather conditions.

1.94 Force 9 Energy is committed to adopting good practices for dust management during construction, thereby controlling and reducing any potential effects. With adherence to these good practice measures, the predicted dust effects will be temporary and will not be significant.

1.95 No significant cumulative effects are predicted in relation to aviation and defence, telecommunications, television reception and dust effects.

Carbon Balance

1.96 The purpose of Craigton and Spittalhill Wind Farm is to generate electricity from a renewable source of energy, offsetting the need for power generation from the combustion of fossil fuels. Consequently, the electricity that will be produced by the Development results in a saving in emissions of carbon dioxide (CO_2) with associated environmental benefit.

1.97 The carbon balance assessment (see **Appendix 14.1**) has calculated that the expected payback time (the length of time for the Development to become a 'net avoider', rather than a 'net emitter' of carbon dioxide emissions) will be approximately 24 months. This is based on the assumption that backup generation capacity of 5% will be required. With a 25 year operational life, this would mean that the Development would save over twelve times the carbon emissions generated making a positive net contribution to reducing carbon dioxide emissions.

Summary

1.98 The EIA for the proposed Development been carried out in accordance with regulatory requirements and guidance on good practice. The findings of the surveys undertaken, in addition to extensive consultation, have informed the design process and, as a result, design changes have been introduced to reduce effects on the surrounding landscape, hydrological regime and taking into account local ground conditions.

1.99 Prior to committed mitigation, significant effects are predicted in relation to landscape and visual amenity, ornithology, archaeology and cultural heritage and geology, hydrology and hydrogeology. However, there is scope to mitigate most of the predicted significant effects and many effects are therefore not significant following the proposed mitigation. With the exception of temporary effects during construction, all significant residual effects are associated with landscape and visual amenity, and cannot be avoided in their entirety given the inherent nature of wind farm development.

1.100 Overall, this EIA shows that, given the iterative design process, and with the committed good practice measures and proposed mitigation in place, most potential environmental effects associated with the construction and operation of the Development can be avoided or minimised.

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[i] The Town and Country Planning (Scotland) Act 1997, as amended by The Planning Act (Scotland) 2006, Available [online] at: http://www.legislation.gov.uk/ukpga/1997/8/contents, Last accessed on: 12/12/2012

[ii] The Town and Country Planning (Hierarchy of Development) (Scotland) Regulations 2009, Available [online] at: http://www.legislation.gov.uk/ssi/2009/51/contents/made, Last accessed on: 12/12/2012

[iii] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011, Available [online] at: http://www.legislation.gov.uk/ssi/2011/139/contents/made, Last accessed on: 12/12/2012

[iv] Scottish Natural Heritage. (2009). Siting and Designing windfarms in the landscape (Version 1), Chapter 5

[v] Scottish Natural Heritage. (2006). Visual Representation of Windfarms: Good Practice Guidance

[vi] Scottish Natural Heritage. (2010). Survey methods for use in assessing the impacts of onshore windfarms on bird communities. SNH.

[vii] General Registry Office for Scotland (GRO Scotland), (2011), 'High Level Summary of Statistics Trends' Available [online] at: http://www.gro-scotland.gov.uk/statistics/at-a-glance/high-level-summary-of-statistics-trends/index.html, Last accessed on: 16/11/2012

[viii] NOMIS Official Labour Market Statistics for Scotland (2011), 'Labour Market Profile: Stirling', Available [online] at: http://www.nomisweb.co.uk/reports/lmp/la/2038432150/report.aspx#tabempunemp, Last accessed on: 16/11/2012.

1 Introduction

Introduction

1.1 This Environmental Statement (ES) has been prepared by LUC on behalf of Force 9 Energy to accompany an application for planning permission to construct and operate a wind farm development known as Craigton and Spittalhill Wind Farm in the Stirling Council area. Craigton and Spittalhill Wind Farm is located 12km south-west of Stirling and 7.5km to the east of Balfron (see **Figure 1.1** showing the application boundary and wider land ownership boundary).

1.2 As Craigton and Spittalhill Wind Farm will have a maximum generating capacity of less than 50 megawatts (MW), Force 9 Energy will submit an application for planning permission to Stirling Council under the Town and Country Planning (Scotland) Act 1997, as amended by The Planning etc. Act (Scotland) 2006[i]. The application has been prepared as a 'Major Development' application under the Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009[ii] on the basis that the total installed capacity of the wind farm is anticipated to be 20MW or over.

1.3 The application is accompanied by this Environmental Statement (ES) which has been undertaken in accordance with the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 ('the EIA Regulations')[iii]. The ES presents information on the identification and assessment of the likely environmental effects of Craigton and Spittalhill Wind Farm. Further details of the statutory requirements for Environmental Impact Assessment (EIA) are set out in **Chapter 2: Approach to the EIA**.

The Proposal

1.4 The Development is described in detail in **Chapter 4: Development Description** of this ES. In summary, it will comprise:

- up to seven turbines of up to 125m (to tip) height, with a maximum combined output of 21 megawatts (MW);
- an electrical substation;
- onsite underground electrical cables;
- onsite access tracks;
- crane hardstandings;
- a permanent meteorological mast;
- a temporary site construction compound/laydown area;
- a control building;
- two borrow pits;
- site signage.

1.5 The operational life of the Development will be 25 years. In addition, 12 months are required for construction and, following the 25-year operational period, 12 months are set aside for decommissioning. Decommissioning would involve the removal of the turbines and all above ground components. Alternatively, subject to further consent, the life of Craigton and Spittalhill Wind Farm could be extended.

The Applicant

1.6 Force 9 Energy is a dedicated wind farm development company with offices in Scotland and England and with a focus on the UK market. To date Force 9 Energy has taken six developments through planning, four of which will have been consented without appeal or Public Inquiry, one of which was consented on appeal, and one of which was refused after public inquiry. Two of those developments are now in operation, one is under construction, one is in pre-construction and work is on-going to discharge planning conditions on the remaining consented project. The remaining consented development is likely to be in construction during 2013. Force 9 Energy is continuing to expand its wind farm development portfolio in response to the Government's targets for energy generation from renewable sources and is currently awaiting determination of a further four wind farm planning applications.

1.7 Force 9 Energy has a joint development agreement with EDF Energy Renewables (EDF). Through the agreement Force 9 Energy leads on the development process of wind farm proposals up to the start of construction. Should a wind farm be consented, EDF will take the lead during construction and subsequently own and operate the wind farm. Force 9 Energy is supported by EDF both financially and with staff resources requested by Force 9 on issues such as grid studies, access studies and public relations.

1.8 Further details of Force 9 Energy's approach to wind farm development are provided in **Chapter 3: Site Selection and Design Strategy**.

Legislative Requirements for Environmental Impact Assessment

1.9 As Craigton and Spittalhill Wind Farm exceeds the thresholds for wind farms set out within Schedule 2 of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011[1], and as it is considered that the scheme could potentially result in significant impacts, an Environmental Impact Assessment (EIA) is required. Where an EIA is required, the information must be provided to the determining authority by the applicant in the form of an ES. This ES presents the findings of the EIA undertaken for Craigton and Spittalhill Wind Farm.

Climate Change and Renewable Energy

1.10 The impacts of climate change are widely recognised as being one of the greatest global environmental and social challenges facing the world today. A major cause is a rise in the concentration and volume of greenhouse gases in the atmosphere, a major contributor to which is the growing use of fossil fuels to generate power.

1.11 The European Commission's Green Paper, 'Towards a European strategy for the security of energy supply', highlights the importance of diversity of energy supply and of energy generation within the European Union (EU), along with an emphasis on increasing energy from renewable sources[iv].

1.12 Renewable sources of energy ('renewables') are those that are not based on finite reserves. Using wind to generate electricity creates very little carbon dioxide (CO_2) or other air pollutants, and therefore is a cleaner form of electricity generation than fossil fuels. It is also recognised that the development of a diverse range of electricity generating technologies contributes to reducing the risks related to the supply and cost of electricity. In March 2007, the Heads of Government of the EU agreed to adopt a new European Climate and Energy Policy. In December 2008, the package of measures comprising the European Climate and Energy Policy were agreed by the member states. As part of this, a binding target to generate 20% of the energy consumed in the EU from renewables by 2020 was agreed. This has been given legal effect by Directive 2009/28/EC on the promotion of the use of energy from renewable sources[v]. This target includes all energy consumption and is not restricted to electricity. The UK is committed to the generation of 15% of energy from renewable sources by 2020.

1.13 The UK Government set a domestic goal of reducing CO_2 emissions to 20% below 1990 levels by 2010, and in 2006 launched the UK Climate Change Programme. This programme outlines the target areas and policies through which it aims to achieve this domestic target. Renewable sources of energy are a

[1] 1 (i) the installation of more than 2 turbines; (ii) the hub height of any turbine or height of other structure exceeds 15m.

major element of this climate change programme. Government energy policy recognises that UK renewable energy generation contributes to the diversity and security of the UK electricity supply.

1.14 On 26 November 2008, three statutes received Royal Assent that, together, provide a framework for UK climate and energy policy: the Climate Change Act 2008[vi], the Planning Act 2008[vii] and the Energy Act 2008[viii].

1.15 The Climate Change Act 2008 sets a target to reduce the emission of greenhouse gases in the UK by 80% of 1990 levels by 2050. Within Scotland, the Climate Change (Scotland) Act 2009[ix] received assent on 4 August 2009. The Act creates the statutory framework for greenhouse gas emissions and reductions in Scotland by setting an interim 42% reduction target for 2020, with power for this to be varied on expert advice, and an 80% reduction target for 2050.

1.16 To meet these ambitions targets, the Scottish Government Climate Change Delivery Plan[x] has been prepared to target investment and effort across a range of relevant sectors, and renewable energy has an essential place in the strategy.

1.17 The Scottish Government issued the Renewables Action Plan (RAP)[xi] in June 2009 that identifies what is required in the renewable energy sector to achieve Government objectives. The RAP refers to the necessary actions to address climate change (demonstrated by Scotland's world leading carbon reduction target of 42%) and mentions that this imperative is driving development across a range of policy interests. It makes reference to the Scottish Government's commitment to achieve a headline target of 20% of Scottish energy use coming from renewable sources by 2020. The RAP sets out the framework for action in the specific area of renewable energy. Key objectives include:

- to establish Scotland as a UK and EU leader in the field;
- to ensure maximum returns for the Scottish domestic economy;
- to meet targets for energy from renewables, and for emissions reductions, to 2020 and beyond.

1.18 Scotland's current renewable energy target is to deliver the equivalent of 100% gross annual electricity demand from renewable sources by 2020[2]. Following announcement of the new renewables targets, the Scottish Government published the 2020 Routemap for Renewable Energy in July 2011[xii]. This is an update and extension to the RAP. An update to the Routemap was published in October 2012 which set out an interim renewable energy target of 50% by 2015[xiii].

1.19 Scottish Planning Policy (SPP)[3] (February 2010)[xiv] maintains the importance of tackling climate change and, in particular, addresses the need to reduce greenhouse gas emissions and continue to develop renewable energy resources. Further detail on SPP is provided in **Chapter 5: Planning Policy Context**.

1.20 The Development has been proposed in response to these requirements for renewable energy production.

Scotland's Wind Resource

1.21 Scotland has a significant wind resource according to a report on the regional renewable energy assessments commissioned by the Department of Trade and Industry[xv].

1.22 The Scottish Executive report, 'Scotland's Renewable Resource 2001'[xvi], considered a range of available renewable energy technologies, examining associated development constraints and costs. The key conclusion relating to onshore wind development was that the resource is widespread and is the cheapest of the technologies considered. On this basis, onshore wind energy can be expected to contribute to the bulk of near-term government targets.

1.23 The UK Government and the Scottish Government are committed to ensuring that an increased proportion of electricity is generated from wind power and other renewable energy sources. Improvements in technology and rising fossil fuel costs have also resulted in the cost of wind power converging towards the costs of conventional sources of electricity.

[2] Target announced by First Minister Alex Salmond on 18th May 2011.

[3] Consultation on the revised SPP closed in July 2013. The new SPP is expected to be published in June 2014.

Benefits of Wind Power

Avoided Pollutant Emissions

1.24 The principal atmospheric pollutants produced by burning fossil fuels are CO_2, sulphur dioxide (SO_2), and oxides of nitrogen (NO_X). In contrast, the harnessing of wind energy is non-consumptive and produces no gases or other by-products. The key environmental benefit of Craigton and Spittalhill Wind Farm will be the generation of electricity from a renewable energy source that will reduce or avoid the use of fossil fuels through the displacement of electricity generated from other sources of energy.

Energy Balance

1.25 The comparison of the energy used during the manufacture and construction of a power station with the energy generated during its operation is known as the energy balance. The energy balance can be expressed in terms of energy pay-back time, which is the time needed to generate the equivalent amount of energy used in manufacturing and constructing the power station.

1.26 An Economic Development Committee of The Welsh Assembly Government Review of Energy Policy in Wales[xvii] states that wind power has the shortest energy pay-back time, typically taking only a few months of operation for a wind turbine to pay for itself in energy terms. The energy invested in manufacturing a wind turbine is typically paid off within six to nine months of operation[4xviii].

CO_2 Emissions

1.27 The purpose of Craigton and Spittalhill Wind Farm is to generate electricity from a renewable source of energy, offsetting the need for power generation from the combustion of fossil fuels. Consequently, the electricity that will be produced by the Development results in a saving in emissions of carbon dioxide (CO_2) with associated environmental benefit. The 'payback time' is defined as the length of time (in months) required for the Development to be considered a net avoider of emissions rather than a net emitter. The calculation of payback time includes a consideration of emissions resulting from the construction and operational phases of the Development, and the quantification of the carbon storage loss as a result of loss of peat within the site (expressed as CO_2 emissions).

1.28 Assuming a requirement for backup generation capacity of 5%, the expected payback time is calculated to be approximately 2 years or 24 months. With a 25 year operational life, this would mean that the Development would save over twelve times the carbon emissions generated.

Environmental Statement

1.29 This ES reports the findings of the assessment of the likely environmental effects of Craigton and Spittalhill Wind Farm during construction and operation. The assessment forms part of the wider process of EIA, which is undertaken to ensure that the likely significant effects, both positive and negative, of certain types of development are considered in full by the decision maker prior to the determination of an application for development consent or planning permission.

1.30 The objectives of the ES are summarised as follows:

- to establish the existing environmental conditions of the site and surrounding area;
- to identify both positive and negative potential effects that may arise from the construction and operation of Craigton and Spittalhill Wind Farm, taking account of its size and location, the sensitivity of the local environment, the concerns of interested parties and the requirements of statutory consultees;
- to predict and evaluate the extent and significance of potential effects;
- to identify and evaluate possible mitigation measures to reduce any adverse effects;
- to identify residual effects.

[4] The figure of six to nine months relates only to the manufacture of the wind turbines. The assessment of pay-back time also takes into several other factors associated with construction of the Development including transportation and carbon loss through felling.

1.31 The general methodology for the ES is detailed in **Chapter 2**. The ES has been prepared by LUC with input from specialists as outlined in **Table 1.1** below:

Table 1.1: Structure of the Environmental Statement and Responsibilities

Chapter Number	Description	Organisation Responsible
Chapter 1	**Introduction** provides a brief introduction to the scheme, the legislative requirements and outlines the structure of the ES.	LUC
Chapter 2	**Approach to the EIA** provides more detail on the EIA process including consultation.	LUC
Chapter 3	**Site Selection and Design Strategy** summarises the reason for selection of the chosen site. The approach to the design strategy and layout modifications is also detailed.	LUC and Force 9 Energy
Chapter 4	**Development Description** provides a detailed description of Craigton and Spittalhill Wind Farm (including Borrow Pit Assessment and outline Peat Management Plan).	LUC, Grontmij and Mouchel
Chapter 5	**Planning Policy Context** summarises the national, regional and local planning policy relevant to Craigton and Spittalhill Wind Farm.	LUC
Chapter 6	**Landscape and Visual Amenity**	LUC
Chapter 7	**Noise**	Hayes McKenzie
Chapter 8	**Geology, Hydrology and Hydrogeology** (including Peat Stability Assessment)	Mouchel
Chapter 9	**Ecology**	MacArthur Green
Chapter 10	**Ornithology**	MacArthur Green
Chapter 11	**Archaeology and Cultural Heritage**	CgMs
Chapter 12	**Access, Traffic and Transport**	Grontmij
Chapter 13	**Socio-Economics**	LUC
Chapter 14	**Other Issues**	LUC, Mouchel and The Wind Consultancy Service
Chapter 15	**Summary**	LUC

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

- *Introduction*: provides a description of the study area and outlines the effects which have been assessed in full, and those which have been 'scoped out' of the EIA;
- *Assessment Methodology*: summarises the key methods used in the assessment (desk based study, field survey, consultation and consideration of significance of effect);
- *Planning Policy*: cross refers to the relevant planning policy detailed in **Chapter 5**;
- *Existing Conditions*: summarises the baseline situation, including field survey results where appropriate. A description of how the baseline situation might change if Craigton and Spittalhill Wind Farm were not to be built is also provided;
- *Wind Farm Layout Considerations*: describes the constraints taken account of in designing the layout and any modifications to it as part of the iterative design process;
- *Assessment of Effects*: provides an overview of the type of effects considered in the assessment;
- *Construction Effects*: describes the predicted effects, proposed mitigation and residual effects associated with construction of Craigton and Spittalhill Wind Farm;
- *Operational Effects*: describes the predicted effects, proposed mitigation and residual effects associated with operation of Craigton and Spittalhill Wind Farm;
- *Cumulative Impact Assessment*: describes the incremental construction/operation effects associated with adding Craigton and Spittalhill Wind Farm to the other wind farms being considered in the cumulative assessment, i.e. the additional effects resulting from Craigton and Spittalhill Wind Farm if all other developments are assumed to be constructed or operational. Proposed mitigation measures and residual cumulative effects are also described;
- *Further Survey Requirements and Monitoring*: describes any additional survey work or monitoring proposed;
- *Summary of Effects*: includes a table summarising the significance of effects including mitigation measures and residual effects.

1.33 The ES is prefaced by a Non-Technical Summary (NTS) of its findings. A stand-alone NTS has also been produced to accompany the application.

1.34 The planning application is also supported by two mandatory stand-alone reports which are required for applications for Major Developments:

(i) A Pre-Application Consultation Report, which sets out the steps which have been taken to comply with the requirements for consultation;

(ii) A Design and Access Statement, which sets out the design principles and concepts that have been applied in developing the wind farm layout and explain how issues relating to access for the disabled have been taken into account.

1.35 In addition, a separate Planning Statement has been prepared by LUC. The Planning Statement does not form part of the ES. Its purpose is to assess the Development in the context of the relevant Development Plan and other material considerations that may affect the proposal.

[i] The Town and Country Planning (Scotland) Act 1997, as amended by: (2006) The Planning Act (Scotland) 2006
[ii] The Town and Country Planning (Hierarchy of Development) (Scotland) Regulations 2009
[iii] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011
[iv] European Commission (2000), Green Paper: Towards a European strategy for the security of energy supply
[v] The European Parliament and the Council of the European Union (2009), Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
[vi] OPSI (2008), Climate Change Act 2008
[vii] OPSI (2008), Planning Act 2008
[viii] OPSI (2008), The Energy Act 2008
[ix] OPSI (2009), The Climate Change (Scotland) Act 2009
[x] The Scottish Government (2009), Climate Change Delivery Plan: Meeting Scotland's Statutory Climate Change Targets
[xi] The Scottish Government (2009), Renewables Action Plan
[xii] 2020 Routemap for Renewable Energy in Scotland (2011)
[xiii] The Scottish Government, (2012), 'Update to 2020 Routemap for Renewable Energy', Available [online] at: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/UpdateRenewableRoutemap, Last accessed on: 23/11/2012.
[xiv] The Scottish Government (2010), Scottish Planning Policy
[xv] OXERA (2002) Regional Renewable Energy Assessments, 2002: A report to the DTI and DTLR by OXERA Consulting Ltd
[xvi] Scottish Executive (2001). Scotland's Renewable Resource 2001, Garrad Hassan and Partners Limited
[xvii] Welsh Assembly Government (2003), Economic Development Committee (2003) Review of Energy Policy in Wales
[xviii] Vestas Wind Systems (2005), Life Cycle Assessment of Offshore and Onshore sited wind power plants based on Vestas V90-3.0MW Turbines, Vestas Wind Systems A/S

2 Approach to the EIA

Introduction

2.1 Environmental Impact Assessment (EIA) involves the compilation, evaluation and presentation of any potentially significant environmental effects resulting from a proposed development, to assist the consenting authority in considering and determining an application. Early identification of potentially adverse environmental effects also leads to the identification and incorporation of appropriate mitigation measures into the project design to avoid, reduce, and if possible, remedy potentially significant adverse environmental effects.

2.2 This chapter sets out the broad methodology that has been used in the EIA for the Development. It provides an overview of the key stages that have been followed, in line with EIA good practice.

The EIA Process

EIA Regulations

2.3 The ES has been prepared in accordance with the latest regulations and advice on good practice, comprising:

- Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 ('The EIA Regulations')[i];
- Planning Circular 3 2011 Guidance on The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011[ii];
- The Scottish Government Online Onshore Wind Turbines Information, modified October 2012)[iii];
- Planning Advice Note 1/2013 Environmental Impact Assessment (2013)[iv];
- Institute of Environmental Management and Assessment (IEMA) (2004) Guidelines for Environmental Impact Assessment[v];
- Scottish Natural Heritage (SNH) (updated and extended in 2009 and published in 2009) A Handbook on Environmental Impact Assessment: Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland (3rd Edition)[vi].

2.4 Schedule 4 Part 1 of the EIA Regulations[vii] sets out the information "*reasonably required to assess the environmental effects of the development and which the applicant can, having regard in particular to current knowledge and methods of assessment, reasonably be required to compile*". This includes the following:

- a description of the development including information on the physical characteristics of the whole development and land use requirements during construction. A description of the nature and quantity of materials used is also suggested for inclusion along with consideration of any emissions from the development (including water, soil, noise etc.).
- an outline of the main alternatives considered by the applicant and an indication of the reason for the choices made.
- a description of the aspects of the environment likely to be significantly affected by the development.
- a description of the likely significant effects of the development (including direct, indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative).
- a description of the measures envisaged to avoid, reduce and, if possible, prevent potentially significant adverse environmental effects (mitigation measures).
- a non-technical summary of the above information.
- an indication of any difficulties encountered during compilation of the ES.

2.5 Schedule 4 Part 2 of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011[viii] requires that an Environmental Statement should include at least:

- a description of the development comprising information on the site, design and size of the development;
- a description of the measures envisaged in order to avoid, reduce and, if possible, prevent significant adverse impacts (mitigation measures);
- the data required to identify and assess the main impacts[1] which the development is likely to have on the environment;
- an outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for this choice, taking into account the environmental impacts;
- a non-technical summary of the above information.

Good Practice Guidance

2.6 Scottish Planning Circular 3 2011 and Planning Advice Note 1/2013 provide guidance on good practice. The key steps to be followed in the EIA process are:

Scoping

2.7 Undertake a scoping exercise to establish likely significant effects.

Baseline Studies

2.8 Examine, through baseline studies, the environmental character of the area likely to be affected by the development.

2.9 Identify relevant natural and man-made processes which may already be changing the character of the site.

Predicting and Assessing Effects

2.10 Consider the possible interactions between the proposed development and both existing and future site conditions.

2.11 Predict and assess the possible effects, both negative and positive, of the development on the environment.

Mitigation

2.12 Introduce design and operational modifications or other measures to avoid, minimise or mitigate adverse effects and enhance positive impacts.

EIA and Design Process

2.13 EIA should be treated as an iterative process, rather than a one-off, post design environmental appraisal. In this way, the findings from the EIA can be fed into the design process, to avoid, reduce and if possible, remedy environmental effects. This approach has been followed in the design of Craigton and Spittalhill Wind Farm. Where potentially adverse environmental effects were identified through preliminary investigations as part of feasibility work, or later in the detailed EIA, consideration was given as to how the scheme design should be modified to design out adverse environmental effects, or where this was not possible, to determine appropriate mitigation. This process is explained further in **Chapter 3: Site Selection and Design Strategy** and in the subsequent assessment chapters (**Chapters 6** to **14**).

Scope of the Environmental Statement

2.14 To determine which aspects of Craigton and Spittalhill Wind Farm are likely to give rise to environmental effects and to inform the requirements for the ES, a Scoping Report was submitted to Stirling Council in September 2012, outlining the potential environmental effects proposed to be considered in the EIA. The

[1] Section 11.2 of the IEMA EIA Guidelines states that whilst distinguishing between the characteristics of an 'impact' and the significance of the 'effect' can be helpful, the distinction between 'impact' and 'effect' may not necessarily be appreciated by the public and requires a high level of rigour to ensure that the two terms are used in a consistent fashion. For simplicity, the term 'effect' has been used throughout this ES.

Scoping Report identified all potentially significant environmental effects of Craigton and Spittalhill Wind Farm and highlighted the key issues proposed for consideration in the ES.

2.15 The purpose of scoping is to ensure that the EIA focuses on the key environmental issues. Therefore, the Scoping Report sought to focus the EIA on the main effects, with each of the topic-based chapters within the Report setting out a provisional list of potential effects and a second provisional list of non-significant effects to be 'scoped out' of full assessment. These were drafted on the basis of the findings of the preliminary survey work undertaken, the professional judgement of the EIA team, experience from other projects of a similar nature and policy guidance and standards of relevance to the topic area in question.

2.16 On this basis, whilst a range of possible effects has been investigated as part of the EIA process, only effects identified as being of potential significance prior to the implementation of the proposed mitigation measures have been addressed fully in the ES.

2.17 Stirling Council responded to the submission of the Scoping Report in October 2012 and provided a Scoping Opinion. The Scoping Opinion included comments received from a number of consultees and a summary of the issues raised in response to the Scoping Report is provided in **Table 2.1**.

2.18 In addition to the consultees contacted during the formal scoping process, a number of other stakeholders were contacted by both LUC and topic specialists to obtain background information to further inform the EIA and allow them the opportunity to raise any concerns that they might have in relation to Craigton and Spittalhill Wind Farm. Details of these consultations are provided in **Chapters 6** to **14**.

Topic Areas Scoped Out

2.19 Planning Circular 3/2011 provides advice on the general requirements relating to the preparation and content of an ES and states:

> "*Whilst every ES should provide a full factual description of the development, the emphasis of Schedule 4 [of the EIA Regulations] is on the 'main' or 'significant' environmental effects to which a development is likely to give rise. Other impacts may be of little or no significance for the particular development in question and will need only very brief treatment to indicate that their possible relevance has been considered.*"

2.20 In line with this guidance, where no significant effects have been identified for a particular topic these have been 'scoped out' and given only brief treatment in the relevant topic chapters.

Table 2.1: Craigton and Spittalhill Wind Farm Scoping Responses

Consultee	Issues Raised	Action Taken
Stirling Council (Policy and Planning)	**General** • Highlighted that the topics to be covered in the Environmental Statement (ES) are appropriate for the development. **Local Policy Context** • Stated that the Craigton and Spittalhill Wind Farm site lies within an 'Area of Significant Protection' as shown on the Council's interim windfarm location policy and guidance. Advised that EIA should set out clearly why development in this area would be acceptable.	No action required. **Chapter 5: Planning Policy Context** sets out the main policies of relevance and the accompanying **Planning Statement** assesses compliance against the relevant planning policy framework.
Stirling Council (Landscape and Visual)	**Viewpoint Selection** • Highlighted that the number of viewpoint locations (13) as set out in the Scoping Report is below the average number of viewpoints typically included in a Landscape and Visual Impact Assessment (LVIA). Stated that the number and location of viewpoints can be agreed through further discussions. **Cumulative Developments** • Highlighted that the status of Craigannet Wind Farm is currently at appeal rather than being under construction, as highlighted in the Scoping Report Draft Cumulative Wind Farm List.	Suggested viewpoints provided were considered in relation to theoretical visibility. Final viewpoints were subsequently agreed with Stirling Council following requests for additional viewpoints during consultation. Craigannet Wind Farm was refused following appeal and consequently scoped out of the cumulative landscape and visual assessment.
Stirling Council (Environmental Health)	**Noise** • Advised that the latest Scottish Government web based guidance concerning noise effects should be used for the EIA. • When determining baseline background noise at potential receptors, noise from existing or consented wind farm developments within 2km of Craigton and Spittalhill Wind Farm site should be excluded, in line with ETSU-R-97. • If background noise data already exists for the proposed receptor locations then this should be used. This will reduce the likelihood of data contamination, and different noise limits being established for different windfarms which affect the same property. **Contaminated Land** • Contaminated land should be scoped out of the EIA once it is confirmed that contaminated land effects are unlikely to occur.	**Chapter 7: Noise** presents an assessment carried out according to the recommendations of ETSU-R-97, as referred to within the latest Scottish Government web based guidance. Noise limits derived from background noise measurements at Todholes from the Carron Valley Wind Farm ES have been used in the cumulative noise assessment. There is no evidence of the presence of contaminated land and consequently this has been scoped out of the assessment.

Consultee	Issues Raised	Action Taken
Stirling Council (Environmental Services - Roads)	Recommended that a detailed Transport Statement is provided covering the following: • Traffic generation during construction, operation and decommissioning phases of Craigton and Spittalhill Wind Farm, • Anticipated length of operations. • Assessment of traffic routes and road network (including bridges) to accommodate heavy loads during construction. • Proposed modifications. • Predicted traffic and transport effects. • Proposed mitigation. • Development of a Traffic Management Plan (TMP) to Stirling Council's satisfaction. • Section 96 of Roads (Scotland) Act 1984 covering extraordinary damage to the public road network.	An assessment of traffic and transport related effects, covering the points raised, is presented in **Chapter 12: Access, Traffic and Transport**. A Traffic Management Plan forms part of mitigation proposals.
Scottish Natural Heritage	**Strategic Locational Guidance** • Highlighted that site is within an area with some landscape sensitivities including Carron Valley (Zone 2 of Stirling Council's Strategic Locational Guidance (SLG) which is an 'An Area of Great Landscape Value'). • Stated that by careful choice of site location and design there is often scope to accommodate development within these areas. Advised that the EIA justifies the site location. **Nature Conservation Designations** • EIA to include consideration of likely impacts on designated sites in close proximity to the site, and ES to suggest mitigation to offset significant impacts on Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSI). • Highlighted that there is hydrological connectivity between Craigton and Spittalhill Wind Farm site and Endrick Water SAC via Backside Burn to the north. Due to there being the potential for particulate or chemical pollution of Endrick Water, pollution prevention measures should be implemented through a construction method statement as per SEPA Guidance, and this should be detailed in the ES. • Recommended that impacts on Firth of Forth SPA and Ramsar site, Slamannan Plateau SPA and Loch Lomond SPA can be scoped out as they are unlikely to be directly or indirectly affected by Craigton and Spittalhill Wind Farm. • SSSIs within 10km of the site are all unlikely to be affected by construction. • All new or/and existing access tracks are to be mapped in relation to designated sites. **Ecology (Excluding Birds)** • Otter surveys should be undertaken by licensed and experienced surveyors using recognised methodologies. • Bat surveys should be undertaken using SNH guidance -'Bats and Wind Turbines'. • Species Protection Plan to be included as part of the ES if evidence of either species is found. • ES to detail surveyors, methodologies, results and mitigation for the above surveys. • ES to detail habitat loss/modification likely from development of Craigton and Spittalhill Wind Farm, and present details of suitable mitigation measures. • ES to include how the effectiveness of mitigation measures will be monitored. • Recommended that effects on bats can be scoped out of the ES. Bat survey results should be included in the ES however.	**Chapter 6: Landscape and Visual Amenity** has detailed the sensitivity of the local landscape and provided a robust assessment of the likely landscape and visual effects. **Chapter 3: Site Selection and Design** and the **Design and Access Statement** provides the design and location justification. **Chapter 9: Ecology** has considered the likely effects on designated sites and any necessary mitigation measures. Effects upon the Endrick Water SAC fully assessed within **Chapter 9: Ecology**. Pollution prevention measures detailed within **Chapter 8: Geology, Hydrology, Hydrogeology and Peat** and referenced within **Chapter 9: Ecology** where relevant. These have been scoped out of the ecology assessment. This has been confirmed in **Chapter 9: Ecology**. There are no designated sites within the Development Area and those sites within 5km are identified in **Chapter 9: Ecology.** All protected species surveys have been undertaken by experienced and licenced surveyors. Bats surveys were undertaken with due consideration of current good practice guidance. Otter surveys completed during 2012. A Species Protection Plan (SPP) for otter is included in the mitigation proposals. Survey details are presented in the relevant appendix (**Appendices 9.1** to **9.5**). **Chapter 9: Ecology** provides details of the likely habitat loss and presents suitable mitigation measures. Mitigation measures to be monitored by an appointed Ecological

Consultee	Issues Raised	Action Taken
	• Experienced ecological surveyors to advise on what species are likely to be present on the site, and therefore what protected species surveys will be required. If species found, then a species protection plan is to be included as part of the ES. ES to detail surveyors, methodologies, results and mitigation for these surveys. • Any UK Biodiversity Plan (BAP) species recorded during mammal surveys to be given consideration. Mitigation measures to be detailed where necessary. • Details of reasons why any survey was not undertaken are to be included in the ES. • Phase 1 Habitat Survey to be undertaken for habitats within 250m of the proposed site. Survey to be accompanied by a species list of any rare or scarce plant species. • National Vegetation Classification (NVC) Survey to be carried out as suggested by Scoping Report. • Secondary effects on vegetation to be considered, assessed and mitigation proposals presented in the ES. **Bird Ecology** • Advised that impact on osprey, greylag goose and hen harrier be included in ES. • Full ornithological survey results including calculations and raw data to be included in ES. Information on direct and indirect impacts, as well as details of mitigation measures are to be presented. **Soil and Water** • Areas of deep peat are to be avoided and any remnant areas of peatland onsite are to be clearly mapped and to be used in routeing of proposed access and siting of other infrastructure. • Reference to be made to Scottish Government's guidance on peat slide hazard risk assessment if peat is identified on site during surveys. • EIA to demonstrate that there is a commitment to the restoration of borrow pits. • Effects on designated watercourses and waterbodies are to be considered in the EIA. **Recreation and Access** • Current recreational activities within the study area are to be identified, and an assessment of the significance of the positive and negative effects to be detailed in the ES. • EIA to detail the temporary and permanent effects of Craigton and Spittalhill Wind Farm on recreation and access. **Infrastructure** • Infrastructure to be taken into account in the consideration of potential effects. **Decommissioning** • EIA to assess the potential effects of both redevelopment and decommissioning of the site. • Additional consultation to be undertaken in advance of the year of decommissioning to ensure all natural heritage assets are taken into account.	Clerk of Works. Bat survey findings are provided in **Appendix 9.4**. SPP to be implemented for otter as agreed with the Local Authority in consultation with SNH. Otter listed in Stirling BAP. Likely effects on otter and necessary mitigation measures presented in **Chapter 9: Ecology**. All survey details are provided in **Appendices 9.1-9.5** with the rationale for the scope of survey work presented in **Chapter 9: Ecology**. The Phase 1 Habitat Survey report is presented in **Appendix 9.1.** The NVC Survey report is provided at **Appendix 9.2.** Secondary effects on vegetation have been considered in the assessment presented in **Chapter 9: Ecology**. Effects on osprey and greylag goose are considered in **Chapter 10: Ornithology**. Effects on hen harrier have been scoped out due to the very low levels of activity recorded during surveys. Ornithological survey results are presented in **Appendix 10.1** and Annexes. The wind farm design and layout has been informed by the findings of a peat depth survey (peat depths on site are shown in **Figure 8.6**) consequently the development footprint avoids areas of deeper peat. The approach to reinstatement is described in **Chapter 4: Development Description**. Effects on surface water and groundwater have been considered in **Chapter 8: Geology, Hydrology and Hydrogeology**. **Chapter 13: Socio-Economics** identifies current recreational activities within the vicinity of the Development Area and the likely effects of the Development on recreation and access as well as employment and the local economy. Infrastructure including proposed access tracks has been considered within the assessment of effects for all environmental topic areas. Decommissioning is considered in **Chapter 4: Development Description**. A decommissioning method statement will be prepared and agreed with the relevant statutory consultees prior to decommissioning of the site.

Consultee	Issues Raised	Action Taken
	Landscape and Visual Amenity • Advised that the *Stirling Landscape Sensitivity and Capacity Study 2007* highlights that there is no capacity in the landscape to accommodate Craigton and Spittalhill Wind Farm. • LVIA to address the offsite impacts of improving public roads i.e. the landscape and visual impacts of road alteration. Access tracks and borrow pits to be included in visualisations less than 10km from the site. LVIA of felling options is also recommended. • LVIA to present wirelines and photomontages for all selected viewpoints within 15km of the site. • Cumulative LVIA to distinguish between cumulative landscape effects, cumulative visual effects, static combined effects, static successive effects and sequential effects. • Craigton and Spittalhill Wind Farm should be designed in the context of the existing baseline. • Local authorities to be contacted for a current list of all known wind farm developments within the cumulative study area. • Choice of cumulative viewpoints for the illustration of cumulative visual impacts are to be based on the ZTV.	All relevant national and local guidance and policy has been considered during the design and assessment of the proposed Development. Provision of visualisations and graphics to support the assessment subsequently agreed with SNH. All LVIA viewpoints within 35km study area are represented by wirelines and photomontages. Methodology for LVIA and CLVIA has been developed to meet requested requirements and agreed during subsequent consultation.
Scottish Environment Protection Agency (SEPA)	**Disruption to Wetlands including Peatlands** • The ES should detail how the project layout takes impacts on wetlands and peatlands into consideration and should avoid such areas if possible. • A Phase 1 Habitat Survey and NVC survey should be undertaken and infrastructure to be overlain on habitat maps to show which areas will be affected. • Results from NVC and SEPA guidance to be used to determine if wetlands are groundwater dependent terrestrial ecosystems (GWDTEs). The location of roads or tracks within 100m, or borrow pits within 250m of groundwater ecosystems should be reconsidered and further assessment will be required if this is not possible. If avoidance of GWDTEs is not possible, potential impacts on wetlands should be detailed in ES (particularly relating to waste management, drainage and pollution. • Mitigation should be considered in a Construction Environmental Management Document. **Disturbance and Re-use of Excavated Peat** • Map of peat depths (detailing peat characteristics) to be submitted where project is located on wetland areas. • ES should detail volumes of surplus peat generated and how it will be re-used or disposed of. • Attention to be given to the waste management implications of surplus peat – landscaping with surplus peat may not be of ecological benefit and a waste management exemption may not apply. • An overall approach to minimise peatland disruption should be employed. **Engineering Activities in the Water Environment** • Engineering works in the water environment should be avoided where possible. Culverts, bridges, watercourse diversions, bank modifications or dams should be avoided unless there is no practicable alternative. Where a watercourse crossing cannot be avoided, bridging solutions or bottomless or arched culverts should be employed. • A Flood Risk Assessment (FRA) should be undertaken and incorporated into ES if required. • The ES should include details of site survey of all water features and a map of locations of all engineering activities should be included together with a	Wind farm layout design considerations in relation to surface water resources and peat are described in **Chapter 8: Geology, Hydrology and Hydrogeology**. Phase 1 Habitat and NVC surveys have been undertaken and findings are reported in **Appendices 9.1** and **9.2**, respectively. Groundwater Dependent Terrestrial Ecosystems identified, however, the primary source of water is not considered to be groundwater but rainfall and surface water run-off. Consequently no mitigation is proposed. **Figure 8.6** shows peat depths within the Development Area. An outline Soil and Peat Management Plan is presented at **Appendix 4.2**. The wind farm layout has been designed to avoid areas of deeper peat. The layout design strategy included the objective of minimising the number of watercourse crossings. One bridge crossing is proposed, along with other crossings for smaller streams, appropriately designed to suit local conditions and following the SEPA General Binding Rules under the Controlled Activities Regulations. Flood Risk has been considered in the assessment described in **Chapter 8: Geology, Hydrology and Hydrogeology**. **Chapter 8: Geology, Hydrology and Hydrogeology** presents a

Consultee	Issues Raised	Action Taken
	table detailing justification for the activity an how adverse impacts would be mitigated. A photograph and dimensions of the waterbody should also be included. • Measures to avoid or offset environmental impacts to be considered and may include: the removal of redundant weirs, creation of buffer strips, and provision of fencing along watercourses. **Pollution Prevention and Environmental Management** • All aspects of site work that might impact upon the environment, potential pollution risk associated with the proposals and principals of preventative measures and mitigation should be identified, and a draft Schedule of Mitigation produced. This will form the Construction Environmental Management document which should be included in the ES. • Advised to look at best practice guidance prepared by SEPA and SNH titled, 'Good Practice During Windfarm Construction' and Highland Council guidance titled, '*Construction Environmental Management Process for Large Scale Projects'*. **Existing Groundwater Abstractions** • Advised that a list groundwater abstractions within 100m of tracks, roads and trenches and 250m from borrow pits and foundations to be provided. If groundwater abstractions are identified within these buffers then engineering operations are to avoid these areas. Alternatively further investigation will be necessary to show that effects on abstractions are acceptable. **Water Abstraction** • ES to detail if a private or public water supply will be used if water abstraction is proposed. • Cumulative effects to be considered. **Borrow Pits** • The need for and assessment of impacts from borrow pits should be included in the ES and information regarding location, size, and nature should be detailed. **Flood Risk** • The site should be assessed for flood risk from all sources in line with Scottish Planning Policy (SPP). • If a flood risk is identified then a Flood Risk Assessment should be undertaken following SEPA guidance.	description of the existing hydrological conditions and features are shown in **Figure 8.2**. Proposed stream crossings are shown in **Figure 8.8** and **Figure 8.9**. A range of good practice measures and mitigation measures are set out in **Chapter 8: Geology, Hydrology and Hydrogeology**. Construction Method Statements and an Environmental Management Plan, detailing measures to avoid or mitigate potential effects, will be prepared prior to commencement of construction activity. A range of good practice guidance, including the suggested titles, has been considered during the iterative design process and EIA. No existing groundwater abstractions have been identified within or adjacent to the development area. No water abstraction is proposed. Two borrow pit search areas have been identified (described in **Chapter 4: Development Description** and shown in **Figure 4.1**) and have been considered in the effects assessment for all relevant environmental topics. A Borrow Pit Assessment is presented at **Appendix 4.1**. Flood risk has been assessed and is confined to the immediate vicinity of the Backside Burn channel and its confluence with Burnfoot Burn.
Historic Scotland	Recommended that contact be made with Stirling Council for information on all non-statutory cultural heritage features. Advised that the following statutory sites be considered in the EIA: **Direct Impacts** • Fintry Castle; • Double Craigs, hut circle; • Craigton, dun 460m North of Index no. 2556.	Stirling Council was contacted in this regard. These assets are no longer within the proposed Development Area due to a revision in the site boundary and there are no potential direct effects (indirect setting effects were still assessed in **Chapter 11: Archaeology and Cultural Heritage**).

Consultee	Issues Raised	Action Taken
	Impacts on Setting (Scheduled Monuments) *Scheduled Monuments* • Todholes, cairn 1300m NNW of Index no. 4491. • Todholes, cairn 1000m NNE of Index no. 2492. • Sir John de Graham's Castle (Index no. 4278). • Dunmore, fort (Index no. 2575). • Stronend, cairn at Summit of Gargunnock Hills (Index no. 7005). • Keir Knowe, motte 460m West of Easter Glinns (Index no. 2561). • Inchmahome Priory (Index no. 90169). *Listed Buildings and Gardens and Designed Landscapes* • Cardross House. • Gargunnock House. • Touch. Specified that cumulative photomontages be produced for Sir John de Graham's Castle, Todhole cairns and Stronend cairns.	**Chapter 11: Archaeology and Cultural Heritage** considers potential effects on the setting of the specified assets and appropriate visualisations are provided **(Figures 6.10, 6.11, 6.27, 6.28, 11.4, 11.5 and 11.6)**. **Chapter 11: Archaeology and Cultural Heritage** considers potential effects on the setting of the specified assets and appropriate visualisations are provided as above. Cumulative wireframes **(Figures 6.27, 6.28, 11.4, 11.5 and 11.6)** were supplied to Historic Scotland and it was confirmed that these provided sufficient information to assess effects.
Transport Scotland	Highlighted that traffic generation is likely to be minimal and therefore don't foresee any significant environmental effects on the trunk road network.	No action required.

Identification of Effects

2.21 To ensure the identification of key effects arising from Craigton and Spittalhill Wind Farm, the following principles were applied throughout the EIA process.

Significant Effects

2.22 The assessment of the significance of effects arising from Craigton and Spittalhill Wind Farm is a key stage in the EIA process. It is this judgement that is vital in informing the decision-making process.

2.23 As the significance of effects will differ depending on the context and the 'receptors' affected by Craigton and Spittalhill Wind Farm, there is no general definition of what constitutes significance. In EIA, the term significance reflects both its literal meaning of 'importance' and its statistical meaning where there is an element of quantification. This combination of judgemental/subjective and quantifiable/objective tests has become the standard approach to understanding and applying the test of 'significance'.

2.24 Specific significance criteria have been defined for the majority of topic areas, and these are listed in the topic chapters. As the specialists undertaking each element of the assessment have defined these criteria based on guidance/professional judgement, there is some variation. However, each of the sets of criteria is based on the following aspects:

- type of effect (adverse/beneficial);
- extent and magnitude of effect;
- nature of effect: reversible, irreversible, long term, short term;
- sensitivity of receptor;
- comparison with legal requirements, policies and standards;
- comparison with environmental thresholds.

2.25 Using the criteria in each chapter, the significance of the effects arising from Craigton and Spittalhill Wind Farm has been categorised, where possible, as follows:

- major;
- moderate;
- minor;
- negligible.

2.26 Effects of 'major' or 'moderate' significance are considered to be 'significant' in the context of the EIA Regulations.

Interrelationships between Effects

2.27 For the purposes of the ES, the potential effects of Craigton and Spittalhill Wind Farm are considered in terms of effects on each of the discrete environmental topic areas. In reality, topic areas such as ecology and hydrology are interrelated. Indirect and secondary effects resulting from the interaction of separate direct effects arising both within a topic area and interrelated with other topics areas are addressed within the ES.

Cumulative Effects

2.28 The EIA Regulations state that types of effect identified "*should cover direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects*." It is also important to consider the possible effects that the proposal may have in combination with existing, consented or other proposed developments or activities. Likely cumulative effects have been defined as the likely effects that Craigton and Spittalhill Wind Farm may have in combination with other developments which are at application stage, consented, under construction or operational (i.e. the incremental effects resulting from Craigton and Spittalhill Wind Farm if all other developments are assumed to be constructed/operated)[2]. Within the assessment chapters, a two stage approach to assessment has been adopted, with the second stage comprising the cumulative assessment:

Stage 1: construction and operational effects of Craigton and Spittalhill Wind Farm in isolation;

Stage 2: cumulative effects assessment of Craigton and Spittalhill Wind Farm with other nearby schemes. The schemes included in the cumulative assessment for each topic area are set out in the relevant chapters.

[2] A 'cut-off' date of 9 November 2012 was selected as a timescale for the inclusion of other developments in the cumulative assessment.

Mitigation and Enhancement

2.29 Part I (5) of Schedule 4 of the EIA Regulations states that the ES should include "*a description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment*." These measures have been termed 'mitigation' measures for the purposes of the Craigton and Spittalhill Wind Farm ES.

2.30 The EIA has identified, and assessed, likely significant effects prior to mitigation, and, where mitigation measures are proposed, their likely effectiveness has been examined and the significance of the 'residual' effect assessed. Force 9 Energy is committed to implementing all the mitigation measures identified in this ES.

2.31 It is important to note that given both Force 9 Energy's commitment to, and prior experience of, implementing accepted good practice during construction and operation of schemes such as this, and the current regulatory context, a number of measures are not considered 'mitigation' as such but rather an integral part of the design/construction process, and have been taken into account prior to assessing the likely effects of Craigton and Spittalhill Wind Farm. Where relevant, these good practice measures are described in the relevant topic chapters.

Monitoring

2.32 The ES sets out details of any post-consent monitoring which is proposed. This includes, where appropriate, proposals to measure the effectiveness of the identified mitigation measures.

Data Gaps and Uncertainty in Assessment

2.33 The EIA process is designed to assist informed decision-making, based on sound information about the environmental implications of a proposed development.

2.34 It is considered that the ES contains adequate information to enable Stirling Council to review and form a judgement on the likely significant environmental effects of Craigton and Spittalhill Wind Farm.

Consultation

2.35 Consultation has formed an integral part of the EIA process and the EIA team and Force 9 Energy contacted a number of interested parties to determine their views on the scheme, collect baseline information and to refine survey methodologies. Replies received from consultees in response to Scoping are detailed in **Table 2.1** and responses from other consultees who were contacted for further information to inform the EIA are detailed in the relevant topic chapters.

2.36 The responses received indicated that, generally, the scope of the ES had been defined appropriately. However, a number of consultees did highlight issues where further investigation or clarification was required. This has been highlighted and addressed where appropriate within the ES.

Consultation with Statutory and Non-Statutory Consultees

2.37 On-going consultations, including discussions relating to the landscape and visual effects assessment, cultural heritage, noise, ecology and ornithology assessments, were undertaken by the relevant specialists throughout the EIA process. Further details of these consultations are provided in the relevant specialist topic assessment **Chapters 6** to **14**.

Public Consultation and Public Exhibitions

2.38 Public consultation formed a key component of the iterative EIA process. The consultation undertaken by Force 9 consisted of three public exhibitions that were advertised in the Stirling Observer as well as by addressed letters to 51 households and businesses within a 5km radius of the proposed Development and also in addressed letters to 6 community councils whose area is within or neighbouring the site.

2.39 Full details of the public consultation undertaken for the Development is provided in the Pre-Application Consultation report which accompanies the application for planning permission.

2.40 Force 9 Energy held three public exhibitions between 23rd and 25th October 2012 in Kippen (1pm -8pm), Fintry (12pm – 8pm) and Howietown (12pm – 7:30pm). The timing of the events within the overall programme for the EIA enabled the findings of some of the environmental surveys and turbine layout to be presented whilst importantly providing an opportunity for comments and feedback received from the public to be taken into account.

2.41 The events were advertised in the Stirling Observer on the 10th and 12th of October 2012. Exhibition boards were used to display information about the Development and associated EIA. Force 9 Energy and LUC were present at the exhibitions to answer any queries and questions from members of the public. In total, 36 people attended the public exhibitions, 10 of whom completed the feedback form.

2.42 Meetings have also been held with Fintry Community Council (14th November 2012) and with the Fintry Development Trust (28th November 2012). A meeting planned for the 6th December 2012 with Carron Valley Community had to be postponed due to adverse weather conditions. An alternative date will be sought.

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[i] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (The EIA Regulations)

[ii] Scottish Government, 2011, Planning Circular 3 2011: The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011

[iii] Scottish Government, 2011, 'Onshore Wind Turbines', Scottish Government Renewable Energy Policy Subject, Available [online] at: www.scotland.gov.uk/Resource/Doc/212607/0114118.pdf, Last accessed on: 12/12/2012

iv Scottish Government, 2013, Planning Advice Note 1/2013: Environmental Impact Assessment

v Institute of Environmental Management and Assessment (2004) Guidelines for Environmental Impact Assessment

vi SNH (2009 Draft 2) A Handbook on Environmental Impact Assessment: Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland (3rd Edition)

vii The Town and Country Planning (Environmental Impact Assessment (Scotland) Regulations 2011, 'Schedule 4 Part 1', Available [online] at: http://www.legislation.gov.uk/ssi/2011/139/schedule/4/made, Last accessed on: 12/09/2012

viii The Town and Country Planning (Environmental Impact Assessment (Scotland) Regulations 2011, 'Schedule 4 Part 2', Available [online] at: http://www.legislation.gov.uk/ssi/2011/139/schedule/4/made, Last accessed on: 12/09/2012

3 Site Selection and Design Strategy

Introduction

3.1 This chapter provides details of the approach to the design of the wind farm and how, and why, the turbine layout and associated infrastructure has been modified during the iterative EIA process. This chapter also outlines the site selection process that was undertaken by Force 9 Energy prior to taking the site forward to the EIA stage.

Site Selection

3.2 Scottish Planning Policy (February 2010) provides support for wind development in principle and encourages local authorities to guide developments towards appropriate locations. It states that *"Development plans should support all scales of development associated with the generation of energy and heat from renewable sources, ensuring that an area's renewable energy potential is realised and optimised in a way that takes account of relevant economic, social, environmental and transport issues and maximises benefits."*

3.3 The site at Craigton and Spittalhill was selected by Force 9 Energy for a number of reasons, including the following:

- it has a good wind resource and is available for wind energy development;
- there are no international or national natural heritage or landscape designations within the Development Area;
- the Development Area is at distance from the nearest residential receptors;
- there are no radar or other technical constraints associated with the Development Area;
- there are grid connection options available;
- there is good access to the Development Area, for construction traffic and turbine deliveries; and
- the landscape is, in part, defined by the existence of the nearby Earlsburn Wind Farm.

3.4 Following on from this, more detailed feasibility work was undertaken, such as to inform the understanding of ornithological interests and possible landscape and visual effects as well as considering in more detail the potential wind yield. Much of this early work provided the foundation for the EIA. Further details on the iterative design process are provided below.

The 'Do-Nothing' Scenario

3.5 The 'do-nothing' scenario can be considered as the existing conditions, taking account of only clearly foreseeable changes over the lifespan of the Development. Effects of the Development have been assessed relative to this baseline. If the Development did not proceed, it is reasonable to assume that the management of the Development Area would be likely to continue as at present, as open moorland and rough grazing.

The Design Strategy

3.6 Preliminary feasibility work was undertaken by landscape architects from LUC for the proposed development site in July 2011, which explored the potential landscape and visual constraints related to development of a wind farm within an agreed land option boundary. This preliminary review identified objectives for avoiding and reducing potential landscape and visual effects, and would shape the proposed design strategy for the proposed Development.

3.7 The overall aim of the design strategy was to create a wind farm with a cohesive design that relates to the surrounding landscape, in line with appropriate published guidance[i]. The inherent nature of wind turbines as tall, modern structures means that the form of the wind farm as a whole is important, and a clear design strategy is necessary. The strategy therefore considered the appearance of the wind farm as an object or composition in the landscape as the primary factor in generating the layout.

Objectives of the Design Strategy

3.8 The objectives of the design strategy were as follows:

- to produce a layout that would relate well to its landscape setting and appear contained within its extents;
- to develop a layout that would appear cohesive and well considered from all aspects;
- to develop a layout that seeks to match the perceived scale of the turbines, and the scale of the overall Development, with the scale of the landscape;
- to develop a layout that relates to other wind farms in the local area as well as being coherent it its own right;
- to develop a layout that fulfils the above objectives whilst respecting other environmental constraints including ecological, hydrological and ground conditions (including peat) related constraints identified during the EIA process.

Scope of the Strategy

3.9 The design strategy sets out the overall approach to the development of the design of the wind farm. It describes the starting point for the wind farm design, and subsequent alterations to the layout that were made in response to landscape and visual, hydrological, archaeological, ecological, wind yield and ground conditions considerations as information emerged through the EIA process. During each design iteration, careful consideration was given to minimising effects on natural and heritage features whilst maintaining the objectives of the overall design strategy.

3.10 In the development of the designed layout, computer modelling was used as a tool to aid design. In particular, Zone of Theoretical Visibility (ZTV) models were created for the proposed Force 9 Energy layout and wireframes were generated for views from key locations around the site and used to 'test' the design in views from the surrounding area.

3.11 The key considerations in the iterative design process for Craigton and Spittalhill Wind Farm ('the Development') have been to relate the scale of the Development to the scale of the landscape; to consider the effect of the Development within the Fintry Hills alongside the existing pattern of wind farm development and the proposed future pattern of development located within the adjacent Gargunnock and Touch Hills; and to develop a layout which appears well-composed from all these aspects.

3.12 There are a number of other wind farms, operational, consented, valid planning application and scoping, within the 35km study area defined for the landscape and visual assessment (see **Chapter 6: Landscape and Visual Amenity**). The closest of the operational sites is Earlsburn Wind Farm, with the closest turbine located approximately 2km to the east. The consented Earlsburn North Wind Farm is located approximately 1.5km to the east, north-east of the Development. The importance of relating the Development to Earlsburn and Earlsburn North, and other wind farm sites, is so that they appear as part of a co-ordinated approach to wind farm development. Collectively, a unified appearance will help to minimise visual conflicts, with similarities in terms of relationship with landform, number of turbines and scale of turbines readily apparent in line with published guidance[ii]. Earlsburn, Earlsburn North and the Development occur in a landscape character type (LCT) classified as *Lowland Hills*: Fintry, Gargunnock and Touch Hills. The developments are similar in number of turbines, scale of turbines and follow a similar loose layout located across the elevated plateau of the Fintry, Gargunnock and Touch Hills, south of the Forth Valley.

Topography

3.13 The Fintry Hills provide a reliable wind resource in which to locate turbines as the hills are medium in scale, elevated above the surrounding lowland valleys and carse. These elevated lowland hills occupy a prominent position above the Forth Valley and the western extent of the Carron Valley, therefore wind energy development across these elevated hills would lead to extensive visibility across the study area. The Development site has been restricted to the lower eastern slopes of the hills to minimise potential visibility of the Development to the north-west, west and south-west, avoiding the southern and northern ridge lines and the west hill summits. The Development site and the surrounding Fintry Hills are marginal in terms of land use and as a result accommodate rough grazing rather than the more intensive agricultural farming found on the lower slopes to the west and in the Forth Valley to the north. This distinction is evident in the land cover which comprises predominantly grazed moorland and with some remnants of heather moorland across the upper summits. This adds to the upland character and accentuates the contrast with the lowlands. The uplands are more appropriate for wind farm development and result in a logical association between landscape and land use. The homogenous nature of the land-cover and lesser extent of field boundaries or other landscape features provides a simplicity that prevents awkward comparisons of scale from arising.

3.14 In order to mitigate landscape and visual effects, views in all directions from the site were considered to be of importance in determining the final turbine layout. This is due to the configuration of the Fintry, Gargunnock and Touch Hills as a wide west-east elevated plateau, with the steep scarps descending into the Forth Valley to the north, creating a distinct transition between lowland and upland character. Placing turbines on the northern ridges would increase the visibility of turbines in views from that direction and locating turbines on the southern edge of these hills would increase visibility of turbines across the Carron Valley, Campsie Fells and Kilsyth Hills to the south.

Design Approach

3.15 The approach to the design of the site has been to achieve a clean and simple layout which appears carefully composed from all directions. This is so that the turbines appear well spaced, with minimal overlapping or inconsistent spacing. Composition was especially important from the most sensitive receptors. Sensitive receptors to the north and north-west include the Loch Lomond and The Trossachs National Park, The Trossachs NSA (National Scenic Area), Loch Lomond NSA and the Rob Roy Way long distance walking route, residential receptors and settlements located within the Forth Valley to the north were also considered, including Kippen, Thornhill and Gargunnock. To the south, there are several residential receptors and small settlements at relatively close proximity, including Fintry to the south-west. Potential views from Scheduled Monuments, Garden and Designed Landscapes (GDLs) and Listed Buildings, the settled landscape of the Carron Valley and associated scenic designations were all considered during the design of the wind farm.

3.16 Early iterations showed that turbines located across the northern and western area of the Fintry Hills increased the extent of visibility to many of the close range lowland receptors, specifically to the north across the Forth Valley. Turbines located close to the southern ridge of the hills also increased potential visibility of turbines across the Carron Valley. Later iterations contained turbines further towards the south-east extents of the Development site to reduce visibility from the north across the Forth Valley through the Spout of Ballochleam and south of the ridge of the Fintry Hills north of Loch Walton and Cairnoch Hill within the Carron Valley.

3.17 Containing visibility of the proposed Development within the lowland hills of the Fintry, Gargunnock and Touch Hills was a key consideration of the layout design in order to minimise introducing visibility of turbines from the Forth Valley to the north of the steep escarpment formed by these hills. The consented Earlsburn North Wind Farm will introduce visibility of wind turbine blades above the horizon formed by the Gargunnock Hills, therefore the visibility and scale of the Earlsburn North turbines was considered in the design of the proposed Development layout in order to minimise introducing new visibility of turbines into views from the north.

3.18 The final layout is compact in extent with the seven turbines located in the south-eastern extent of the Development site, west of Backside Burn. This results in limited visibility of the turbines in views south through the Spout of Ballochleam, west across the elevated plateau of the Touch and Gargunnock Hills, and long distance views from elevated hill summits located across the study area. Very few locations within the study area will experience views of all seven turbines at their full extent (turbine towers, hubs and blades), with many views limited to visibility of blades tips and hubs. Further detail is provided in **Chapter 6: Landscape and Visual Amenity**.

Infrastructure

3.19 The access route to the Development site from the nearest public road utilises the existing access road to the Earlsburn Wind Farm, which is also the proposed access road for the proposed Earlsburn North Wind Farm, entering from the B818 at Todholes Farm, south of the Development site. New sections of access track will lead north-west from the existing track close to Todholes Cairn. The route was chosen to: minimise the additional access infrastructure required; avoid deposits of deep peat; minimise the number of water crossings required; and minimise the potential landscape and visual effects of an alternative route. Modifications to the public road between Denny and Todholes Farm (B818) in advance of the delivery of turbines to Earlsburn and Craigengelt Wind Farms during construction, means that minimal modifications will be required for turbine delivery vehicles for the proposed Development. The route chosen will involve road delivery of turbines from the M80 of M876 near Denny before following the A872 through Denny west and onto the B818 through the Carron Valley. This involves the least highway modification and disruption to road users and delivery of turbines has successfully implemented using this route.

3.20 Steep areas, which will require extensive earthworks to construct the turbines and tracks, and areas of deeper peat were avoided where possible and the choice of a primary access route from the south-east was heavily influenced by the desire to avoid construction of additional tracks across the steep slopes of the western Fintry Hills and the steep scarp north of the Spout of Ballochleam. The control building has been sited to follow the contours, to avoid interrupting the skyline in key views and to be located in the vicinity of other structures.

Scale

3.21 The Fintry and Gargunnock Hills are medium in scale and so it was important that the scale of the Development did not become as large as to overwhelm the scale of the landscape, in terms of both their vertical height and horizontal spread. The early iterations explored the possibility of an eight turbine layout. The final layout shows seven turbines, which is considered an appropriate number to be comfortably accommodated within the Fintry Hills, alongside the operational Earlsburn Wind Farm and the consented Earlsburn North Wind Farm, both located to the east of the Development site.

3.22 The height of the turbines in the early iteration was 125m to blade tip, with a proposed hub height of 80m and a rotor diameter of 90m. The subsequent design iterations specified the same turbine size, in order to maximise the energy yield of the scheme located within the lower eastern reaches of the Fintry Hills. Although opportunities were identified for increasing the elevation of the turbines into zones of higher wind speed across the slopes of the Fintry Hills to the west, this was deemed to compromise the limited visibility of the Development, therefore the use of the specified turbines at a lower elevation was deemed more satisfactory compromise between potential landscape and visual effects and energy yield.

Turbine Colour

3.23 The Scottish Natural Heritage (SNH) guidance paper, *Siting and Designing Windfarms in the Landscape (2009),* states that *"As a general rule for most rural areas of Scotland, a single colour of turbine is generally preferable ...a light grey colour generally achieves the best balance between minimising visibility and visual impacts when seen against the sky ... paint reflection should be minimised ... for multiple windfarm groups or windfarm extensions, the colour of turbines should generally be consistent"*. The turbines proposed for the Development are to be a non-reflective pale grey colour, to be consistent with other proposed wind farms in consultation with SNH.

Outcome

3.24 The application layout is based on the design strategy described above. In particular, the strategy seeks to create a design that reads coherently with the landscape, taking account of cumulative issues. The predicted landscape and visual effects of the wind farm are considered further in **Chapter 6: Landscape and Visual Amenity.**

Modifications to Scheme Design

3.25 As a consequence of the EIA process, there have been a number of modifications to the design, to avoid or minimise environmental effects without compromising the overall design strategy. These modifications have been made as a result of the findings of the baseline survey work and consultation undertaken with consultees and the public.

3.26 A summary of the modifications to the design of the wind farm is provided in **Table 3.1** below and these are illustrated in **Figure 3.1**. These modifications have included the relocation and reduction in the number of turbines to:

- minimise the visual effects of the Development in views from the wider landscape;
- avoid construction activity in areas of potentially deeper peat (see **Chapter 8: Geology, Hydrology and Hydrogeology**); and
- minimise the number of watercourse crossings required and ensure appropriate buffer distances between surface waters and turbine bases and associated infrastructure (see **Chapter 8: Geology, Hydrology and Hydrogeology**).

Table 3.1 Modifications to Scheme Design

Layout Number	No. of Turbines	Purpose of Modification
Layout 1	8 turbines	-
Layout 2 (Scoping Layout)	7 turbines	Reduction in number of turbines and turbine grouping moved to the south-east of the site to reduce landscape and visual effects. Visibility from the settlements of Kippen and Gargunnock removed as a consequence.
Layout 3 (Application Layout)	7 turbines	Minor adjustments (generally between 30m to 50m) to positions of all turbines following peat probing survey and hydrological walkover survey in order to establish an appropriate buffer in relation to watercourses and to avoid areas of potentially deeper peat.

[i] Scottish Natural Heritage. (2009). Siting and Designing Windfarms in the Landscape (Version 1)
[ii] Scottish Natural Heritage. (2009). Siting and Designing Windfarms in the Landscape (Version 1), Chapter 5.

4 Development Description

Introduction

4.1 This chapter describes the components of the Development for which planning permission is being sought and which have been assessed in the ES. It includes details about the construction of the Development as well as its operation, and includes measures proposed for the protection of the environment during these stages.

Description of the Development Area and Surrounding Area

4.2 The Development Area, including the land occupied by the access track and construction compound, occupies a total area of approximately 121 hectares (ha.). However, the actual Development will only occupy a small percentage of this area. The turbines are proposed to be located on elevations between 296m-333m Above Ordnance Datum (AOD).

4.3 The Development Area comprises an area of open moorland and rough grazing in the eastern Fintry Hills, approximately 12km south-west of Stirling and approximately 4.5km to the east of the village of Fintry. It lies wholly within the Stirling Council area.

4.4 The Fintry Hills are located at the north head of the Carron Valley Reservoir which is enclosed by the Campsie Fells to the west, the Kilsyth Hills to the south and the Gargunnock Hills to the north. Adjacent to the western Gargunnock Hills, the Development Area extends northwards from the valley of Endrick Water to the valley of Backside Burn and to within approximately 1km of the Spout of Ballochleam to the north. A network of burns form the watershed of the site feeding into Loch Walton and Endrick water to the south and Backside Burn to the north.

4.5 Several isolated farmsteads and residential properties are located in the surrounding valleys to the north, west and south of the Development Area, including the properties at Craigton and Spittalhill, and the settlements of Fintry, Kippen, Gargunnock and Carron Bridge within 10km of the site. Approximately 1km west of the Development Area is the operational Earlsburn Wind Farm.

Project Components

4.6 As outlined in **Chapter 1: Introduction**, the main components of the Development comprise:

- seven wind turbines (including external transformers) of up to 125m (to tip) height, with a maximum combined output of 21 megawatts (MW);
- crane hardstandings;
- onsite underground electrical cables;
- a control building;
- a permanent meteorological mast;
- a temporary site construction compound/laydown area;
- two areas within which it is proposed to win rock for wind farm construction (borrow pits);
- approximately 5km of onsite access tracks.

4.7 The proposed layout of the Development is shown in **Figure 4.1** (see also **Figure 4.1a Site Layout: General Arrangement**). Each component is described in further detail later in this chapter.

4.8 **Table 4.1** details the locations of the turbines and the permanent meteorological mast.

Table 4.1: Proposed Turbine Locations

Turbine ID	Easting	Northing
T1	266025	689180
T2	266129	688934
T3	266530	688748
T4	266703	688563
T5	266188	688661
T6	266406	688435
T7	266842	688306
Meteorological Mast	265800	689175

Wind Turbines

4.9 Permission is being sought for the erection of seven three bladed horizontal axis turbines (individual maximum capacity up to 3MW). The turbine hub height and rotor (blade) diameter will depend on the model of turbine selected, although all of the turbines will have a maximum height to blade tip of 125m. For the purpose of preparing the EIA, the indicative turbine dimensions used have been a hub height of 80m and rotor diameter of 90m.

4.10 The dimensions of the indicative turbines are illustrated on **Figure 4.2**. The blades will be made from glass fibre/carbon spar with glass fibre airfoil shells and the tower will be constructed from steel. The finish and colour of the turbines and blades are likely to be semi-matt and pale grey respectively.

4.11 Blades will rotate at approximately 9.6 to 17 revolutions per minute, generating power at all wind speeds between approximately 4 to 25 metres per second (m/s) (8.9 to 55.9 miles per hour (mph)). At wind speeds greater than 25 m/s, the turbines will shut down for self-protection.

Turbine Foundations and Crane Hardstandings

4.12 The turbines will be installed on foundations comprising both stone and steel-reinforced concrete. These typically measure 16m by 16m square in plan with a concrete depth of between approximately 3m and 3.5m and overlay of depth approximately 1m dressed back with topsoil to allow re-vegetation (**Figure 4.3**). Each foundation will require between approximately 400 and 500 cubic metres (m^3) of concrete. The detailed design, sizing and specification for each foundation will depend on the finally selected turbine type and the specific ground conditions encountered at each turbine location. The working area at each turbine will be 30m x 30m.

4.13 Adjacent to each turbine, an area of hardstanding approximately 30m x 40m will be constructed for use as a crane pad. The exact geometry and position of the crane pad will depend on the turbine suppliers standard procedures and the specific crane selected for erection. These areas will be levelled using cut and fill operations and surfaced in crushed stone to provide a durable surface. These hardstandings are used during the erection process as a platform for the cranes to lift the turbine components into position. During operation, the hardstanding provides safe access for maintenance and repairs which may also require the use of a crane. An indicative hardstanding arrangement is shown in **Figure 4.3.**

Transformers and Cables

4.14 Depending on the manufacturer selected, should the transformer not be located within the nacelle or tower, each turbine will require the installation of an external transformer close to the base of the tower. This will normally be placed within steel or glass reinforced plastic housing. The size of housing will depend on the type of transformer selected but in general it will be approximately 3 metres by 2.5 metres in plan and 2.5 metres in height above surrounding ground level.

4.15 The transformers will be either oil-filled with a bunded footing to remove any risk of spillage or a solid cast resin type which is effectively non-polluting. The transformers will increase the electrical voltage to 33 kilovolts (kV) and will be connected to the control building via underground high voltage (HV) cables.

4.16 Approximately 2.2km of cable trenches will be required for the 33kV cabling that will connect the turbine transformers to the control building. To minimise ground disturbance cable trenches will be excavated along the side of the access tracks where possible. Typical cable trench details are shown in **Figure 4.4.**

4.17 A Supervisory Control and Data Acquisition (SCADA) system will be installed to gather information from the individual wind turbines and provide the facility to control them from a central location. A fibre optic communications cable will run alongside the power cables to link the turbines to the SCADA system. The wind turbines can be monitored remotely via a telephone or data connection to the SCADA system.

4.18 An underground power supply and SCADA cable will connect the meteorological mast to the nearest turbine, allowing data to be transmitted onwards to the control building. It is anticipated that this will run alongside the access tracks and 33kV cable.

Grid Connection and Control Building

4.19 The Development will be connected to the national electricity network ('grid'). The grid connection will be subject to a separate consenting process. The grid connection will be made via a new line, which would typically be a wooden pole type line running from the location of the control building to the grid connection point.

4.20 Electrical power from the turbine transformers will be transferred to the electricity distribution system through a switchgear unit, housed within the control building. The control building will be located in the north of the site as shown on **Figure 4.1.**

4.21 An indicative plan and elevation of the control building is shown in **Figure 4.5**. The compound will comprise the control building and a fenced hardstanding area for vehicle access and parking. The single storey control building will have a pitched roof and measure 16.6m x 10.6m. The fenced compound will measure 33m x 17m. Subject to grid operator requirements, the building will house welfare facilities for visiting maintenance staff. Rainwater will be collected from the roof of the building via a gutter and inlet pipe to fill a header tank. Waste will be held in a closed system and removed by a licensed contractor at regular intervals. The building will be constructed in keeping with the local built environment. Any associated fencing would be either moorland green/brown or dark grey to blend with the existing landscape colours.

Meteorological Mast

4.22 A single permanent freestanding meteorological mast will be erected to aid performance monitoring of the wind turbines and to gather meteorological data throughout the lifetime of the Development. The mast will be located at NGR 265800 689175 (the location is shown on **Figure 4.1**). The mast will be of a lattice design and will have a maximum height of 80m (**Figure 4.6**).

Temporary Construction Compound/Laydown Area

4.23 A temporary construction compound of 50m x 30m will be located at (NGR) 266450, 688720 as shown on **Figure 4.1**. This location has been chosen to be central to the development but at sufficient stand-off distance from watercourses.

4.24 The construction compound will consist of a hardstanding area upon which will be accommodated temporary site offices, car parking, storage, and welfare facilities for site staff. A temporary laydown area approximately 30m x 7.5m in size will also be established at this location. This laydown area would be used to store turbine components, plant and materials, for the duration of the works.

4.25 An indicative construction compound is shown in **Figure 4.8**.

4.26 The compound will contain provision for fuel storage, an electrical generator and a temporary septic tank. The fuel storage area will be above ground with necessary secondary containment in accordance with the Scottish Environment Protection Agency (SEPA) standards (PPG7 and PPG8) and will be situated a minimum of 50m from watercourses to reduce the risk of pollution to watercourses;

4.27 The compound site will be restored to its current condition once construction is complete and turbines are operational.

Borrow Pits

4.28 It is estimated that approximately 30,000m^3 of stone aggregate will be required for construction of the Development (including permanent and temporary access tracks, structural fill beneath turbine foundations and crane hardstandings). Two potential borrow pit areas ('search areas') are proposed. The location of the borrow pit search areas has been influenced by the likely availability of stone and by onsite environmental characteristics, including topography, peat depth, ecology (habitats), surface hydrology and potential visibility from surrounding areas, and which will allow successful restoration measures to be put in place as appropriate. The two search areas for the potential borrow pits are shown on **Figure 4.1**.

4.29 Further details are presented in **Appendix 4.1**: Borrow Pit Assessment which identifies a preferred borrow pit location.

4.30 Based on the rock type anticipated to be encountered, it is unlikely that the crushed rock would be suitable for use as concrete aggregate. The volume of concrete required for the construction of the turbine foundations is estimated to be 420m^3 per turbine (or a total of 2940m^3 for 7 turbines). For the purposes of assessment, it has been assumed that concrete will be delivered by lorry from a local off-site concrete batching plant.

Site Access from Public Road Network

4.31 It is proposed that the Development Area will be accessed via the existing Earlsburn Wind Farm access track which connects to the B818 in the vicinity of Todholes to the south.

4.32 Details of the proposed vehicle movements during construction and operation of the Development are provided in **Chapter 12: Access, Traffic and Transport**.

Onsite Access Tracks

4.33 A new access track will be constructed to facilitate access to the turbines and other infrastructure locations as shown on **Figure 4.1**. The new track will branch-off from the existing Earlsburn Wind Farm access track at a point just before it crosses the Endrick Water. In total, approximately 5km of new onsite access track will be constructed.

Track Design

4.34 The design of the access track layout was based on the following objectives:

- to facilitate safe access to each turbine, avoiding deeper areas of peat and maintaining a sufficient buffer from watercourses;
- to minimise requirements for passing places and turning areas;
- to minimise environmental effects, including effects on protected species and habitats, areas of archaeological interest and the local hydrological regime;
- to keep overall track length to a minimum, thus reducing stone requirements and associated potential environmental effects;
- to follow the existing ground topography as much as possible, minimising the necessity for slope cuttings and embankments and associated visual effects.

4.35 Passing place construction will be minimised through consideration of the layout of junctions or turbine hardstandings which can generally be used by traffic as an alternative to dedicated passing places. The passing places are not shown on any of the figures accompanying this ES as their locations will be established during construction. They will, however, be sited to avoid ecological, archaeological and hydrological features on site.

4.36 The tracks will generally be limited to a running surface width of 5m (depending on the turbine supplier specifications), except at bends where surface width will be widened as required to accommodate the 'swept path' of vehicles carrying long and wide loads. An indicative track design is shown in **Figure 4.4.**

4.37 The exact details of track construction methodologies will vary depending on local topographic and ground conditions but the approximate balance of construction types expected is explained below under 'Construction Details'.

Water Crossings

4.38 Tracks have been designed to minimise watercourse crossings, however, given the nature of the site one bridge crossing over a tributary of the Backside Burn will be required along with a further 17 culvert crossings for smaller surface water flows.

4.39 Monitoring of water quality and water flow will be undertaken during construction of the Development and a water quality monitoring plan will be devised. Further information in relation to watercourse crossings and water quality monitoring is provided in **Chapter 8: Geology, Hydrology and Hydrogeology**.

Micro-siting

4.40 Prior to construction of the Development, micro-siting may take place to allow adjustment within a defined radius of the proposed turbine locations, and a similar tolerance either side of indicative access track locations. This will ensure that the final position of the turbines and associated infrastructure are not varied to such a degree as to cause a notable change in the predicted environmental effects outlined in the ES but allows flexibility should unfavourable or unforeseen ground conditions be encountered.

4.41 It is anticipated that an agreed micro-siting distance will form a condition accompanying permission for the Development. Beyond this distance, any relocation of Development components will require either written approval from Stirling Council or will be treated as a formal variation to the application. In line with recent wind farm planning decisions, it is proposed that a 50m micro-siting distance from turbines and the centreline of access tracks is applied to this site.

Construction Details

4.42 The construction period for the Development will last for approximately 12 months. It is estimated the number of people employed at site during the construction period will range from 10-30 people with an average of approximately 20 people employed at site at any one time.

4.43 The construction phase will consist of the following principal activities:

- construction of site access tracks (Phase 1), including drainage, to access central site area and main borrow pit;
- construction of temporary compound, laydown area, offices and car parking;
- construction of site access tracks (Phase 2),including drainage, to inter-link turbine locations, met mast and control building;
- construction of turbine foundations and external transformer bases (if required) at each turbine location;
- construction of crane hardstandings at each turbine base location and also at the permanent meteorological mast location;
- delivery to site and erection of wind turbines and permanent meteorological mast;
- excavation of trenches and laying of electrical and control cables adjacent to the site roads connecting the turbines to the control building;
- testing and commissioning of site equipment including wind turbines;
- site restoration.

Construction of Temporary Compound

4.44 The compound will be formed by stripping organic and soft surface material and laying geotextile and crushed rock to create a firm regular surface. Perimeter drainage will intercept rainfall and then channel water to temporary filtration and dispersion structures, utilising where possible the natural contours of the landscape. The stripped surface material will be stockpiled nearby for reinstatement.

Construction of Tracks

4.45 As there is limited peat onsite, a cut track design will be used and will be constructed by excavating through to a suitable formation. During construction, vegetation, topsoil and subsoil will be placed to the sides of the tracks. A layer of stone will be compacted on top of the base formation to a thickness of around 150-250 millimetres (mm) dependent upon ground conditions. The total track thickness will depend on the strength of the base formation and the gradient of the slope being traversed but is typically 450 to 800mm thick. Drainage ditches will then be constructed (as described below). Surplus soil will be placed and dressed alongside the track to blend in with the surrounding landscape and finally topsoil will be placed on the track shoulders and seeded to promote vegetation.

4.46 The tracks will have adequate crown or cross-slope to allow rainwater to be shed and, where gradients are present, lateral drainage will intercept flow. A drainage ditch will be formed on the upslope side of the track, dependent on a detailed drainage design. Cross pipes will be laid as required in areas where the position of the site track could lead to ponding on one side. As far as possible these will coincide with naturally occurring drainage channels. Experience at other sites has shown that cross pipes simply placed at regular intervals are often ineffective and unnecessary. When the track slopes downhill, 'waterbars' will be placed to divert the flow into naturally occurring channels. The advice of the Ecological Clerk of Works (ECoW) will be sought to ensure that the location and outfall of cross pipes and waterbars minimises vegetation damage or change.

4.47 Final track drainage design will be determined prior to the commencement of construction of the relevant track section. The design of track and ancillary drainage will comply with Sustainable Drainage Systems (SuDS) standards and be agreed with SEPA. Further details of measures which will be taken to manage run-off and avoid erosion are provided in **Chapter 8: Geology, Hydrology and Hydrogeology**.

Construction of Turbines

4.48 Construction of turbine bases will require the excavation of surface organic and soft surface material through to underlying rock. This excavated material may be used to partially backfill the excavation and provide material for landscaping and surfacing reinstatement. As such, this material will be stored near to the excavation until required. The underlying rock will be levelled to provide a workable platform for the assembly of reinforcing bars and formwork used to contain the poured concrete.

4.49 During construction, dewatering may be required to keep the construction area dry (for example, if rainwater gets into construction areas). Suitable filtration systems will be employed to ensure that silt laden water does not contaminate surface watercourses and that extracted water is returned to the surrounding area with a limited effect on local hydrology (see **Chapter 8: Geology, Hydrology and Hydrogeology**).

4.50 The area around the turbine will be back filled with selected excavated material. Should an external transformer be required at the base of each turbine, the fill beneath the transformer slab will be of such a nature as to provide sufficient structural support.

Installation of Cabling

4.51 The cabling connecting each turbine to the control building will be laid in a trefoil arrangement. Detailed construction and trenching specifications will depend on ground conditions encountered. Typically cables would be laid in a trench 1m deep and 0.5m wide. To minimise ground disturbance cables will be routed along the side of the access tracks where practicable.

4.52 Cables will be laid within a sand or granular bedding to prevent damage to the cables from sharp stones. Trenches will be backfilled with excavated material and the surface redressed. If sand bedding is used, clay bunds will be placed at intervals within the bedding to prevent unnatural flows of ground water.

Construction Programme

4.53 An indicative programme for the construction activities is shown in **Table 4.2**.

Table 4.2: Indicative Construction Programme

Month	1	2	3	4	5	6	7	8	9	10	11	12
Access Tracks (Phase 1)												
Construction Compound												
Access Tracks (Phase 2)												
Turbine Foundations												
Hardstandings												
Control Building												
Onsite Cabling												
Turbine Erection												
Commissioning												
Site Restoration												

4.54 Many of these operations will be carried out concurrently, although predominantly in the order identified, reducing the overall length of the construction programme. Site restoration will be programmed and carried out to allow the restoration of disturbed areas as early as possible and in a progressive manner.

4.55 Depending on the month of commencement of construction, pre-construction surveys and construction timing constraints may be required to reduce potential effects on breeding birds. Appropriate exclusion zones will be marked out around sensitive archaeological and ecological sites where necessary. An ECoW will be on site during construction in certain areas/months as agreed with Stirling Council.

4.56 Further specific measures proposed to avoid or minimise effects during construction are discussed on a topic-by-topic basis in **Chapters 6** to **14**.

Working Hours

4.57 In general, working hours for construction will be from 07.00 to 19.00 Monday to Friday and 07.00 to 13.00 on Saturday. No working is proposed on Sundays and public holidays.

4.58 Exceptions to the proposed working hours will be made for foundation pours and turbine erection. Concrete pouring for an individual turbine foundation must take place continuously and so activity will only cease when the pour has been completed. Turbine erection can only occur during periods of low wind speeds and so to minimise the construction programme, lifting operations may need to be scheduled out with the above hours. In addition, it may be necessary to complete a particular lifting operation in order to ensure the structure is left safe.

Reinstatement

General Approach

4.59 Following construction, the site will be reinstated by the contractor. The anticipated type and extent of reinstatement is outlined below.

4.60 Where a re-turfing method is appropriate, such as along track verges, the surface layer of soil and vegetation will be stripped and stored separately from the lower soil layers, and replaced as intact as possible once construction is complete.

4.61 Local reinstatement will be carried out to retain the structure and composition of the original plant communities, as well as forming a stable area over reformed ground, thus reducing erosion by rain, run-off and wind.

4.62 Bare soil areas will be allowed to re-vegetate naturally in combination with reseeding using a low density (~20kg per hectare) seed mix which mirrors local vegetation to help bind the soil more quickly.

Site Tracks

4.63 Site tracks are required throughout the operational phase of the Development to permit access for maintenance and repair operations. They will also be necessary to allow access during the decommissioning stage.

4.64 Generally the sloping verges of access tracks will be dressed with site sourced turf or seed bank material. If suitable material is generated during the construction of the track, this material can be used to form a low lying bund along the downhill side of the track, to be dressed as per the track verges. This will assist in reducing the visibility of the track.

Turbine Bases and Crane Hardstandings

4.65 Turbine foundations will be capped with a minimum of 150mm of soil material, which may form a raised mound between 300 and 500 mm above the existing ground level. These will be re-turfed with the removed material, but where vegetation is sparse or unlikely to regenerate, reseeding with an appropriate local seed mix may be undertaken as outlined above.

4.66 The condition of turfs will be monitored regularly during the first two months following reinstatement. If necessary, water will be imported to the site to ensure the re-establishment of this vegetation.

4.67 Hard-standing areas at each turbine location will be retained for use during operation and decommissioning, however the edges will as far as possible be blended to the adjacent contours and natural vegetation allowed to re-establish.

Construction Compound and Laydown Area

4.68 The temporary construction compound and laydown area will be reinstated into the surrounding landscape, and restored to their original condition.

Environmental Management

4.69 Construction Method Statements and an Environmental Management Plan will be prepared prior to the start of construction, detailing measures to avoid or mitigate potential effects associated with key construction activities. These will reflect and expand upon measures identified in the ES, and will be agreed with Stirling Council, SEPA, SNH and other stakeholders where appropriate.

Peat Management

4.70 In accordance with Scottish Government Guidance[i], the Development has been designed to avoid peat landslide hazard. A Peat Stability Assessment has been carried out and a copy of the report is included at **Appendix 8.2** with further consideration in **Chapter 8: Geology, Hydrology and Hydrogeology**.

4.71 Whilst the Development has been designed to minimise disturbance to peatland, it has not been possible to avoid areas of peatland entirely. Consequently, peat will require to be excavated during the construction of turbine foundations, site access tracks, crane hardstandings, the control building and temporary compound.

4.72 An outline Peat Management Plan (PMP), adhering to Scottish Renewables/SEPA guidance[ii] is presented at **Appendix 4.2** and includes the following information:

- an overview of peat conditions within the Development Area;
- identification of the activities that will involve peat excavation along with an estimate of volumes;
- the classification of excavated peat and its suitability for re-use;

- identification of restoration and reinstatement options; and
- principles for the handling and storage of excavated peat.

4.73 The PMP will ensure that excavated peat is appropriately managed and re-used within the Development Area. It is anticipated that all excavated peat can be reused within the Development Area for reinstatement of ground, at both the point of excavation as well as in the landscaping of track shoulders and hardstandings. Prior to construction and on completion of ground investigations and micro-siting, the PMP will be refined and agreed with SEPA and SNH.

Waste Management

4.74 Materials will be generated, and will require management, during construction, in particular the topsoil removed and stockpiled prior to construction area activities, and construction waste such as packaging and used formwork.

4.75 Measures to reduce potential environmental effects associated with the storage and transportation of waste will include:

- the careful location of stockpiles and other storage areas;
- the use of good practice in the design of storage areas and the use of suitable containers;
- the use of sheeting, screening, and damping where appropriate and practicable;
- the control and treatment of runoff from soil and soil stockpiles;
- minimising storage periods;
- minimising haulage distances.

4.76 All materials will be identified, classified, quantified and, where practicable, appropriately segregated. Any materials that cannot be reused will be disposed of according to relevant waste management legislation which will serve to address a number of possible environmental effects. This includes:

- the Duty of Care imposed by Section 34 of the Environmental Protection Act 1990;
- the Waste Management Licensing Regulations 1994 (as amended), particularly provisions relating to registered exemptions from waste management licensing.

4.77 All materials removed from site will be handled in accordance with relevant waste and environmental regulations. Waste will be transferred using a registered waste carrier to a licensed waste disposal site or recycling centre.

Health and Safety

4.78 All construction activities will be managed within the requirements of the Construction (Design and Management) Regulations 2007 and will not conflict with the Health and Safety at Work etc. Act 1974. The design of the Development has taken full account of these regulations. To further reduce possible health and safety risks, a Health and Safety Plan for the project will also be drawn up. All staff and contractors working on the construction of the Development will be required to comply with the safety procedures and work instructions outlined in the Plan at all times.

4.79 To ensure that hazards are appropriately managed, risk assessments will be undertaken for all major construction activities, with measures put in place to manage any hazards identified.

Ice Throw

4.80 In certain weather conditions, one potential hazard relates to ice forming on turbine blades. This may result in ice fragments being thrown from the rotor when operating and in ice falling from the rotor when shut down. The Scottish Government web based renewables advice for onshore wind turbines states *"The build-up of ice on turbine blades is unlikely to present problems on the majority of sites. When icing occurs, the turbines' own vibration sensors are likely to detect the imbalance and inhibit the operation of the machines[iii]"*. In addition, the operator would implement measures to ensure the safety of workers and the general public in relation to ice throw and ice fall.

4.81 The design of the Development has taken into account the possibility of ice throw occurring and turbines have been sited in locations to ensure that the rotor blades do not oversail any public roads or recreational routes to minimise the risk from ice fall. The low risk of ice throw is further minimised by the turbine's vibration sensors (or other ice detection measures) which detect any imbalance which might be caused by icing. The turbines which are affected by icing would be temporarily shut down until normal balance is restored. Operational procedures would also be put in place to ensure the safety of both workers and the public in relation to ice throw and ice fall. Procedures would include turbine shutdown and warning signage.

Operational Details

4.82 The Development has been designed to have an operational lifespan of up to 25 years.

4.83 Once operational, the Development is not manned and it is envisaged that the amount of traffic associated with the Development would be minimal. Traffic generated would comprise routine service and maintenance team visits, together with the occasional need for more extensive maintenance, repair or management purposes. Wind turbine operations will be overseen by suitably qualified contractors.

4.84 Routine maintenance and servicing will take place two to four times per year. Servicing will include the performance of tasks such as maintaining bolts to the required torque, adjustment of blades, inspection of blade tip brakes and inspection of welds in the tower. Other visits to the site will take place more frequently to ensure that the turbines are operating at their maximum efficiency. In the event of any unexpected events onsite appropriate repair works will be carried out.

4.85 The vehicle used for the majority of these visits is likely to be a small four wheel drive vehicle, although there may be an occasional need for an HGV or crane to access the site for heavier maintenance and repairs.

4.86 On-going track maintenance will generally be undertaken in the summer months when tracks are dry. Safe access will be maintained all year round.

Decommissioning

4.87 At the end of the 25 year operational period, the Development will either be decommissioned, or an application made for consent to extend its operational life. It is estimated that decommissioning the Development, given its size, will take approximately 6 months.

4.88 Decommissioning will involve the removal of all above ground infrastructure. Demolition of the control building will involve the removal of the equipment followed by demolition of the building. All demolition waste will be removed to a licensed waste disposal site. The plinth and the top surface of the wind turbine foundation bases will be broken out and removed to approximately 1 m below ground level and all cabling will be cut out at the same depth. The area will then be reinstated with a final layer of topsoil over the foundations. Roads will either be left for use by the landowner or covered in topsoil. No stone will be removed from the site during decommissioning. This approach is considered to be less environmentally damaging than seeking to remove all foundations, underground cables and roads entirely.

4.89 All material arising from decommissioning and demolition will be disposed of responsibly and in accordance with the relevant waste management regulations at the time.

4.90 A decommissioning method statement will be prepared and agreed with the relevant statutory consultees prior to decommissioning of the site.

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[i] The Scottish Government (2006), Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments.

[ii] Scottish Renewables & Scottish Environment Protection Agency (January 2012), Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.

[iii] The Scottish Government (2011). 'Onshore Wind Turbines' Web Based Renewables Advice (http://www.scotland.gov.uk/Resource/Doc/212607/0113777.pdf).

5 Planning Policy Context

Introduction

5.1 This chapter outlines the main policies of relevance to the determination of the Craigton and Spittalhill Wind Farm planning application and sets out a summary of the planning and regulatory context in relation to the key topics covered in the ES. References are included to the national, regional and local policy and guidance frameworks where appropriate, and other relevant material considerations are also identified.

5.2 To maintain the impartiality of this ES, this chapter does not present an assessment of the acceptability of the proposed Craigton and Spittalhill Wind Farm in planning terms. A separate Planning Statement has been prepared to accompany the application for consent. The Planning Statement assesses the compliance of the proposed Craigton and Spittalhill Wind Farm against the relevant planning policy framework and reaches conclusions on the acceptability of the development of the same.

Legislative Background

5.3 As the proposed Craigton and Spittalhill Wind Farm has a maximum generating capacity of less than 50 megawatts the application will be determined under the Town and Country Planning (Scotland) Act 1997[i], as amended[ii]. The application has been prepared as a 'Major Development' application under the Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009[iii] on the basis that the total installed capacity of the wind farm is anticipated to be 20MW or over.

5.4 Major developments require that pre-application consultation is undertaken as set out in The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013[iv]. Craigton and Spittalhill Wind Farm lies within the Stirling Council area and pre-application consultation has been carried out with reference to best practice and relevant guidance notes, including *Planning Advice Note 3/2010 Community Engagement*[v] by the Scottish Government. A Pre-Application Consultation (PAC) Report[1] has been prepared to accompany the application. This provides a summary of the public consultation which was undertaken with respect to the development of Craigton and Spittalhill Wind Farm, including feedback from, and examples of material provided at the Public Exhibitions. Further details can be found in **Chapter 2: Approach to the EIA**.

Planning and Regulatory Framework

Introduction

5.5 This section outlines the planning and regulatory framework of relevance to the application for Craigton and Spittalhill Wind Farm. As noted above, further details of the planning policy framework and discussion as to how the proposal accords with this framework are included in the Planning Statement.

The Existing Development Plan

5.6 Sections 25 and 37(2) of the Town and Country Planning (Scotland) Act 1997, as amended, requires that applications are determined in accordance with the Development Plan, unless material considerations indicate otherwise.

5.7 The site lies wholly within the boundary of Stirling Council, approximately 12km to the south-west of Stirling and 7.5km to the east of Balfron. The Development Plan for the area comprises:

- Clackmannanshire and Stirling Structure Plan 2002[vi];
- Structure Plan Alteration 1 – Renewable Energy (2004)[vii];
- Stirling Council Local Plan 1999[viii].

The Emerging Local Development Plan

5.8 Stirling Council published a Proposed Local Development Plan[ix] in October 2012 and this sets out the proposed vision, strategy, policies and supplementary guidance of the final Local Development Plan. Until the final Local Development Plan is adopted, the existing Development Plan will continue to stand and is therefore detailed within this chapter.

5.9 The Stirling Council Development Plan Scheme[x] highlights that the Proposed Local Development Plan will pass through a period of consultation and examination before being finally modified and adopted in June 2014. As the planning application for Craigton and Spittalhill Wind Farm will be submitted prior to the adoption of the final Local Development Plan, it has been deemed necessary to include the relevant policies within the Proposed Local Development Plan as material considerations to the application. Therefore, these have been included in the 'Other Material Considerations' section below.

Review of Development Plan Policy

5.10 The relevant Development Plan policies against which the application will be assessed are detailed below. Specific considerations of relevance to Craigton and Spittalhill Wind Farm are also identified. To aid understanding, these are arranged by theme, reflecting chapter divisions within the ES. The full wording of certain policies is provided where this provides clarity to the text.

General Considerations

Clackmannanshire and Stirling Structure Plan 2002

5.11 The Structure Plan aims to make a significant contribution to sustainable development, ensuring that sustainable development is translated into land use planning through four key themes:

- caring for the environment;
- promoting appropriate development;
- improving the quality of life;
- promoting access to opportunity.

5.12 Clackmannanshire and Stirling Councils have developed key principles for delivering the plan's strategy of working towards sustainable development. ***Policy SD1: Key Principles*** is intended to be an all-embracing policy with which all development should comply. Although the proposed Craigton and Spittalhill Wind Farm will be assessed against the policy as a whole, the following key principles are of particular relevance:

- ***Principle 1*** states that full account must be taken of the effect of the development on the environment;
- ***Principle 2*** relates to the Precautionary Principle, ensuring that it is applied wherever the environmental implications of a development are unclear, or inconclusive, and where there is potential for irreversible environmental damage;
- ***Principle 3*** seeks to ensure that the potential for a development to contribute to the enhancement of the quality and distinctiveness of the natural environment is addressed;
- ***Principle 5*** requires that the potential of a development to contribute towards the enhancement of employment opportunities, social inclusion, community safety and rural regeneration is taken into account;
- ***Principle 7*** states that efficient use and re-use of resources including energy, materials, land, buildings and infrastructure should be addressed;
- ***Principle 8*** requires appropriate mitigation and compensatory measures from the developer should adverse effects on the community or environment be identified; and

[1] Details of how to obtain copies of the PAC Report are set out in the Preface to the ES.

- ***Principle 9*** relates to the requirement for new development to be accompanied by appropriate infrastructure and other facilities.

Stirling Council Local Plan 1999

5.13 Moreover, the Local Plan contains two Keynote Policies that together reflect the principles of sustainability. Local Plan Policy ***KEY1*** gives primary importance to the protection and enhancement of the environmental wealth of the district of Stirling. Local Plan Policy ***KEY2*** seeks to ensure that new development that is necessary to meet the economic and social needs of the district is undertaken in a manner that does not compromise the ability of future generations to meet their own needs and to enjoy a high quality environment. Local Plan Policy ***KEY2*** states that "*all development must, insofar as is practicable, protect environmental assets, conserve resources and keep environmental impacts to a minimum*."

5.14 With respect to development in the countryside, Stirling Council aims to conserve rural amenity and promote appropriate use of rural land. Local Plan Policy ***POL.E7*** provides protection to areas within Countryside Policy Boundaries (drawn to exclude village and town centres) from inappropriate development. Only development proposals that are essential to the proper functioning of the primary rural activities, or other uses which can be shown to have an overriding need for a countryside location, will be considered favourably by the Council.

Renewable Energy

Structure Plan Alteration 1 – Renewable Energy (2004)

5.15 As a response to the Structure Plan ***Proposal ENVP5: Renewable Energy*** which states, "*The Councils will prepare a policy on renewable energy in accordance with NPPG6 and submit it as an alteration by 31 March* 2003", Structure Plan Alteration 1 – Renewable Energy was approved as a ministerial modification to the approved Clackmannanshire and Stirling Structure Plan 2002.

5.16 ***Policy ENV14: Renewable energy and energy-efficient development*** of the Structure Plan Alteration 1 – Renewable Energy supports "*(i) developments required for the generation of energy from renewable sources and fuels*", and the supporting text further notes that such developments will be encouraged "*in locations where there would be no significant loss of amenity, and the setting and integrity of features of importance for their scenic, conservation and heritage value would not be harmed*" (para. 3.14.1).

Stirling Council Local Plan 1999

5.17 The Local Plan supports the principle of renewable energy developments "*as a means of protecting the environment through the reduction in "greenhouse" gases and encouraging a diversity of means of electricity supply, particularly in rural areas*" (para.2.27), as long as adverse environmental effects are fully considered. It also highlights the "*considerable potential for renewable energy developments*" (para.2.27) in rural and upland areas within the Council boundary. Local Plan Policy ***POL.E10*** supports renewable energy applications that will not have a significant adverse effect on the environment "*within areas of defined countryside".*

Wind Energy Developments

Structure Plan Alteration 1 – Renewable Energy (2004)

5.18 ***Policy ENV 16: Wind energy*** sets out the criteria against which wind energy developments will be assessed in order to ensure location and design of such is done sensitively. ***Policy ENV 16: Wind energy (1.)*** identifies 'Exclusion Areas' including National Scenic Areas and Green Belts within which the "*siting of wind turbines will not normally be acceptable".*

Stirling Council Local Plan 1999

5.19 Local Plan Policy ***POL.E12*** states that the Council will consider wind farms favourably within areas of defined countryside (but outwith Green Belt areas), where a number of stated criteria are met. The criteria relate to appearance, amenity, landscape effects, traffic, heritage designations, electromagnetic interference, site restoration, aircraft disruption and bird strike.

Landscape and Visual Amenity

5.20 A comprehensive assessment of Craigton and Spittalhill Wind Farm's likely effects on landscape and visual amenity is set out in **Chapter 6: Landscape and Visual Amenity**.

Clackmannanshire and Stirling Structure Plan 2002

5.21 Structure Plan ***Policy ENV2: Protected Landscapes*** states that developments within National Scenic Areas will only be permitted where "*there is a specific site requirement for the development which could not be met in a less sensitive location, and where the nationally important landscape character and scenic interest of the designated area would not be adversely affected*". Furthermore, developments will be required to meet strict quality standards if they are to be located on these sites. ***Policy ENV2: Protected Landscapes*** stipulates that within 'Areas of Great Landscape Value' developments will only be permitted if they are in line with ***Policy ENV3: Development in the Countryside*** (as highlighted below) and where the overall quality of the designated landscape area is not compromised.

5.22 Structure Plan ***Policy ENV3: Development in the Countryside*** outlines the Council's position on developments within the Countryside, as defined by the Local Plan. Developments will only be permitted where the proposal is *"dependent upon a countryside location"* or where the development complies with ***Policy ED4: Rural Development***. This policy states that the Council will support developments within rural settings based on their dependency for this location and ability to "*support the economic and social needs of communities*". ***Policy ENV3: Development in the Countryside*** also stipulates that developments proposed for a rural setting should be appropriate for its location based on its "*function, siting and design*" and should contribute to the preservation of local character features.

5.23 Structure Plan ***Proposal ENVP3: Countryside Access and Management*** directs Councils to work in partnership with land managers/owners to promote countryside management with the intention of safeguarding and enhancing public access, the local landscape and habitats.

Structure Plan Alteration 1 – Renewable Energy (2004)

5.24 ***Policy ENV 16: Wind energy (1.)*** reinforces the Council's commitment to protecting National Scenic Areas and Green Belt locations from being chosen as locations for development. The policy states, "*For overriding landscape character, built heritage and natural heritage conservation reasons, siting of wind turbines will not normally be acceptable in National Scenic Areas, in Green Belts or in the areas shown on the Structure Plan Renewable Energy Supplementary Key Diagram as 'Exclusion Areas'. These areas area:*

- *"The Ochil Hills escarpment*
- *The Touch – Gargunnock – Fintry Hills escarpments (including Lewis Hill)*
- *The Campsie Fells escarpments*
- *Queen's View (Auchineden)*
- *Kippen Muir view*
- *The settings of Abbey Craig – Wallace Monument, Stirling Castle, Bannockburn Memorial and battlefield, and Sheriffmuir battlefield*
- *Flanders Moss".*

5.25 ***Policy ENV 16: Wind energy (2.)*** highlights that the remaining Structure Plan area can be regarded as an 'area of search' for developments with the exception of areas within the Loch Lomond and The Trossachs National Park. The policy states that scope for developments within the National Park is "*expected to be limited and developments there should demonstrate that the objectives of the designation of the Park and the overall integrity of the area will not be compromised*".

Stirling Council Local Plan 1999

5.26 Local Plan Policy ***POL.E12*** sets out Stirling Council's eight point criteria for wind farm developments of over 25Kw capacity within defined areas of countryside. These criteria must be adhered to in order for applications to be deemed as favourable. Of these eight points, three directly address landscape and visual elements of wind energy developments and include:

"(b) the development will not result in unacceptable intrusion into the landscape;

(d) the development will have no significant detrimental effect on any designated heritage feature, including Listed Buildings, Conservation Areas, Ancient Monuments, Historic Gardens and Designed Landscapes, Areas of Great Landscape Value and National Scenic Areas;

(e) the development will not affect the amenities of neighbouring occupiers unacceptably by reason of noise, visual dominance, shadow flicker, reflected light or other emission".

5.27 Local Plan Policy ***POL.E15*** once again recognises the need to protect 'Areas of Great Landscape Value' and highlights that there will be a general presumption against developments in these areas which do not relate to farming, forestry, tourism and recreation. However, the policy further states that other developments may be permissible if their "*particular locational requirements cannot be satisfied elsewhere*". The policy emphasises that strict conditions will apply to all development types within these areas including siting, design, and landscape treatment.

5.28 Local Plan Policy ***POL.E17*** relates to developments within or affecting Designated Landscapes as identified in the 'Inventory of Historic Gardens and Designed Landscapes in Scotland' as established by SNH and Historic Scotland. The policy highlights that any development within areas identified in the Inventory "*will require to be situated and designed to avoid an unacceptably adverse impact on the landscape*".

5.29 Local Plan Policy ***POL.E54*** recognises the effect that developments may have on landscapes that support wild flora and fauna. In addition it emphasises that the Council will not normally permit developments which will have a negative effect on the same, and will only grant consent "*where the reasons in favour of a development clearly outweigh the desirability of retaining the feature(s)*", and where mitigation measures will be implemented.

Noise

5.30 A comprehensive assessment of the likely noise effects of Craigton and Spittalhill Wind Farm is set out in **Chapter 7: Noise**.

Structure Plan Alteration 1 – Renewable Energy (2004)

5.31 ***Policy ENV 16: Wind energy ENV16 (4.)*** recognises that wind farm developments can have significant adverse effects in combination with either other operational wind farms or proposed schemes. The policy emphasises that proposals likely to have significant adverse cumulative effects on amenity will not be supported.

Stirling Council Local Plan 1999

5.32 Likewise, Local Plan Policy ***POL.E12 (e)*** states that another criteria which wind farms should meet, in order to be regarded as favourable, is the ability to function without causing adverse effects on amenities of neighbouring occupiers by reason of noise.

Geology, Hydrology and Hydrogeology

5.33 **Chapter 8: Geology, Hydrology and Hydrogeology** sets out the likely effects of Craigton and Spittalhill Wind Farm on ground and water features.

Clackmannanshire and Stirling Structure Plan 2002

5.34 Structure Plan ***Policy ENV9: Water Resources Management*** sets out the Council's position on water resources and highlights that as a general principle the Council will secure the retention of undeveloped floodplains in the interests of floodwater retention, biodiversity and amenity, and *"development will not normally be permitted"* in these areas. Moreover, the policy highlights that development within floodplains will not generally be consented unless it can be demonstrated that:

- there are no other suitable locations for the development; and
- implemented works, as a result of a Flood Risk Assessment, will not lead to flooding to other areas or habitat loss.

5.35 The policy also encourages sustainable surface water management such as Sustainable Urban Drainage Systems. Flood protection and run-off attenuation works in association with development will only be permitted if long-term maintenance and management arrangements are in place.

Stirling Council Local Plan 1999

5.36 Local Plan Policy ***POL.E61*** stipulates that a FRA will be required to be submitted for development proposals where:

(a) "There is firm evidence of past flooding; or

(b) The proposal is located on a river bank (or on adjacent land at the same level unprotected by intervening higher ground)".

5.37 The policy conveys that the Council will refuse developments (or grant consent subject to conditions) if the flood risk assessment highlights that flooding will occur as a result of a new development. Moreover, it highlights that preventative measures may be required in such instances as well as long term maintenance.

Natural Heritage

5.38 An assessment of the likely effects of Craigton and Spittalhill Wind Farm on species and habitats is provided in **Chapter 9: Ecology and Chapter 10: Ornithology.**

Clackmannanshire and Stirling Structure Plan 2002

5.39 Structure Plan ***Policy ENV1: Nature Conservation*** demonstrates the way in which the Council aims to protect and enhance the conservation value of wildlife and habitats with regards to new developments. ***Policy ENV1: Nature Conservation (1.)*** states that developments which will have a negative effect upon the conservation value of international and nationally important conservation areas will not be consented unless "*it is demonstrated that the objectives of designation and overall integrity of the area will not be damaged or that there is no alternative solution and there are overriding public interest imperatives*".

5.40 ***Policy ENV1: Nature Conservation (2.)*** states that where developments are likely to have a negative effect on sites of local importance for nature conservation (including features listed in Annex 1 of the EU Habitats Directive) then development will only be consented "*where it can be demonstrated that it will have no significant adverse impact on the conservation interest of the site, habitat or feature*".

5.41 ***Policy ENV1: Nature Conservation (3.)*** outlines that *"all development proposals will be considered in the light of the recommendations and findings of the Local Biodiversity Action Plans (and related Habitat Action Plans and Species Action Plans)."* Furthermore, where it is evident that a development will contradict these plans, an ecological appraisal will be required before a planning application is submitted.

5.42 ***Policy ENV1: Nature Conservation (4.)*** states that ecological enhancement measures shall be provided by all developments which affect nature conservation sites. By agreement this may be at off-site locations.

Stirling Council Local Plan 1999

5.43 Local Plan Environmental Keynote Policies ***KEY1*** and ***KEY2*** set out the overarching environmental objectives of the local plan to which all policies within the plan should conform. As both of these policies are generic in order to achieve the Council's environmental objectives, both policies address Ecology to a certain extent. ***KEY1*** addresses the environmental protection value of the Stirlingshire region and stipulates that this will be given "*primary importance*". It also highlights that polices should not "*override* this principle".

5.44 ***KEY2*** conveys that all developments should help deliver the social, economic, and environmental needs of the region, and thus contribute towards the aim of sustainability being realised.

5.45 Local Plan Policy ***POL.E10*** highlights that renewable energy developments will only be permitted within areas of international conservation interest (as defined in para. 2.64 of the Local Plan) if the proposal can demonstrate that *"the overall integrity of the designated area will remain largely unaffected".*

5.46 In terms of nature conservation policy within the Local Plan, ***POL.E54*** emphasises that the Council will not consent developments which would have an adverse effect on:

- the wildlife interests and management of nature reserves and fully designated Wildlife Sites; and
- the integrity of landscape character features which support biodiversity.

5.47 Local Plan Policy ***POL.E55 (a)*** augments the Council's intentions in relation to nature conservation and highlights that new developments will not be permitted where they are likely to lead to significant

adverse effects on designated nature conservation sites such as Special Protection Areas (SPAs), Special Areas of Conservation (SACs), and Ramsar sites. ***POL.E55 (b)*** states that developments which are likely to affect Sites of Special Scientific Interest (SSSI) and National Nature Reserves (NNRs) will not be permitted unless it can be demonstrated that the objectives of the sites will not be compromised.

Cultural Heritage

5.48 An assessment of the likely effects of Craigton and Spittalhill Wind Farm on the historic environment and features of archaeological interest is set out in **Chapter 11: Archaeology and Cultural Heritage**.

Clackmannanshire and Stirling Structure Plan 2002

5.49 Structure Plan ***Policy ENV6: The Historic and Built Environment*** states that *"The Councils will seek to ensure that cultural heritage resources are recognised, recorded, protected and enhanced as appropriate, and that new development respects and contributes to the character and quality of the area".* It states that developments which are likely to affect a conservation site should enhance *"the special character or appearance of the area".*

5.50 ***Policy ENV6: The Historic and Built Environment (1.)*** states that *"all development within or likely to affect a Conservation Area should preserve or enhance the special character of appearance of the Area."* ***Policy ENV6: The Historic and Built Environment (2.)*** highlights that there will be a presumption against the demolition of protected buildings and adverse effects upon the historical architectural character of listed buildings. ***Policy ENV6: The Historic and Built Environment (3.)*** protects Scheduled Ancient Monuments and other important archaeological sites or landscapes against inappropriate development. ***Policy ENV6: The Historic and Built Environment (4.)*** protects inventory listed Historic Gardens and Designed Landscapes from inappropriate development.

Stirling Council Local Plan 1999

5.51 Local Plan Policy ***POL.E12 (d)*** states another criteria by which wind farm applications over 25Kw will be assessed against and thus will have to meet in order to be considered as favourable. This part of the policy relates to cultural heritage and states, *"the development will have no significant detrimental effect on any designated heritage feature, including Listed Buildings, Conservation Areas, Ancient Monuments, Historic Gardens and Designed Landscapes, Areas of Great Landscape Value and National Scenic Areas".*

5.52 Local Plan Policy ***POL.E43*** adds to this and highlights that the Council is committed to the preservation of listed buildings and their setting. It emphasises the importance of ensuring that the design and choice of materials, for developments that will affect Listed Buildings, is done in a way that does not compromise a building's character.

5.53 Moreover, ***POL.E45*** states, "*Development which adversely affects the character or the setting of a Listed Building will not be permitted unless strong justification is produced in support of the application".*

5.54 With regards to Scheduled Monuments, Local Plan Policy ***POL.E47*** conveys that there will be a presumption against developments which will have an adverse effect on a Scheduled Monument and its setting, and unscheduled remains and their setting, where it is considered that these remains are of archaeological interest.

5.55 Local Plan Policy ***POL.E48*** outlines that the Council will examine the benefits to developments and decide whether these outweigh the effect of losing features of archaeological interest. It states that approval to such developments, where preservation of such features cannot be attained, "*will be conditional upon satisfactory provision being made by the developer for the appropriate level of archæological investigation, including publication of the results*".

5.56 Local Plan Policy ***POL.E49*** makes provision for the preservation of archaeological features of unknown significance and extent. The policy states that where such features are found then an evaluation must be undertaken by the developer prior to the application being determined. This evaluation should establish "*importance of the site, its sensitivity to development and the most appropriate means for preserving or recording surviving archæological features*".

5.57 Local Plan Policy ***POL.E50*** states that opportunity should be afforded to undertaking an archaeological investigation where archaeological features are discovered during construction of developments. The policy states that it is in the Council's interest that features remain preserved.

Transportation and Access

5.58 The likely effects of Craigton and Spittalhill Wind Farm in relation to transportation and access are set out in **Chapter 12: Access, Traffic and Transport.**

Clackmannanshire and Stirling Structure Plan 2002

5.59 Structure Plan ***Policy TR1: Integrated Transport*** emphasises the need for developer responsibility with regards to transport assessments and mitigation of adverse effects. It encourages the developer to ensure that environmental effects are reduced through management of air quality, noise pollution and congestion levels.

Stirling Council Local Plan 1999

5.60 Local Plan Policy ***POL.E12 (c)*** outlines the criteria that the Council require to be met in order for wind energy developments to be regarded as favourable. The policy states that the Council will require access for construction and maintenance traffic to be achieved without compromising road safety and the environment.

Socio-Economics

5.61 Potential social and economic effects of Craigton and Spittalhill Wind Farm are considered in **Chapter 13: Socio-Economics**.

Clackmannanshire and Stirling Structure Plan 2002

5.62 Structure Plan ***Policy ED4: Rural Development*** highlights that Councils should support economic development in rural areas to support the economic and social needs of local communities. Developments should be focussed within existing towns and centres and should be restricted within the Green Belt and Clackmannanshire's Countryside Area.

Stirling Council Local Plan 1999

5.63 Reference is made to economic and social development in the context of sustainable development within Keynote Policy ***KEY2***. The policy states, "*New development will be provided for to meet the economic and social needs of the district in a manner which does not compromise the ability of future generations to meet their own needs and to enjoy a high quality environment"*.

Other Issues

5.64 The likely effects of Craigton and Spittalhill Wind Farm on issues such as aviation and defence, telecommunications and air quality are assessed in **Chapter 14: Other Issues**.

Structure Plan Alteration 1 – Renewable Energy (2004)

5.65 ***Policy ENV 16: Wind energy ENV16 (4.)*** addresses effects on amenity, and indirectly addresses shadow flicker. The policy states that, "*Proposals will not normally be acceptable where they would result in an adverse effect upon amenity, or features of scenic and/or heritage value, by reason of cumulative visual impact".* ***Policy ENV 16: Wind energy ENV16 (4.)*** also relates indirectly to aviation, defence and telecommunications and stipulates that the strategic location and design of wind energy proposals should take into account their relationship with other existing developments, and the cumulative effects this could have on amenity.

Stirling Council Local Plan 1999

5.66 Local Plan Policy ***POL.E12 (e)*** outlines other criteria which wind farm proposals should meet in order to be regarded as favourable. The policy states that shadow flicker should not affect the visual amenity of neighbouring occupiers. ***POL.E12 (f)*** relates to telecommunications and sets out that, "*no electromagnetic disturbance is likely to be caused by the proposal to any existing transmitting or receiving system or (where such disturbances may be caused) that measures will be taken to remedy or minimise any such interference".* ***POL.E12 (h)*** relates directly to the possible effects of wind farms on aviation and emphasises that wind turbines should not interfere with the effective operation of aviation radar. In addition, air quality is addressed within ***POL.E12 (e)*** of the Local Plan. The policy states that emissions of any kind from wind energy developments shall not affect the amenity of neighbouring occupiers.

Other Material Considerations

Introduction

5.67 There are a number of additional material considerations relevant to the consideration of the Craigton and Spittalhill Wind Farm application. These include:

- National Policy Considerations:
  - UK and Scottish Government Energy and Climate Change Polices;
  - The National Planning Framework for Scotland 2 (NPF 2) 2009;
  - Scottish Planning Policy 2010 (SPP);
  - Planning Advice Notes (PANs);
  - Scottish Government Web Based Renewables Guidance;
- Emerging Framework, Policy and Local Development Plan:
  - The National Planning Framework 3: Main Issues Report & Draft Framework;
  - Scottish Planning Policy (Consultation Draft 2013);
  - Stirling Council Local Development Plan – Proposed Plan (October 2012); and,
- Supplementary Planning Guidance.

National Policy Considerations

UK Climate Change and Renewable Energy Target

Climate Change Programme

5.68 In addition to commitments under the Kyoto Protocol, the Doha Amendment and EU obligations, the UK Government has also set a separate domestic goal of reducing CO_2 emissions by 20% below 1990 levels by 2010. In an effort to deliver these targets, the **Climate Change Programme**[xi] was launched in November 2000 and then updated in 2006 by **Climate Change: The UK Programme**[xii].

Climate Change Act 2008

5.69 Following a UK Government Energy Review published as a White Paper in 2007[xiii], the UK Climate Change Act[xiv] received Royal Assent in 2008. The **Climate Change Act 2008** created a legal framework for the UK to achieve a reduction of carbon emissions through both domestic and international action. The key provisions of the Act as it relates to the energy sector are as follows:

- Introducing a legally binding target of an 80% reduction in carbon dioxide emissions by 2050, and at least 26% by 2020, against the 1990 baseline.

5.70 Of additional significance in this Act is the banding which requires all UK electricity suppliers to provide 10% of their electricity from new renewable sources by 2010 and 15% by 2015. The banding regime came into effect in April 2009, and generators that fail to meet their targets will be forced to pay a 'buy-out price', which is effectively a financial penalty.

UK Energy Policy

Energy Act 2008

5.71 The **Energy Act 2008**[xv] brings into law the legislative content of the Energy Review 2006: The Energy Challenge[xvi] and the Energy White Paper 2007: Meeting the Energy Challenge[xvii]. In terms of renewable energy, the key provisions centre on:

- Strengthening the Renewables Obligation to drive greater, and more rapid, development of renewables in the UK. This will increase the diversity of the UK's electricity mix, thereby improving the reliability and security of supply and reducing carbon emissions from the generating sector; and,
- Introducing 'feed-in' tariffs. This has enabled the Government to introduce a tailor-made scheme to financially support low carbon generation projects up to 5MW.

UK Renewable Energy Strategy

5.72 In July 2009, the UK Government published the **UK Renewable Energy Strategy**[xviii], which implements the EU Directive 2009/28/EC on Renewable Energy and supports the UK Climate Change Programme. The Strategy sets out the path to be followed for the UK to meet its legally binding target to ensure that 15% of UK energy comes from renewable sources by 2020. The lead scenario suggests that more than 30% of the UK's electricity could be generated from renewables, with more than two thirds of this coming from wind power, both on and offshore. However, it is recognised that such a scenario will only be possible with strong, co-ordinated efforts from central, regional and local government and the devolved administrations, as well as other public groups, the private sector and community groups and individuals.

2010 Annual Energy Statement and 2050 Pathways Analysis Report

5.73 In the Coalition Programme for Government, the Government committed to producing an Annual Energy Statement (AES)[xix] to provide market direction, set strategic energy policy and help guide investment. The first statement was delivered to Parliament on 27 June 2010. In setting the strategic direction of energy policy and guiding investment, the statement sets out the full secure and low carbon energy context, covering climate change and energy efficiency as well as supply-side issues, international security and liabilities.

5.74 The **2010 Annual Energy Statement** was accompanied by the **2050 Pathways Analysis Report**[xx], which presents a framework through which to consider some of the choices and trade-offs to be made in the UK by 2050. The Pathway Analysis covers all parts of the economy and all greenhouse gas emissions released in the UK and will be revised and updated regularly to provide an evidence base for decision-making.

National Renewable Energy Action Plan

5.75 In July 2010, the UK Government submitted the UK's **National Renewable Energy Action Plan** (NREAP)[xxi] to the European Commission under Article 4 of the European Renewable Energy Directive (2009/28/EC). The NREAP is based on a template set by the European Commission, which asks for the trajectory and measures that will enable the UK to reach its legally binding target for 15% of energy consumption in 2020 to be from renewable sources.

Carbon Plan & Carbon Budgets

5.76 The Climate Change Act 2008 established the principle of five year carbon budgets. The first three budgets were set in 2009 and cover 2008-12, 2013-17 and 2018-22. The fourth budget, 2023-2027 was legislated in June 2011.

5.77 In December 2011, the UK Government published its first **Carbon Plan**[xxii] which sets out the Government's plans for achieving the emissions reductions committed to in the first four Carbon Budgets, on a pathway consistent with meeting the 2050 target. The Carbon Plan brings together the Government's strategy to curb greenhouse gas emissions and deliver climate change targets, as well as an updated version of the actions and milestones for the next five years.

5.78 Paragraph 46 of the Carbon Plan states that over the next decade:

"We need to continue reducing emissions from electricity generation through increasing the use of gas instead of coal, and more generation from renewable sources. Alongside this, we will prepare for the rapid decarbonisation required in the 2020s and 2030s by supporting the demonstration and deployment of the major low carbon technologies that we will need on the way to 2050".

5.79 In early October 2013 the Government's Response to the **Fifth Annual Progress Report of the Committee on Climate Change: Meeting the Carbon Budgets – 2013 Progress Report to Parliament**[xxiii] was published. The Response made clear that the latest projections suggest the UK is on track to meet the first three legally-binding carbon budgets provided that current planned policies are undertaken. This means that by 2020, greenhouse gas emissions in the UK will have fallen by at least 34% relative to 1990 baseline levels.

5.80 As set out in the Carbon Plan in 2011, there is more to do to meet the legally-binding target to reduce the UK's greenhouse gas emissions by at least 80% by 2050. Based on current planned policies there is an expected shortfall of 215 $MtCO_2e$[2] over the fourth carbon budget. To meet the statutory commitments, the Government has made a number of recommendations to increase the rate of decarbonisation in a number of areas across the economy.

[2] $MtCO_2e$ means millions tonnes of carbon dioxide equivalent.

Renewable Energy Review

5.81 In May 2011 the Committee on Climate Change, which is the independent body established under the Climate Change Act 2008 to advise the UK Government on setting and meeting carbon budgets and on preparing for the impacts of climate change, published its **Renewable Energy Review**[xxiv]. The Review forecasts a major role for renewables (alongside nuclear and Carbon Capture and Storage) in decarbonising power, heat and transport.

UK Renewable Energy Roadmaps

5.82 On 27 July 2011, the UK Government published the **UK Renewable Energy Roadmap**[xxv] which sets out a comprehensive action plan to accelerate the UK's deployment and use of renewable energy, to put the UK on the path to achieve the 2020 target, while driving down the cost of renewable energy over time. It identifies onshore wind as one of the eight technologies that have either the greatest potential to help the UK meet the 2020 target in a cost-effective and sustainable way, or offer great potential for the decades that follow.

5.83 The latest iteration of the government's renewable energy roadmap, the **UK Renewable Energy Roadmap Update 2013**[xxvi], was published in November 2013. The '2013 Update' suggests that the UK is on track to make its country-specific target of generating 15% of its energy from renewables by the end of the decade. It calculates that 4.1% of UK energy consumption came from renewable sources in 2012 – greater than the EU interim target of 4.04%. In 2011 and 2012, the UK achieved an average of 3.94%. This is within the margin of error for the interim target, according to the government.

5.84 The amount of electricity generated from renewables has increased by a factor of four over the last decade and nearly doubled in the three years since 2010. In particular, between the period July 2012 and June 2013, there has been a significant increase in renewable energy generation with the overall capacity growing by 38% to 19.5 gigawatts (GW). In the second quarter of 2013, the UK generated 15.5% of its electricity – or more that 4% of overall energy supply – from renewable energy.

5.85 Since the publication of the last Update in 2012 there has been steady growth in the deployment of onshore wind. In the 12 months to June 2013, onshore wind generation increased by 25% on the previous 12 months, with capacity up 30%.

The Energy Act 2011

5.86 In October 2011, the Energy Bill received Royal Assent and became the **Energy Act 2011**[xxvii]. The flagship policy in the Act is the 'Green Deal', a scheme whereby householders, private landlords and businesses would be given finance upfront to make energy efficiency improvements, which would then be paid for by energy bill savings.

2012 and 2013 Annual Energy Statements

5.87 The **2012 Annual Energy Statement**[xxviii] continued to drive the strategic UK energy policy in a strategic direction whilst guiding investment. The Statement emphasises the key focus areas in order to meet the UK's energy objectives, including the investment in new energy infrastructure and cleaner technologies, giving householders greater power over their energy bills through the 'Green Deal', and Electricity Market Reform (EMR).

5.88 On the 31 October 2013, the DECC published the **2013 Annual Energy Statement**[xxix]. The Government has set three clear priorities in delivering the UK's energy policies in the near term. Firstly, to help householders and businesses keep energy costs down (through the EMR), secondly to unlock investment in the UK's energy infrastructure that will support economic growth and thirdly, to play a lead role in efforts to secure international action to reduce greenhouse gas emissions and tackle climate change.

Energy Bill 2012-13 to 2013-14

5.89 The **Energy Bill** completed Commons passage with overwhelming majority in June 2013, and is currently making its way through the House of Lords (HM Government, 2013)[xxx], with its third reading scheduled for the 19 November 2013. This Bill will establish a legislative framework for delivering secure, affordable and low carbon energy. The Bill includes provisions on:

- Electricity Market Reform: puts in place measures to attract the £110 billion investment which is needed to replace the current generating capacity and upgrade the grid by 2020, and to cope with a rising demand for electricity;
- Strategy and Policy Statement (SPS): Introduction of a SPS to improve regulatory certainty by ensuring that Government and Ofgem are aligned at a strategic level;
- Government Pipelines and Storage System (GPSS): Provisions to enable the sale of the GPSS; and
- Offshore transmission: change to the Electricity Act 1989 to aid the construction of the UK offshore grid for exporting power.

Electricity Market Reform Delivery Plan

5.90 In July 2013, the Government published the draft **Electricity Market Reform (EMR) Delivery Plan**[xxxi] for consultation. EMR is currently a key component of the proposed Energy Bill, and the draft Plan discusses the need for major investment in the UK electricity sector. The draft Plan outlines key clauses which will be implemented by the Energy Bill to encourage EMR including, 'Contracts for Difference (CfD), to support investment in low-carbon generation, and a 'Capacity Market', to ensure security of supply.

Scottish Climate Change and Renewable Energy Target

Climate Change (Scotland) Act 2009

5.91 The Climate Change Bill[xxxii] was published by the Scottish Government on 05 December 2008 and the **Climate Change (Scotland) Act 2009**[xxxiii] received Royal Assent on 04 August 2009. The Act creates the statutory framework for the reduction of greenhouse gas emissions in Scotland by setting an interim 42% target for 2020 and an 80% reduction target for 2050.

Climate Change Delivery Plan 2009: Meeting Scotland's Statutory Climate Change Targets

5.92 To meet these highly ambitious targets, the Scottish Government **Climate Change Delivery Plan: Meeting Scotland's Statutory Climate Change Targets**[xxxiv] has been prepared to target investment and effort across a range of relevant sectors, and renewable energy has a fundamental place in this strategy. Scotland's current renewable energy targets are to deliver 50% gross electricity generation from renewable sources by 2015 and the equivalent of 100% by 2020.

Scottish Energy Policy

5.93 The Scottish Government seeks to move Scotland to a low carbon society and has published a suite of publications on climate change, energy and the low carbon economy to support this transition, as set out below.

The Scottish Government Renewables Action Plan 2009

5.94 The **Scottish Renewables Action Plan**[xxxv] was published by the Scottish Government in July 2009 to set out what needed to happen and by when to meet the Scottish Government's Renewable Energy targets, with a focus on the period to 2011 - 2012 (24 - 36 months). It supports development of onshore wind farms in environmentally acceptable locations where cumulative effects can be addressed. The Action Plan was updated in February 2010, August 2010, February 2011 and March 2011.

The Energy Efficiency Action Plan

5.95 **Conserve and Save: The Energy Efficiency Action Plan**[xxxvi], published on 06 October, 2010, sets out in detail the actions the Scottish Government is taking to achieve a step change in energy use.

A Low Carbon Economic Strategy for Scotland: 'Scotland – A Low Carbon Society'

5.96 **A Low Carbon Economic Strategy for Scotland**[xxxvii], published on 15 November, 2010, sets the policy direction for low carbon economic opportunities, aims to strengthen business confidence in exploiting those opportunities. In respect of onshore wind the Strategy states that: *"It is important to recognise that onshore wind is still the technology that can make the most immediate positive impact on our low carbon economy, and therefore the Scottish Government will continue to encourage large, medium and small scale developments that are sited appropriately."* (section 2.2, page 49).

Low Carbon Scotland: Meeting the Emissions Reduction Targets

5.97 **Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010-2022**[xxxviii], published on 14 March, 2011, describes the measures identified to meet the emissions reduction targets established by the Climate Change (Scotland) Act 2009, over the period 2010-2022. By 2020 renewable electricity generation must account for at least 80% of gross electricity consumption.

5.98 On 27 June 2013 the Scottish Government published the **Low Carbon Scotland: Meeting the Emissions Reduction Targets 2013-2027: The Second Report on Proposals and Policies (RPP2)** [xxxix]. The report sets a decarbonisation target of 50 gCO2/kWh by 2030 to meet overall emissions targets. The Ministerial Foreword notes that the target set is challenging and that the decarbonisation of electricity is a key driver in the progress towards a low carbon economy. The report highlights that Scotland missed its annual carbon reduction target for 2011 by 0.8 million tonnes of carbon dioxide equivalent (CO_{2e}) having also missed its targets in 2010 by 1.1 million tonnes of CO_{2e}.

The 2020 Routemap for Renewable Energy in Scotland

5.99 On 30 June 2011, the **2020 Routemap for Renewable Energy in Scotland**[xl] was launched, to *"drive forward the renewables revolution, and to meet the Scottish Government's world-leading green energy targets*". The Routemap is an update and extension to the Renewables Action Plan 2009.

5.100 The original Renewables Action Plan set out short term actions towards the delivery of 2020 targets for renewable energy. The updated and expanded Routemap reflects the challenge of the new target to meet an equivalent of 100% demand for electricity from renewable energy by 2020, as well as the target of 11% renewable heat.

5.101 In regard to onshore wind, the Routemap identifies the objectives in respect of energy consents and planning and records the actions to be taken to meet them. In the Sectoral Routemaps at Annex A, the onshore wind vision is the "*continued expansion of portfolio of onshore wind farms to help meet renewables target, with robust planning framework supporting timely processing of consents applications and ensuring wind farms are consented where they are environmentally acceptable*." One of the headline ambitions is to "*Support the development of onshore wind farms in locations where it is environmentally acceptable, and hence contributes most effectively to sustainable economic growth"*.

5.102 Given the proven status of the technology, and the known and anticipated quantity of applications in the system, the Routemap notes that onshore wind is expected to provide the majority of capacity in the timeframe of the interim and 2020 renewable electricity targets. In addition an update report entitled **2020 Renewable Routemap for Scotland – Update**[xli] was issued on 30 October 2012 to report on the progress of the Routemap for Renewable Energy in Scotland. The update report highlighted that at current levels Scotland is on course to meet its renewable electricity targets. The update stated that a new interim renewable electricity target of 50% has been set for 2015 as above.

Electricity Generation Policy Statement 2013

5.103 In March 2012, the Scottish Government published its draft Electricity Generation Policy Statement (EGPS) for consultation. The final version of the **Electricity Generation Policy Statement 2013**[xlii] , published in June 2013, discusses the way in which Scotland currently generates electricity, and examines the changes which will be necessary to meet the Scottish Government's electricity generation target: "*Achieving the 100% target will require Scottish installed generation capacity to almost double over the 10 year period to 2020 – with wind (offshore and onshore) playing a critical role*" (para. 107).

The National Planning Framework for Scotland 2009[xliii] *(NPF2)*

5.104 **NPF2** is the long term strategy for the development of Scotland. The Scottish Government's commitment to sustainable development is reflected within the document. Paragraph 25 advises that tackling climate change and reducing dependence on finite fossil fuels are two of the major global challenges of our time. To address these issues, the Scottish Government has developed various policies promoting renewable energy production and targets to contribute to the battle against climate change.

5.105 NPF2 advises that the Government is committed to a Greener Scotland. Paragraph 48 states that key elements of the strategy for achieving a substantial reduction in emissions are greater energy efficiency, making the most of, and realising, Scotland's renewable energy potential. As part of the development strategy NPF2 lists key elements of the spatial strategy to 2030. This includes the promotion of development which helps to reduce Scotland's carbon footprint, facilitating adaptation to climate change.

5.106 Paragraph 144 advises that whilst the previous target of generating 50% of the electricity we use from renewable sources by 2020 is likely to be met, Scotland also needs to derive a higher proportion of its energy requirements for heating and travel from renewable sources. It advises that in line with EU objectives, the Scottish Government is committed to working towards deriving 20% of total energy use from renewable sources by 2020.

Scottish Planning Policy (SPP)

5.107 **Scottish Planning Policy (SPP)**[xliv] was published in February 2010 and is a statement of Scottish Government policy on land use planning.

Renewable Energy

5.108 Paragraph 182 of SPP advises that "*the commitment to increase the amount of electricity generated from renewable sources is a vital part of the response to climate change. […] Hydro-electric and onshore wind power are currently the main sources of renewable energy supplies."*

5.109 Paragraph 183 discusses the potential for communities and small businesses in urban and rural locations to become involved in renewable energy projects through investment in ownership or development of projects for local benefit. It advises that "*Planning authorities should support communities and small businesses in developing such initiatives in an environmentally acceptable way."*

5.110 Furthermore, paragraph 184 advises that: "*Planning authorities should support the development of a diverse range of renewable energy technologies, guide development to appropriate locations and provide clarity on the issues that will be taken into account when specific proposals are assessed. Development plans should support all scales of development associated with the generation of energy and heat from renewable sources, ensuring that an area's renewable energy potential is realised and optimised in a way that takes account of relevant economic, social, environmental and transport issues and maximises benefits."*

Wind Farms

5.111 Paragraph 187 of SPP advises that: "*Planning authorities should support the development of wind farms in locations where the technology can operate efficiently and environmental and cumulative effects can be satisfactorily addressed. Development plans should provide a clear indication of the potential for development of wind farms of all scales, and should set out the criteria that will be considered in deciding applications for all wind farm developments including extensions".* The criteria will vary depending on the scale of development and its relationship to the characteristics of the surrounding area, but are likely to include:

- "*landscape and visual impact;*
- *effects on the natural heritage and historic environment;*
- *contribution of the development to renewable energy generation targets;*
- *effect on the local and national economy and tourism and recreation interests;*
- *benefits and disbenefits for communities;*
- *aviation and telecommunications;*
- *noise and shadow flicker; and*
- *cumulative impact*".

5.112 Paragraph 187 further states, "*The design and location of any wind farm development should reflect the scale and character of the landscape. The location of turbines should be considered carefully to ensure that the landscape and visual impact is minimised*".

5.113 Paragraph 189 of SPP provides information in respect of spatial planning for wind farms above 20MW. It provides guidance for the preparation of spatial strategies to guide wind farm development through the Development Plan process. It advises that spatial frameworks should not be used to put in place a sequential approach to determining applications which requires applicants proposing development outwith an area of search to show that there is no capacity within areas of search.

5.114 Paragraph 190 discusses the potential constraints on wind farm development which planning authorities should consider and advises that "*A separation distance of up to 2km between areas of search and the edge of towns, cities and villages is recommended to guide developments to the most appropriate sites."*

5.115 SPP illustrates that plans should support the development of all technologies, regardless of scale, ensuring that an area's energy potential is achieved whilst being compatible with other Development Plan policies and objectives.

Planning Advice Notes (PANs)

5.116 **Planning Advice Notes (PANs)** are intended to supplement the SPP at the national level in providing good practice advice and policy guidance.

5.117 The following PANs are identified as relevant to Craigton and Spittalhill Wind Farm:

- PAN 1/2011: Planning and Noise[xlv];
- PAN 2/2011: Planning and Archaeology[xlvi];
- PAN 3/2010: Community Engagement[xlvii];
- PAN 50: Controlling the Environmental Effects of Surface Mineral Workings[xlviii];
- PAN 51: Planning, Environmental Protection and Regulations[xlix];
- PAN 1/2013: Environmental Impact Assessment[l];
- PAN 60: Planning for Natural Heritage[li];
- PAN 61: Planning and Sustainable Urban Drainage Systems; and
- PAN 75: Planning for Transport, 2005[lii].

Scottish Government Web Based Renewables Guidance

5.118 In February 2011, PAN 45 *Renewable Energy Technologies*[liii] was superseded by Scottish Government web based advice on renewables. Of particular relevance are the **'Onshore Wind Turbines**[liv]**'** and '**Process for Preparing Spatial Frameworks for Wind Farms**[lv]**'** guidance documents.

Onshore Wind Turbines

5.119 **'Onshore Wind Turbines'** suggests areas of focus for planning authorities, and lists opportunities within the planning system for compiling data bases and laying down clear planning procedures.

5.120 The guidance also outlines a number of typical planning considerations in determining planning applications for onshore wind turbine developments. These include:

- Landscape impact;
- Landscape assessment;
- Impacts on wildlife and habitat, ecosystems and biodiversity;
- Assessing impacts on wildlife and habitat, ecosystems and biodiversity;
- Buffer zones;
- Impact on communities;
- Separation distances;
- Aviation matters;
- Military aviation and other defence matters;
- Road traffic impacts;
- Cumulative impacts;
- Good practice during construction; and
- Decommissioning.

Process for Preparing Spatial Frameworks for Wind Farms

5.121 The Advice Sheet **'Process for Preparing Spatial Frameworks for Wind Farms'** was last updated in August 2012.

5.122 This latest version of this advice removed Step 3 from PAN 45, Annex 2, which removes the distinction between *Areas of Search – Minor Constraints* and *Areas of Search*. Therefore, the approach to developing spatial frameworks includes three stages:

- Stage 1 – Identify areas requiring significant protection;
- Stage 2 – Identify areas with potential constraints; and
- Stage 3 –Identify areas of search.

5.123 In terms of cumulative effects, the guidance states that *"it may be appropriate to plan for the clustering of wind farms within areas of search"*. This is the first time in policy guidance that the Scottish Government has been clear in proactively acknowledging the benefits of clustering wind farm developments.

Emerging Policy

The National Planning Framework for Scotland 2013 (NPF 3): Main Issues Report & Draft Framework

5.124 The **NPF 3 Main Issues Report & Draft Framework**[lvi] was issued for consultation on 30 April 2013 and is due to be adopted by 2014. NPF3, like its two predecessors, will be the spatial expression of the Government Economic Strategy, informed by plans and policies in areas such as transport, energy, health and wellbeing, climate change, and land use.

5.125 The development of onshore wind is strongly supported in this document, reflecting the commitments of the Scottish and UK Governments in relation to emissions reduction and energy generation targets. Paragraph 1.12 states that the NPF 3 spatial strategy should *"support the further deployment of onshore wind farms"* to help make Scotland a more low carbon place.

5.126 Paragraph 2.14 explicitly states that *"onshore wind will play a significant role in achieving the target"* of generating the equivalent of at least 100% of gross electricity consumption from renewables by 2020, with an interim target of 50% by 2015. In addition, it advises that *"whilst we increasingly see the development of offshore renewable energy generation, the further deployment of onshore wind remains a key strand in our efforts to reduce greenhouse gas emissions and achieve a balanced energy supply"*.

5.127 However, while there is continued support for renewable energy there is also an increased focus in the emerging NPF 3 on balancing this commitment with protecting nationally important landscapes and residential amenity, particularly in relation to onshore wind.

5.128 One of the key tools that the Scottish Government proposes to use to strike this balance is to increase the level of protection currently afforded to national parks and National Scenic Areas. In addition it is proposed that core areas of 'wild land' as identified in the SNH wild land map should be brought within the spatial planning process for planning authorities to take account of and included within 'areas of significant protection'.

Scottish Planning Policy (Consultation Draft 2013)

5.129 A review of the **SPP**[lvii] was announced in September 2012 with a subsequent draft of the updated SPP being published for consultation on 30 April 2013. The document continues to emphasise the merits of sustainable development and the need to tackle climate change and develop renewable energy resources through supportive Development Plans.

5.130 In its overview of the planning system it states in paragraph 208 that "*the planning system should support the transformational change to a low carbon economy and be consistent with national objectives and targets, including deriving:*

- *the equivalent of 100% of electricity demand from renewable sources by 2020;*
- *11% of heat demand from renewable sources by 2020; and*
- *30% of overall energy demand from renewable sources by 2020*".

5.131 In order to achieve this, the planning system must ensure that *"development plans should support all scales of development associated with the generation of electricity and heat from renewable sources with a view to realising the renewable energy potential of the areas they cover."*

5.132 Perhaps the most significant change proposed from the existing process is the change from the current 'three stage approach' to preparing onshore wind spatial frameworks to the requirement to provide a single map which consolidates information on capacity and the following groupings:

- Group 1 – Areas where wind farms will not be acceptable;
- Group 2 – Areas of significant protection;
- Group 3 – Areas where planning constraints are less significant, where opportunities for wind farm development can be realised through good design or mitigation; and

- Group 4 – Areas where wind farm proposal are likely to be supported subject too detailed consideration.

5.133 The draft SPP includes a consultation question seeking opinions on whether the recommended separation distances between wind farms and cities, towns and villages should be increased from 2km to 2.5km. However, consistent with the adopted SPP the recommended buffer is provided to reduce visual impacts and not to place a restriction upon wind farm development in general and is not applicable to individual dwellings: *"Decision on individual developments should take into account specific local circumstances and geography".*

5.134 The draft SPP also seeks to ensure that communities are able to share in the benefits of renewable energy and encourages *"all commercial wind farm developers to voluntarily offer community benefits and record these on the Scottish Government's Register of Community Benefit from Renewables."*

5.135 Regarding onshore wind energy developments, paragraph 216 states that, *"development plans should support the development of wind turbines at locations where impacts on the environment and communities can be satisfactorily addressed. Strategic development plan spatial strategies should identify capacity for strategic onshore windfarm developments as well as cumulative impact pressures. Local development plans should clearly set out the potential for wind turbine and windfarm development of all scales as part of the spatial framework"*.

5.136 It is proposed that the updated SPP will be published alongside NPF3 in June 2014.

Stirling Council Draft Proposed Local Development Plan (October 2012)

Overarching Policy and Sustainable Development Criteria

5.137 The overarching policy of the Proposed LDP sets out the Council's high level aspirations for new development. These are:

(a) "Compatibility with the Spatial Strategy and conformity with the relevant Sustainable Development Criteria.

(b) A design-led approach, including high standards of design, reinforcement of a sense of place, integration with neighbouring areas and the wider community.

(c) Appropriate measures for mitigation of and adaptation to climate change.

(d) Appropriate measures for the safeguarding, conservation and enhancement of the historic and natural environment.

(e) Safeguarding and appropriate management and utilisation of natural resources.

(f) Adherence to the principles of the National Planning Framework proposal for a Central Scotland Green Network, with relevant contributions to local and national Green Network objectives."

5.138 The Proposed LDP also includes Sustainable Development Criteria derived from Scottish Planning Policy, and like the overarching policy, forms a link between the national policy aims and the objectives of LDP. These are once again to be used as an indication of the Council's aspirations for new development. Of the ten points, point two is of direct relevance to renewable energy and states, "*Contribute to reduction in greenhouse gas emissions, in line with or better than national targets, and encourage energy and heat efficiency, and the use of low and zero carbon power generation*".

Wind Energy Developments

5.139 ***Primary Policy 12: Renewable Energy*** outlines the Scottish Government's ambitious renewable energy targets and highlights that *"The Plan area has the potential to contribute to energy generation through most of the renewable and low-carbon technologies currently being developed".*

5.140 ***Policy 12.1: Wind Turbines*** highlights that wind energy developments will be assessed against the following:

(i) "National planning policy and guidance current at the time of determination of applications.

(ii) Current locational and design guidance by Scottish Natural Heritage.

(iii) Stirling Council's 'Areas of Significant Protection' and Areas of Search', as detailed in SG33.

(iv) The findings from the Stirling Landscape Sensitivity and Capacity Study for Wind Energy Development (March 2008)."

5.141 The policy further states that wind energy developments will be permitted if their scale, layout and nature will not result in significant environmental effects, including cumulative effects. Emphasis is placed on conservation of landscape character and quality.

Landscape and Visual Amenity

5.142 ***Primary Policy 9: Managing Landscape Change*** stipulates that all development proposals should take into account the reasons why any special landscape designations exists and also guidance on the type and scales of development that are likely to be acceptable within that landscape. It also states that outwith landscape designation areas, it should be demonstrated that the landscape has capacity to accommodate a proposed development through reference to landscape character assessments, and that no adverse cumulative landscape and visual effects shall occur. The policy also recommends that developments should make provision to maintain or enhance landscape quality and create new high quality landscapes, especially where large scale developments compromise existing landscape character.

5.143 ***Policy 9.1: Protecting Special Landscapes*** states that developments within the National Scenic Area (NSA) will not be supported unless it can be demonstrated that the development will not compromise the integrity of the area and any adverse effects will be outweighed by social, environmental, and economic benefits. The policy also highlights that development within Local Landscape Areas (LLAs) will only be supported whereby the landscape character and scenic interest of the designation will not be compromised, and where an alternatively less sensitive site for the development has not been found.

5.144 ***Policy 9.2: Landscaping and Planting in Association with Development*** emphasises that new developments should incorporate new landscaping and planting works appropriate to the scale and nature of the envisaged development and states, *"All development proposals should: -*

(a) Identify and safeguard existing landscape or planting features where these make a valuable contribution to local landscape character, biodiversity, cultural heritage or amenity.

(b) Include high quality proposals for new landscape and planting works.

(c) *Demonstrate suitable arrangements for the establishment and long-term maintenance of new landscape and planting*."

Geology, Hydrology and Hydrogeology

5.145 ***Primary Policy 5: Flood Risk Management*** states that development shall not be located on functional flood plains. In addition development located on land as indicated on SEPA's Indicative River and Coastal Flood Map (Scotland) or land which is subject to flooding shall be informed by a Flood Risk Assessment (FRA), shall be assessed against the Risk Framework Scottish Planning Policy, and shall not result in an increase in flood levels to the site.

5.146 The policy highlights that surface water from new developments shall be treated by a Sustainable Urban Drainage System (SUDS) before discharge into the water environment. In addition the policy states that all developments will be assessed for their potential to reduce overall flood risk and emphasises that development outwith functional floodplains are not necessary free from flood risk. A precautionary approach is recommended therefore and water resilient materials should be used.

5.147 ***Policy 5.1: Reinstate Natural Watercourses*** states, "*In the interests of sustainable flood management (and the protection and improvement of the water environment) development proposals will be expected to:-*

(a) Incorporate drainage solutions that avoid channel modification, except works aimed at achieving more natural watercourses and wetlands.

(b) Open out previously culverted watercourses whenever possible.

(c) Remove redundant water engineering installations".

5.148 ***Primary Policy 13: The Water Environment*** states that development proposals should "*minimise and mitigate any potential impacts on the water environment*". Moreover, it states that development proposals should have regard to any potential effects on drinking water supply catchments, including private supplies. It highlights that Stirling Council will ensure that development proposals comply with the Scottish River Basin Management Plan, relevant Area Management Plans, and the forthcoming Flood Risk Management Plans due to be introduced by mid-2016.

5.149 ***Primary Policy 14: Soil Conservation and Agricultural Land*** stipulates that larger developments on areas of productive soil will only be supported where they adhere to the LDP Spatial Strategy. *"All developments should:-*

(a) Consider means of minimising impact on soil resources.

(b) Implement appropriate soil management measures, particularly for valuable soils such as good quality agricultural soils and soils with a high organic content. (Any proposals affecting peat accumulations will be subject to Policy 4.2).

(c) Adopt best practice when moving, storing and reinstating soils. (See Natural Scotland Regulatory Guidance 'Promoting the sustainable reuse of greenfield soils in construction').

(d) *Consider opportunities to re-use soils necessarily excavated from the site".*

5.150 ***Policy 8.3: Proposals affecting Geological Conservation Review Sites*** emphasises that development proposals should not adversely affect sites of value to geodiversity. If development proposals are likely to do so, then an assessment should be carried out by the developer, and support will only be granted if it can be demonstrated that there are social and economic reasons why the development should progress. In such circumstances, developments would be subject to necessary planning conditions.

5.151 ***Policy 4.2: Protection of Carbon Rich Soils*** highlights that a detailed soil investigation will be required if a development site is located in an area of carbon-rich soil. This would be required to identify the exact location of the soils in order to determine the level of mitigation required.

5.152 The policy highlights that the role of carbon-rich soils in maintaining carbon dioxide will be maintained by protection from development and supporting developments which provide carbon and biodiversity benefits. However, the policy emphasises that wind energy developments may be exempted from the above policy where it can be demonstrated that the development will offset the carbon released through peat extraction as determined by the Scottish Government's 'Calculating Carbon Savings from Wind Farms on Scottish Peatlands – A New Approach' guidance[lviii].

Ecology

5.153 ***Primary Policy 8: Conservation and Enhancement of Biodiversity*** states that the protection and enhancement of wildlife and its habitats in international and national designated sites will be supported in accordance with statutory requirements. It highlights that developments which are likely to negatively affect Natura sites (i.e. Special Protection Areas (SPAs) and Special Areas of Conservation (SAC)) will not be in accordance with the LDP unless it can be demonstrated that the integrity of the site will not be compromised. The policy stipulates that developments should afford necessary protection to protected species as listed in the Habitats Directive and Birds Directive. The policy highlights that Stirling Council will consider the potential for developments to enhance biodiversity conservation, and will seek mitigation to offset adverse effects.

5.154 Through the policy Stirling Council will seek to identify and protect Local Nature Conservation Sites and Geological Conservation Review Sites. The policy states that areas not covered by statutory or local designations will be safeguarded if they are deemed to make significant contributions to local biodiversity.

5.155 ***Policy 8.1: Biodiversity Duty*** builds upon Primary Policy 8 and emphasises that all development proposals will be assessed in terms of their potential to affect biodiversity. Where developments are likely to result in effects on biodiversity, support will only be given where it can be demonstrated that measures can be taken to maintain species populations or enhance other habitats such that overall biodiversity is retained.

5.156 ***Policy 8.2: Proposals affecting Local Nature Conservation Sites (LNCS)*** requires that developments should not affect sites of importance to local nature conservation (LNCS). If development is likely to affect these sites, a biodiversity assessment should be undertaken and support will only be granted if it can be demonstrated that there are social and economic reasons why the development should proceed. In such circumstances, developments would be subject to necessary planning conditions.

5.157 ***Policy 10.1: Development Impact upon Trees and Hedgerows*** highlights that development proposals shall afford protection to individual and groups of trees and hedgerows which enhance local amenity or have historic value. The policy emphasises that during construction of development proposals, protection and management of retained trees on site shall be in accordance with BS 5837:2012.

5.158 The policy stipulates that, *"(c) All proposals on sites with existing trees or other significant vegetation features within or close to the site boundaries should: -*

(i) Include an appropriate tree survey and demonstrate how the findings of the tree survey and assessment have informed the development proposals.

(ii) Identify trees proposed for removal and retention, with details of how protection will be afforded.

(iii) Bring forward tree planting proposals to compensate for any removal and / or workable mitigation measures where development would impair connectivity between important woodland habitats.

(iv) Demonstrate suitable arrangements for the long-term management of retained trees and any compensatory planting (on or off-site as appropriate according to the nature and scale of the development). Developers should notify owners of any affected trees.

(v) Ensure the long-term retention of existing and proposed trees by positioning buildings an appropriate distance from them, taking into account the ultimate height of the trees*".*

Archaeology and Cultural Heritage

(a) ***Primary Policy 7: Historic Environment*** states that developments will be assessed against the following: *"The Historic Landscape Assessment reports, the Inventory of Gardens and Designed Landscapes and the Inventory of Battlefield sites.*

(b) Historic Scotland's Managing Change and Inform documents (as an interim measure, pending production where necessary of more detailed Supplementary Guidance specific to the context of the Stirling Plan area).

(c) Conservation Area Character Appraisals.

(d) Current local Planning guidance on the historic environment.

(e) The Council's Sites & Monuments Record.

(f) The potential for sites or structures to harbour undiscovered heritage assets including archaeology".

5.159 ***Policy 7.1: Archaeology and Historic Building Recording (designated and undesignated building and sites)*** states that there will be a presumption against development which directly affects a Scheduled Monument, nationally significant monument or detracts from a designated monument's setting.

5.160 Where the extent of archaeological remains on a site is unknown, an evaluation is required prior to the determination of any application for development to establish the importance of such site. The policy states that approval of developments which will directly affect historic environment features shall be subject to provision being made by the developer to undertake building investigations and recording, assessment, analysis, publication and archiving.

5.161 ***Policy 7.2: Developments within and outwith Conservation Areas*** states, " *(a) Development within a Conservation Area and development outwith, that will impact on the conservation area, shall preserve or enhance its character, appearance and setting. All new development should respect the architectural and visual qualities of the area, have regard to the character of the area as identified in the relevant Conservation Area Character Appraisal".*

5.162 The policy further states that new developments should complement existing development patterns and retain the features which contribute to the unique character of the Conservation Area.

5.163 ***Policy 7.3: Development affecting Listed Buildings*** stipulates that development scale, use, design and materials shall preserve listed buildings and their setting. Where this is not possible, then development will not be permitted. The policy further states that, "*(b) Listed Buildings should not be demolished unless it can be clearly demonstrated that any of the following apply: -*

(i) The building is no longer of special interest.

(ii) The building is beyond repair.

(iii) The demolition of the building is essential to delivering significant benefits to economic growth or the wider community.

(iv) *The repair of the building is not economically viable and it has been marketed at a price reflecting its location and condition to potential restoring purchasers for a reasonable period"*.

5.164 The policy states that a Conservation Plan may be required to support a development proposal in some cases.

5.165 ***Policy 7.8: Development affecting Battlefields, Gardens and Designed Landscapes*** states, "*(a) Development which would have a significant adverse effect upon the archaeology, landscape features, character and setting of sites listed in the Inventory of Historic Battlefields will not be supported unless it can be demonstrated that the overall integrity and character of the battlefield area will not be compromised"*. Where developments are approved on battlefield sites, the policy stipulates that appropriate mitigation shall be employed to enhance or conserve the characteristics and value of these sites.

5.166 In terms of Gardens and Designed Landscapes, the policy states, "*(b) Development affecting sites within Gardens and Designed Landscapes shall protect, preserve and enhance such places and shall not impact adversely upon their character, upon important views to, from and within them, or upon the site or setting of component features which contribute to their value. Such protection will apply to Inventory sites and also to other designed landscapes of more local interest*".

Supplementary Planning Guidance

Stirling Council Landscape Sensitivity and Capacity Study (2007)[lix]

5.167 A Landscape Capacity Study was commissioned by Stirling Council in 2007, to assess the capacity of the landscape within the Stirling Council area to accommodate development (see topic specific summary for Landscape and Visual effects below. At a meeting on 13 March 2008 the Council agreed that the study would form a material consideration for the purpose of determining planning applications. They also agreed to consult on a package of SPG including a revised principal locational policy, complementary revisions to Local Plan policies, and detailed Development Management guidance, all for adoption as interim policy and eventual inclusion in the new style Local Development Plan. This is detailed below.

Stirling Council Interim Locational Policy and Guidance for Renewable Energy Developments (Wind Turbines) (2011)[lx]

5.168 This SPG contains the Council's locational policy and guidance for wind turbines of up to and including greater than 110m in height, i.e. micro to very large. It sets out key guidance and advice on topic areas for developers such as 'Visual and Landscape Impacts', 'Cumulative Impacts', 'Community Turbines' and 'Community Benefits' and presents information on policy maps, typically areas of significant protection and areas of search for each size category. The locational guidance and criteria section provides a guide to the advice within the landscape sensitivity and capacity study according to turbine size and landscape type.

Proposed LDP Supplementary Guidance SG33 – Wind Farms and Wind Turbines[lxi]

5.169 SG33 supports ***Proposed LDP Policy 12.1: Wind Turbines*** and provides a consolidated version of the ***Stirling Council Interim Locational Policy and Guidance for Renewable Energy Developments (Wind Turbines)*** (2011), above. It defines 'Areas of Significant Protection' and 'Areas of Search', and includes guidance on siting and design, landscape and visual assessment and other technical planning and environmental criteria.

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6 Landscape and Visual Amenity

Introduction

6.1 This chapter considers the potential effects of the proposed Craigton and Spittalhill Wind Farm (hereafter referred to as the Development) on the landscape and visual resources of the Development Area (referred to as the site) and the surrounding study area, during construction and operation.

6.2 This chapter should be read in conjunction with **Chapter 9: Ecology, Chapter 11: Archaeology and Cultural Heritage**, **Chapter 13: Socio Economics**, **Appendix 6.1: Landscape Baseline** and **Appendix 6.2: Visualisation Methodology**. Planning policies of relevance to this assessment are identified in **Chapter 5: Planning Policy Context**.

6.3 This chapter is supported by figures which follow the text at the end of this chapter and the Appendices which are contained in Volume II.

Study Area Description

6.4 The study area for the assessment was defined as 35km from the outermost turbines[1] of the Development in all directions, as recommended in current guidance for turbines of 100m to blade tip or higher[i] and in agreement with statutory consultees Scottish Natural Heritage (SNH), Stirlingshire Council and Loch Lomond and The Trossachs National Park Authority. The study area is shown on **Figure 6.1**.

6.5 To consider cumulative effects of the Craigton and Spittalhill Wind Farm in relation to other schemes in the wider area, wind farms within 35km of the Development have been included for the purposes of modelling and detailed assessment, as agreed with Stirling Council (STC), Scottish Natural Heritage (SNH) and Loch Lomond and The Trossachs National Park Authority (LLTNPA). A review of patterns of development is also provided for wind farms in the wider area, extending to 60km, following guidance from SNH[ii].

6.6 The assessment has been undertaken by chartered Landscape Architects at LUC.

Effects Assessed

6.7 The key objective of the assessment is to identify and assess the potential significant landscape and visual effects of Craigton and Spittalhill Wind Farm as perceived by people, including residents, motorists and recreational users, in the surrounding area.

6.8 Effects on the landscape include physical changes to the landscape as well as changes in landscape character. They may also include effects on areas designated for their scenic or landscape qualities, at a national or local policy level. Effects on visual amenity relate to changes in views resulting from the introduction of Craigton and Spittalhill Wind Farm in those views. Effects on landscape and visual receptors (including residents, motorists and recreational users) may also include changes in relation to the interaction between Craigton and Spittalhill Wind Farm and other existing or proposed wind farms (cumulative effects).

6.9 The key objective of the assessment is to identify and assess the likely significant landscape and visual effects of the Development. This emphasis on identifying significant effects is supported by current EIA regulations and guidance[iii], and so these are assessed in full.

6.10 As such, all potentially significant landscape and visual effects are examined, including those relating to construction (short term, lasting less than three years) and operation (long term, lasting longer than 15 years).

Effects Scoped Out

6.11 On the basis of the desk and field based work, initial assessment, the professional judgement of the LVIA and EIA teams, experience from other relevant projects and informed by policy guidance or standards, the following potential effects have been 'scoped out' (in agreement with statutory consultees):

- effects on receptors beyond 35km from the wind farm site, where it is judged that potential significant effects are unlikely to occur, and with the exception of appropriate consideration of cumulative and sequential effects;
- locations where receptors are unlikely to be affected by the Development, through having minimal or no predicted visibility, as predicted by the Zone of Theoretical Visibility (ZTV) mapping (Figures 6.1ai and Figure 6.2); and
- cumulative wind farm developments with turbines of less than 50m to blade tip outside 5km of the Development, with the exception of the Balafark Farm Wind Turbine.

Consultation

6.12 Consultation was carried out regarding the selection of viewpoints, methodology and cumulative developments for the Landscape and Visual Impact Assessment (LVIA) and Cumulative Landscape and Visual Impact Assessment (CLVIA), in addition to the scoping consultation. Consultees included Stirling Council (STC), Scottish Natural Heritage (SNH), Loch Lomond and The Trossachs National Park Authority (LLTNP), Falkirk Council (FKC), North Lanarkshire Council (NLC), East Dunbartonshire Council (EDC), Perth and Kinross Council (PKC) and Clackmannanshire Council (CKC). Given the overlap between the need for visualisations from assets of cultural heritage value, consultation was also undertaken with Historic Scotland regarding viewpoints for the cultural heritage assessment contained in **Chapter 11: Archaeology and Cultural Heritage**. Issues identified during consultation, and how and where in this Chapter these issues are addressed, are set out in **Table 6.1: Consultation Responses**.

Table 6.1: Consultation Responses

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Stirling Council (STC)	Formal Scoping Consultation	Highlighted that the number of viewpoint locations (13) as set out in the Scoping Report is below the average number of viewpoints typically included in an LVIA. Stated that the number and location of viewpoints can be agreed through further discussions. Highlighted that the status of Craigannet Wind Farm[2] is currently at appeal rather than being under construction, as highlighted in the Scoping Report Draft Cumulative Wind Farm List.	Suggested viewpoints provided were considered in relation to theoretical visibility. Final viewpoints subsequently agreed with Stirling Council following requests for additional viewpoints during consultation. Craigannet Wind Farm refused following appeal and subsequently removed from the cumulative assessment.
	Consultation regarding selection of viewpoints for LVIA	Content with the selection of viewpoints.	n/a
	Additional consultation regarding scope of LVIA and CLVIA assessment and final viewpoint selection	Agreed to default to the advice of SNH with regard to the approach to the LVIA and CLVIA and the final selection of assessment viewpoints.	Agreed cut of date for inclusion of cumulative schemes – 09th November 2012[3].

[1] The study area is defined from the outermost turbines, as these components of the development are the only components likely to be visible beyond 15-20km.

[2] Craigannet Wind Farm subsequently refused planning consent at Appeal: 21st November 2012 and therefore not considered in this assessment.

[3] A subsequent cut-off date for the inclusion of wind farm developments in the CLVIA was 1st October 2013.

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Scottish Natural Heritage **(SNH)**	Formal Scoping Consultation	Advised that the *Stirling landscape sensitivity and Capacity Study for wind energy development* (Horner + MacLennan 2007) highlights that there is no capacity in the landscape to accommodate Craigton and Spittalhill Wind Farm. LVIA to address the offsite effects of improving public roads i.e. the landscape and visual effects of road alteration. Access tracks and borrow pits to be included in visualisations less than 10km from the site. LVIA of felling options is also recommended. LVIA to present wirelines and photomontages for all selected viewpoints within 15km of the site. Cumulative LVIA to distinguish between cumulative landscape effects, cumulative visual effects, static combined effects, static successive effects and sequential effects. Craigton and Spittalhill Wind Farm should be designed in the context of the existing baseline. Local Authorities to be contacted for a current list of all known wind farm developments within the cumulative study area.	All relevant national and local guidance and policy considered during the design and assessment of the Development. Provision of visualisations and graphics to support the assessment subsequently agreed with SNH. All LVIA viewpoints within 35km study area represented by wirelines and photomontages. Methodology for LVIA and CLVIA developed to meet requested requirements and agreed during subsequent consultation.
	Consultation regarding selection of viewpoints for LVIA	Confirmed they were content with the selection of viewpoints, but requested the consideration of viewpoints from Falkirk Wheel and the Bathgate Hills and from the B818 through the Carron Valley. Requested consideration of Cardross and Redknock House Inventory Garden and Designed Landscapes (IGDLs).	Viewpoint included from Shieldhill to represent requested views from the south-east. No visibility possible from the B818 through the Carron Valley or Falkirk Wheel - no viewpoints included.
	Additional consultation regarding scope of LVIA and CLVIA assessment and final viewpoint selection	Content with the approach to the LVIA and CLVIA, and the final selection of LVIA and CLVIA viewpoints. Requested that viewpoints are shown on the Landscape Character and Landscape Designation figures. Content with the inclusion of the emerging *Stirling Council Proposed Supplementary Guidance SG28: Landscape Character Assessment* (Stirling Council, 2012).	All LVIA viewpoints within 15km included in CLVIA along with Ben Ledi and Ben Cleuch. Agreed cut of date for inclusion of cumulative schemes – 09th November 2012. Final viewpoints listed in Table 6.19.
Loch Lomond and The Trossachs National Park Authority **(LLTNPA)**	Consultation regarding selection of viewpoints for LVIA	Requested additional viewpoints from Stob Binnein, Balquhidder area and Ben Vorlich and consideration of views from core wildness areas. Requested inclusion of Merkins, Cove Community and Ardchonnel Wind Farms in the cumulative assessment.	Additional viewpoint included from Balquhidder core wildness area at Meall an-t Seallaidh. The proposed Merkins Wind Farm included in cumulative assessment. The Cove Community and Ardchonnel Wind Farms not included as they lie out with the 35 km study area and are currently at pre-application design/scoping stage.
	Additional consultation regarding scope of LVIA and CLVIA assessment and final viewpoint selection		All LVIA viewpoints within 15km included in CLVIA along with Ben Ledi and Ben Cleuch. Agreed cut of date for inclusion of cumulative schemes – 09th November 2012. Final viewpoints listed in Table 6.19.
Falkirk Council (FKC)	Consultation regarding selection of viewpoints for LVIA	Requested the inclusion of three additional viewpoints from Falkirk Council area, suggested Falkirk Wheel, Shieldhill and B803 near Slamannan. Highlighted inclusion of Tod Hill and Ruillie Wind Farms in CLVIA.	Additional viewpoint included from Shieldhill, no visibility from Falkirk Wheel. Tod Hill Wind Farm included in CLVIA, Ruillie Wind Farm now refused.
	Additional consultation regarding final selection of LVIA and CLVIA viewpoints	Content with the final selection of viewpoints within the Falkirk Council area.	All LVIA viewpoints within 15km included in CLVIA along with Ben Ledi and Ben Cleuch. Final viewpoints listed in Table 6.19
North Lanarkshire Council **(NLC)**	Consultation regarding selection of viewpoints for LVIA	Content with the selection of viewpoints for the LVIA, requested that a number are also used for the CLVIA. Suggested inclusion of viewpoint from the Tak Me Doon Road.	No visibility indicated from the Tak Me Doon Road, adjacent viewpoint from Tomtain chosen to represent similar views. All LVIA viewpoints within 15km included in CLVIA along with Ben Ledi and Ben Cleuch;
	Additional consultation regarding final selection of LVIA and CLVIA viewpoints	Content with the final list of viewpoints for the LVIA and CLVIA.	Final viewpoints listed in Table 6.19.
East Dunbartonshire Council **(EDC)**	Consultation regarding selection of viewpoints for LVIA	No comments to make regarding the selection of viewpoints.	n/a
	Additional consultation regarding final selection of LVIA and CLVIA viewpoints	No comments provided.	All LVIA viewpoints within 15km included in CLVIA along with Ben Ledi and Ben Cleuch. Final viewpoints listed in Table 6.19.

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Perth and Kinross Council (PKC)	Consultation regarding selection of viewpoints for LVIA	Requested inclusion of viewpoint from Carn Chois above Comrie.	Carn Chois viewpoint not included, out with 35km study area.
	Additional consultation regarding final selection of LVIA and CLVIA viewpoints	No comments provided.	All LVIA viewpoints within 15km included in CLVIA along with Ben Ledi and Ben Cleuch. Final viewpoints listed in Table 6.19.
Clackmannanshire Council (CKC)	Consultation regarding selection of viewpoints for LVIA	No comments to make regarding the selection of viewpoints.	n/a
	Additional consultation regarding final selection of LVIA and CLVIA viewpoints	Noted the inclusion of viewpoint from Ben Cleuch in the Ochil Hills, within the Clackmannanshire Council area.	All LVIA viewpoints within 15km included in CLVIA along with Ben Ledi and Ben Cleuch. Final viewpoints listed in Table 6.19.

Assessment Methodology

Introduction

6.13 The key steps in the methodology for assessing both landscape and visual effects were as follows:

- the landscape of the study area was analysed and landscape receptors identified;
- the area in which the Development may be visible was established through creation of a zone of theoretical visibility (ZTV) covering a distances of up to 35km from the Site;
- the visual baseline was recorded in terms of the different groups of people who may experience views of the Development, the places where they will be affected and the nature of views and visual amenity;
- viewpoints were selected (including representative viewpoints, specific viewpoints and illustrative viewpoints), in consultation with STC, SNH and the LLTNPA;
- likely effects on landscape and visual resources were identified; and
- the significance of landscape and visual effects were judged with reference to the sensitivity of the resource/receptor (its susceptibility and value) and magnitude of effect (taking cognisance of the scale of effect, geographical extent and duration/reversibility).

6.14 The assessment is based on the introduction of the Development as it is described in **Chapter 4: Development Description**. Key elements include:

- seven wind turbines (including external transformers) of up to 125m (to blade tip) height;
- crane hardstandings;
- onsite underground electrical cables;
- a control building;
- a permanent meteorological mast;
- a temporary site construction compound/laydown area;
- two areas within which it is proposed to win rock for wind farm construction (borrow pits);
- approximately 5km of onsite access tracks;
- a construction phase of approximately 12 months, operation for 25 years, followed by decommissioning (over approximately 6 months).

6.15 Micrositing of turbines (up to 50m as specified in Chapter 4: Development Description) is considered unlikely to result in changes to predicted landscape or visual effects, and therefore will not affect the findings of this assessment.

6.16 The LVIA considers the potential effects of the Development on the existing landscape against a baseline that includes existing wind farms and those under construction[4]. Wind farms considered include those that lie within the 35km study area, and which are over 50m to blade tip height[5].

6.17 The assessment considers the following potential effects:

- effects on landscape and visual amenity during the operational life time of the wind farm;
- effects on landscape and visual amenity during the construction and decommissioning phases;
- cumulative effects on landscape and visual amenity during the operational phase; and
- implications for designated landscapes.

6.18 The methodology for the assessment of cumulative effects (CLVIA) is set out in the cumulative section which follows the assessment of landscape and visual effects (paragraph 6.141 onwards).

Assessment Guidance and Data Sources

Guidance

6.19 The methodology for the landscape and visual assessment is informed by policy and current guidelines. Guidance and data sources used are set out below.

Government policy and guidance

- Scottish Government, 2010. Scottish Planning Policy[iv];
- Scottish Government, 2013. Onshore Wind Turbines[v];
- Scottish Government, 2003. Planning Advice Note 68: Design Statements[vi];
- Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011[vii];
- Clackmannanshire Council and Stirling Council, 2002. Clackmannanshire and Stirling Structure Plan[viii];
- Clackmannanshire Council and Stirling Council, 2004. Clackmannanshire and Stirling Structure Plan: Finalised First Alteration: Renewable Energy[ix];
- Stirling Council, 1999. Stirling Council Local Plan[x]; and
- Council of Europe, 2000. The European Landscape Convention – Council of Europe Treaty Series No. 176[xi].

Methodology Guidance

- Landscape Institute and the Institute of Environmental Management & Assessment, 2013. Guidelines for Landscape and Visual Impact Assessment (Third Edition) (GLVIA3)[xii];
- Landscape Institute and the Institute of Environmental Assessment, 2002. Guidelines for Landscape and Visual Impact Assessment (Second Edition)[xiii];
- Swanick and Land Use Consultants, 2002. Landscape Character Assessment Guidance for England and Scotland[xiv];
- The Countryside Agency and Scottish Natural Heritage, 2004. Landscape Character Assessment Guidance for England and Scotland: Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity[xv];
- horner + maclennan, and Envision, 2006. Visual Representation of Windfarms: Good Practice Guidance[xvi];

[4] Wind farms subject to planning applications or with planning consent but not yet under construction are considered in the cumulative assessment detailed later in this chapter.
[5] An exception to this is the inclusion of Balafark Farm Wind Turbine (46m to blade tip) in the assessment.

- Landscape Institute, 2011. Photography and photomontage in landscape and visual impact assessment: Landscape Institute Advice Note 01/11[xvii]*;* and
- Scottish Natural Heritage, 2012. Assessing the Cumulative Impact of Onshore Wind Energy Developments[xviii].

Design and Locational Guidance

- Scottish Natural Heritage, 2009. Siting and Designing windfarms in the landscape – Version 1[xix]; and
- Scottish Natural Heritage, 2009. Strategic Locational Guidance for Onshore Windfarms in Respect of the Natural Heritage[xx].

Designated Areas

- Scottish Natural Heritage, 2010. The special qualities of the National Scenic Areas. SNH Commissioned Report No.374[xxi]*;*
- Loch Lomond and The Trossachs National Park Authority, 2006. An Evaluation of the Special Qualities Loch Lomond & The Trossachs National Park - Technical Appendix to the National Park Plan Submitted to Scottish Ministers[xxii];
- Structure and Local Plans covering the study area (See **Chapter 5: Planning Policy Context**); and
- Historic Scotland Inventory of Gardens and Designed Landscapes[6].

Landscape Character Assessments

- Land Use Consultants, 1999. Tayside landscape character assessment[xxiii];
- David Tyldesley and Associates, 1999b. Stirling to Grangemouth landscape character assessment[xxiv];
- Scottish Natural Heritage, 2009. Loch Lomond and The Trossachs National Park Landscape Character Assessment[xxv];
- Environmental Resources Management, 1996. Landscape assessment of Argyll and the Firth of Clyde[xxvi];
- ASH Consulting Group, 1999. Central Region landscape character assessment[xxvii];
- ASH Consulting Group, 1998a. Clackmannanshire landscape character assessment[xxviii];
- Land Use Consultants, 1999. Glasgow and Clyde Valley landscape character assessment[xxix];
- ASH Consulting Group, 1998b. The Lothians Landscape Character Assessment[xxx];
- Land Use Consultants, 1999. Tayside landscape character assessment[xxxi];
- David Tyldesley and Associates, 1999a. Fife landscape character assessment[xxxii]; and
- David Tyldesley and Associates, 1995. The landscape of Kinross-shire: A landscape assessment of the Kinross Local Plan Area[xxxiii].

Supplementary Planning Guidance (SPG)

- horner + maclennan, 2007. Stirling landscape sensitivity and capacity study for wind energy development[xxxiv];
- Stirling Council, 2011. Stirling Council Supplementary Planning Guidance: Interim Locational Policy and Guidance for Renewable Energy Developments (Wind Turbines)[xxxv];
- Stirling Council, 2012. Proposed Supplementary Guidance SG28: Landscape Character Assessment[xxxvi]; and
- Stirling Council, 2012. Proposed Supplementary Guidance SG27: Protecting Special Landscapes[xxxvii].

Mapping

- Ordnance Survey (OS) Maps:
  - Landranger 1:50,000 Scale (Sheets 51, 52, 56, 57, 58, 63, 64, 65);
  - Pathfinder 1:25,000 Scale (Sheets 342, 343, 347, 348, 349, 365, 366);
  - Online map search engines; and
  - British Geological Society, 1979. Geological Map, Solid, North.

Modelling

- Landform Panorama Data at 1:50,000 (containing 3-D contour information at 10m intervals, reported as being accurate to ±3m);
- Raster Data at 1:50,000 (to show surface details such as roads, forest and settlement detail equivalent to the 1:50,000 scale Landranger maps); and
- Raster Data at 1:250,000 (to provide a more general location map).

6.20 No data gaps have been identified which will affect the outcome of the assessment. However, the Landscape Character Assessments used as a source of baseline information were found to be variable in their age and detail.

6.21 Field survey work was carried out during several visits under differing weather conditions between May 2012 and October 2013, and records were made in the form of field notes and photographs. Field survey work included a visit to the site, visits to viewpoints and designated landscapes, and extensive travel around the study area to consider potential effects on landscape character and on experiences of views seen from routes.

Visualisations and Modelling

6.22 The methodology for production of the visualisations was based on current guidance [xxxviii] and [xxxix]. Further information about the approach is provided in **Appendix 6.2: Visualisation Methodology**.

Assessing Effects and Significance

6.23 This section sets out the methodology used for the landscape and visual assessment (LVIA) and the assessment of cumulative landscape and visual effects (CLVIA), sets out the methodology specific to the type of effect being considered, describes how the sensitivity ('nature of the receptor', considering both susceptibility and value) and the magnitude of change ('nature of the effect', considering size/scale/extent, duration and reversibility) on each receptor were identified, and how these were used to judge the significance of effect.

6.24 As noted above, consideration of potential landscape effects, dealing with changes to the landscape as a resource, and visual effects, dealing with changes in views and visual amenity are related but distinct components of LVIA[7]. The methodologies used to assess potential landscape and visual effects are broadly similar, but so include some differences.

6.25 In order that the differences are clear, the following sections are structured so that the methodology and means of assessing significance for landscape and visual effects is set out separately, under the following headings:

- Assessment of Landscape Effects; and
- Assessment of Visual Effects.

Assessing significance of Landscape Effects

6.26 Judging the significance of landscape effects requires consideration of the nature of the landscape receptors (sensitivity) and the nature of the effect on those receptors (magnitude). The third edition of the GLVIA state that the nature of landscape receptors, commonly referred to as their sensitivity, should be assessed in terms of the susceptibility of the receptor to the type of change proposed, and the value attached to the receptor. The nature of the effect on each landscape receptor should be assessed in terms of its size and scale, geographical extent, duration and reversibility.

6.27 These aspects are considered together, to form a judgement regarding the overall significance of effect. The following sections set out the methodology used to evaluate susceptibility, value, size and scale, geographical extent, duration and reversibility.

[6] Historic Scotland website: http://www.historic-scotland.gov.uk/index/heritage/gardens.htm

[7] This distinction is emphasised and clearly defined in the GLVIA 3rd Edition.

Landscape Sensitivity

Susceptibility of the Receptor

6.28 Current guidelines state that the nature of landscape receptors, commonly referred to as their sensitivity, should be assessed in terms of the susceptibility of the receptor to the type of change proposed and the value attached to the receptor.

6.29 The susceptibility, of the landscape relates to *"the ability of the landscape receptor (whether it be the overall character or quality/condition of a particular type or area, or an individual element and/or feature, or a particular aesthetic and perceptual aspect) to accommodate the proposed development without undue[8] consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies"* (GLVIA 3 Para 5.40).

6.30 For wind energy developments, **Table 6.2: Criteria to Determine Susceptibility of Landscape Receptors to Wind Turbines** is used by LUC to evaluate susceptibility of landscape types or character areas[9]. Aspects indicating lower susceptibility are listed on the left, and those which generally indicate a higher susceptibility are listed on the right of the table. Evaluations which lie between these extremes are transitional, in that they lie on a sliding scale. For example in relation the scale, the middle column represents a position part way between the two extremes and would equate to a landscape of medium scale, being of a medium susceptibility.

Table 6.2: Criteria to Determine Susceptibility of Landscape Receptors to Wind Turbines

Characteristic Attribute	Aspects indicating lower sensitivity to wind energy development	↔	Aspects indicating higher sensitivity to wind energy development
Scale	Large scale	↔	Small scale
Landform	Absence of strong topographical variety. Featureless, convex or flat/plateau	↔	Presence of strong topographical variety or distinctive landform features
Landscape pattern and complexity	Simple Regular or uniform	↔	Complex Rugged and irregular
Settlement and man-made influence	Presence of contemporary structures e.g. utility, infrastructure or industrial elements	↔	Absence of modern development Presence of small scale, historic or vernacular settlement
Skylines	Non-prominent /screened skylines Presence of existing modern man-made features	↔	Distinctive, undeveloped skylines Skylines that are highly visible over large areas or exert a large influence on landscape character Skylines with important historic landmarks
Inter-visibility with adjacent landscapes	Little inter-visibility with adjacent sensitive landscapes or viewpoints	↔	Strong inter-visibility with sensitive landscapes Forms an important part of a view from sensitive viewpoints
Perceptual aspects	Close to visible or audible signs of human activity and development	↔	Remote from visible or audible signs of human activity and development

6.31 Published landscape capacity or sensitivity studies were reviewed to inform the evaluation of susceptibility of the receptor. The review included an evaluation as to the relevance of the publication to the assessment (e.g. consideration of the purpose and scope of the published studies and whether they have become out of date).

6.32 The published Stirling landscape sensitivity and capacity study for wind energy development[xl] considers the sensitivity of the landscape of Stirlingshire to wind turbines and refines but does not super cede the landscape characterisation set out in the relevant SNH landscape character assessments of the central region, Clackmannanshire and the surrounding areas. This study was reviewed and used in this landscape and visual impact assessment to inform the baseline landscape character of the study area and the evaluation of susceptibility of the landscape receptor to wind farm development. It was also referred to in terms of the guidance it provided on siting and design issues, and cumulative landscape and visual issues, specifically in relation to operational (Earlsburn and Craigengelt Wind Farms) and consented wind farm development (Earlsburn North Wind Farm) in the Fintry, Gargunnock and Touch Hills.

6.33 Judgements on susceptibility of receptors (which may include individual features or areas) are recorded as **high**, **medium** or **low**.

Landscape Value

6.34 The value of a landscape is recognised as being a key contributing factor to the sensitivity of landscape receptors and is indicated in **Table 6.3: Sensitivity of Landscape Receptors**. As with **Table 6.2: Criteria to Determine Susceptibility of Landscape Receptors to Wind Turbines**, the indicators lie on a sliding scale, as suggested by the arrow. Where value falls between the two extremes, for example in the case of regional or local designation, it may therefore be considered to be medium. Value is informed with reference to:

- a review of designations and the level of policy importance that they signify (such as landscapes designated at international, national, local or community level); and
- application of criteria that indicate value (such as landscape quality, scenic quality, rarity, representativeness, conservation interests, recreation value, perceptual aspects, associations e.g. with artists or writers).

6.35 Judgements on the landscape value of receptors (which may include individual features or areas) are recorded as **high**, **medium** or **low**.

6.36 It should be noted that whilst landscape designations at an international or national level are likely to be accorded the highest value, it does not necessarily follow that such landscapes all have a high susceptibility to all types of change[xli]. There may be a complex relationship between the value attached to a landscape and it's susceptibility to change. Therefore the rational for judgements on the sensitivity of the landscape is clearly set out for each receptor, based on the principles established in **Table 6.3: Sensitivity of Landscape Receptors**.

[8] Undue can be interpreted as 'disproportionate'.
[9] These criteria draw on guidelines contained in Countryside Agency and SNH, 2004. Topic Paper 6. Techniques and Criteria for Judging Capacity and Sensitivity, but have been modified and developed by LUC with specific regard to wind energy development

Table 6.3: Sensitivity of Landscape Receptors

Sensitivity of the Landscape Receptors		
Sensitivity	**Sensitivity**	**Sensitivity**
Susceptibility of landscape receptors to change	Attributes that make up the character of the landscape offer very limited opportunities for the accommodation of change without key characteristics being fundamentally altered, leading to a different landscape character	Attributes that make up the character of the landscape are resilient to being changed by wind energy development
Value	Landscapes with high scenic quality, high conservation interest, recreational value, important cultural associations or rarity or uniqueness Areas or features designated at a national level e.g. National Parks or National Scenic Areas (NSAs) or key features of these with national policy level protection	Landscape of poor condition and intactness, limited aesthetic qualities, or of character that is widespread Areas or features that are not formally designated but may be valued at a community level

Sensitivity

6.37 Judgements regarding the sensitivity of landscape receptors combine a consideration of both the susceptibility of the landscape to the type of development proposed and the value attached to the landscape. Judgements are recorded as **high**, **medium** or **low**.

Magnitude of Landscape Effect

Scale and Geographical Extent of Landscape Effect

6.38 The scale and geographical extent of landscape effects are measures of the extent of existing landscape elements that will be lost, the proportion of the resource that this represents, the contribution of such elements to the character of the landscape, and the size of the geographical area across which the effects will be felt. In terms of landscape character, this reflects the degree to which the character of the landscape will change by removal or addition of landscape components, and how the changes will affect key characteristics.

6.39 Size/scale is described as being **large**, **medium** or **small**, and the geographical extent over which the effect will be experienced is considered in terms of whether it will be **widespread** or **localised**, i.e. at a regional or local level, or associated with the more immediate setting of the site.

Duration

6.40 Duration is reported as **short term** (an effect that will occur during construction or operation activities, lasting throughout the relevant project phase, generally lasting 0-5 years), **medium term** (generally lasting 5-10 years) or **long term** (a permanent effect remaining from construction and operation of the development after implementation of mitigation measures, generally lasting over 10 years), as defined in current guidance[xlii].

Reversibility

6.41 Reversibility is reported as **permanent**, **partially reversible** or **reversible**.

Magnitude of Landscape Change

6.42 Judgements regarding the magnitude of landscape change are recorded as **high**, **medium**, **low** or **barely perceptible** and combine an assessment of the scale and extent of the landscape effect, its duration and reversibility, as indicated in **Table 6.4: Magnitude of Landscape Effect**.

Table 6.4: Magnitude of Landscape Effect

Magnitude of Landscape Effect	
Magnitude	**Description of Change**
High	A large change in landscape characteristics and/or over an extensive geographical area and/or which may result in an irreversible landscape effect.
Medium	A medium change in landscape characteristics and/or which may be over a large geographical area, and/or which may be reversible over a long duration of time.
Low	A small change in characteristics of the landscape and/or which may be over a localised geographical area, and/or which may be reversible over a short duration of time.
Barely perceptible	An almost imperceptible change in characteristics of the landscape and/or which is focused on a small geographical area, and/or which is almost or completely reversible.

Visual Effects

6.43 Visual effects are experienced by people at different locations around the study area, at static locations (for example viewpoints or settlements) and transitional locations (such as sequential views from routes). Visual receptors are the people who will be affected by changes in views at different places, and they are usually grouped by what they are doing at that place (for example residents, motorists, recreational users).

6.44 Judging the significance of visual effects requires consideration of the nature of the visual receptors, commonly referred to as their sensitivity, in terms of the susceptibility of the receptor to change in views/ visual amenity and the value attached to particular views. The nature of the effect is assessed in terms of the size and scale, geographical extent, duration and reversibility of the effect.

Sensitivity of Views and Visual Receptors

Susceptibility of the Receptor

6.45 The susceptibility of visual receptors to changes in views/visual amenity is a function of the occupation or activity of people experiencing the view and the extent to which their attention is focussed on views. This is recorded as **high**, **medium** or **low** according to **Table 6.5: Sensitivity of Visual Receptors**.

6.46 Recognition of the value of a view is determined with reference to:

- planning designations;
- importance in relation to heritage assets (such as designed views recorded in citations of Designed Gardens and Landscapes or views recorded as of importance in Conservation Area Appraisals); and
- indicators of the value attached to views by visitors, for example through appearances in guide books or on tourist maps, provision of facilities for their enjoyment and references to them in literature and art.

6.47 Judgements on the value of visual receptors (which may include individual features or areas) are recorded as **high**, **medium** or **low**.

Table 6.5: Sensitivity of Visual Receptors

Sensitivity of Visual Receptors		
Sensitivity	**Higher**	**Lower**
Susceptibility of visual receptors to change	Viewers whose attention or interest is focussed on their surroundings, including: • residents occupying properties; • visitors to heritage assets, or other attractions, where the views of the surrounding landscape are important to the experience; • residential communities where views contribute to a valued landscape setting; or • visiting viewers, whose main focus of outdoor recreational activity is on their surroundings.	Viewers whose attention or main focus of activity is not likely to be focussed on their surroundings, including: • Working viewers; or • Viewers travelling on busy roads/transport routes.
Value	Designated viewpoint or scenic route marked on OS maps or in tourist information; Recognition in relation to heritage assets; Protected by local planning policy.	Viewpoints or routes not formally recognised or advertised in tourist information.

Sensitivity

6.48 Judgements regarding the sensitivity of visual receptors combine a consideration of both the susceptibility of the visual receptor to the type of development proposed and the value attached to the visual receptor or view. Judgements are recorded as **high**, **medium** or **low**.

Magnitude of Visual Change

Size and Scale of Visual Effect

6.49 Size and scale of visual effects depends on:

- the scale of the change in view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by Craigton and Spittalhill Wind Farm;
- the degree of contrast or integration of any new features or changes in the landscape with the existing or remaining landscape elements and characteristics in terms of form, scale and mass, line, height, colour and texture; and
- the nature of the view of Craigton and Spittalhill Wind Farm, in terms of the relative amount of time over which it will be experienced and whether views will be full, partial or glimpses.

6.50 Size/scale is described as being **large**, **medium** or **small**.

6.51 All effects are assumed to be during winter, being the worst case situation with minimal screening by vegetation and deciduous trees. Note that wirelines and ZTVs are calculated on the basis of bare ground and therefore demonstrate the maximum extent of visibility possible, in the absence of buildings or vegetation.

Geographical Extent of Visual Effects

6.52 The geographical extent of visual effects records the extent of the area over which the changes will be visible e.g. whether this is a unique viewpoint from where the Craigton and Spittalhill Wind Farm can be glimpsed, or whether it represents a large area from which similar views are gained. Geographical extent is described as **widespread** or **localised**.

Duration

6.53 Duration is reported as **short term** (0-5 years), **medium term** (5-10 years) or **long term** (over 10 years), as set out in current guidance[xliii]. Construction and decommissioning effects are considered to be short term, but operational effects will all be long term.

Reversibility

6.54 Reversibility is reported as **reversible**, **partially reversible** or **permanent**, and is related to whether the change can be reversed at the end of the phase of development under consideration (i.e. at the end of the construction or at the end of the operational lifespan of the development). Operational effects are considered to be reversible as the decommissioning phase will remove turbines and most infrastructure at the end of the operational phase. Effects are therefore considered to be reversible except were specifically stated in the assessment sections below.

Magnitude of Visual Change

6.55 Judgements regarding the magnitude of visual change are recorded as **high**, **medium**, **low** or **barely perceptible** and combine an assessment of the scale and extent of the visual effect, its duration and reversibility. as indicated in **Table 6.6: Magnitude of Visual Effect**.

Table 6.6: Magnitude of Visual Effect

Magnitude of Visual Effect	
Magnitude	**Description of Change**
High	A large change in views, where the Development is a key/defining element of the view, and/or seen over an extensive geographical area and/or which may result in an irreversible landscape effect.
Medium	A medium change in views, where the Development is clearly discernible but is not a key/defining element of the view, and/or which may be seen over a large geographical area, and/or which may be reversible over a long duration of time.
Low	A small change in views, where the Development is visible and forms a minor element in the view, and/or which may be seen over a localised geographical area, and/or which may be reversible over a short duration of time.
Barely perceptible	An almost imperceptible change in views, where the Development may go unnoticed as a minor element in the view (or it is not visible), and/or which is seen from a small geographical area, and/or which is almost or completely reversible.

Judging the Overall Significance of Landscape and Visual Effects

6.56 The evaluations of the individual aspects set out above (susceptibility, value, size and scale, geographical extent, duration and reversibility) were considered together to provide an overall profile of each identified effect. An overview was then taken of the distribution of judgements for each aspect to make an informed professional assessment of the overall significance of each effect.

6.57 The EIA Regulations require that the significance of each potential effect is identified. In this assessment, four levels of effect are used: **major**, **moderate**, **minor** and **negligible**. A higher level of effect was generally attached to higher magnitude changes affecting higher sensitivity resources or receptors.

6.58 Effects were identified as either **significant** or **not significant** in the context of the EIA Regulations, with major and moderate effects being judged to be significant. Minor and negligible effects are judged not to be significant.

6.59 The determination of levels of effect requires the application of professional judgement and experience to take on board the many different variables which need to be considered, and which are given different weight according to site-specific and location-specific considerations in every instance. Judgements are made on a case by case basis, as required by published guidance.

6.60 A rigid matrix-type approach, where level of effect is defined simply based on the level of sensitivity combined with the magnitude of change, is therefore not used. As such, the conclusion on level of effect is not always the same.

Direction of Effects

6.61 The direction of effect (**positive**, **negative** or **neutral**) is determined in relation to the degree to which the proposal fits with the landscape character or view and the contribution to the landscape or the view that the Craigton and Spittalhill Wind Farm makes, even if it is in contrast to the existing character.

6.62 With regard to wind energy development, there is a broad spectrum of response from the strongly positive to the strongly negative. However, to cover the 'maximum case' situation, potential effects are assumed to be negative unless otherwise specifically stated in the text. The professional judgements made in this assessment may therefore not reflect how the change to the landscape and views will be perceived by all the groups of people considered.

Baseline Conditions (General)

6.63 This section sets out the baseline characteristics of the landscape across the site and study area. This section is pertinent to both the landscape and visual assessments.

The Site

6.64 The site is located in the Fintry Hills above the Carron Valley, approximately 5km east of Fintry and approximately 6km south of Kippen. The site includes the north-east facing slopes of the Backside Burn valley, on the flank of the ridge that runs down from Stronend (511m Above Ordnance Datum, AOD). The site is drained by the Shelloch Burn and tributaries of the Backside Burn, which runs south-eastwards down the valley into the Endrick Water, which drains west wards below the Carron Valley Reservoir (the Endrick Water does not flow into the reservoir, but runs past the dam to the north of the reservoir). The site is covered in grassland and moorland, further details of which are found in **Chapter 9: Ecology.**

The Study Area

6.65 The study area extends to 35km from the turbines in all directions, and includes land under 15 councils: Stirling, Falkirk, West and East Dunbartonshire, North and South Lanarkshire, Perth and Kinross, Clackmannanshire, Fife, West Lothian, Glasgow City, East Renfrewshire and Renfrewshire, Inverclyde and Argyll and Bute Councils as shown in **Figure 6.1**.

Landscape Elements and Landcover

6.66 The study area extends from the southern edge of Glasgow in the south, Grangemouth and the Ochil Hills in the east, Loch Earn in the north and Loch Lomond and Greenock in the west. The study area therefore includes much of the heavily settled Central Belt of Scotland, as well as remote upland areas. The landscape of the study area includes farmland and valleys, to high summits and moorland, and the inland river estuaries of the River Clyde and River Forth.

Geology and Landform

6.67 The underlying geology of the site is predominantly Plagioclase-Macrophyric Basaltic Rock and Microporphyritic Basalt, with areas of Tuff and Agglomerate, and Mugearite. The underlying geology of the wider study area is one of volcanic rock which forms the Clyde Plateau Volcanic Formation. The upper slopes and summits of the Fintry Hills consist of basalt overlain with superficial geology dominated by peat deposits.

6.68 The main valleys across the study area are the Clyde Valley and Forth Valleys, the more minor valleys which include the Carron Valley, Strath Gartney, Glen Artney, Strathyre, Strathblane and Glen Devon. The study area includes the expanses of open water of Loch Lomond, Loch Katrine, Loch Venachar, Loch Ard and the Carron Valley Reservoir as well as other more distant lochs and reservoirs. The site lies within the Fintry Hills, south of the Forth Valley. The Campsie Fells and Kilsyth Hills are located to the south and the Ochil Hills are located to the north-east of the site. The highest mountains in the study area include:

- Ben Vorlich (985m AOD);
- Stuc a Chroin (975m AOS);
- Ben Lomond (974m AOD);
- Ben Ledi (879m AOD); and
- Ben Cleuch (721m AOD).

6.69 Within the Campsie Fells, Fintry, Gargunnock and Touch Hills the highest points are:

- Earl's Seat (578m AOD);
- Meikle Bin (570m AOD);
- Hole Head (551m AOD);
- Stronend (511m AOD); and
- Carleatheran (485m AOD).

Land Use

6.70 The land use of the study area responds to topography and elevation, with ley pasture and some arable farmlands on the lowland areas, pasture farms on the slopes give way to open moorland with rough grazing on the uplands. This land use varies substantially across the study area, from urban and industrial sprawl to intensive farming, forestry and open upland moorland.

6.71 Outside the Central Belt (including the Glasgow Basin and the Forth valley below Stirling) settlements tend to be small, located in low lying valley areas, often associated with watercourses and bridging points. Isolated or grouped properties are scattered throughout the lower lying areas and along valleys.

6.72 Transport routes connect the settlements along valleys, and relatively few roads extend into the upland areas. The transport network across the Central Belt is dense, and includes railways and the Forth and Clyde Canal as well as roads of all grades.

6.73 The study area provides a wide range of opportunities for recreation, from water based activities and fishing on the numerous bodies of open water and rivers, to mountaineering, as well as more accessible forms of recreation such as walking on footpaths and mountain Biking within the Carron Valley. Long distance recreational routes across the Study Area include the Rob Roy Way, West Highland Way, other long distance routes, and parts of the National Cycle Network. Potential effects of the Proposed Wind Farm Development on recreational interests are discussed in **Chapter 13: Socio-Economics**, but many landscape and visual receptors are also represented within this LVIA.

Existing Wind Farm Developments

6.74 There are a number of operational wind farms and wind farms under construction in the study area, including those listed in **Table 6.7: Wind Farms Operational and Under Construction** below. The locations of these developments are shown on **Figure 6.3**. All of these wind farms are included in the baseline for the LVIA. The wind farms considered in the CLVIA include those listed in **Table 6.7: Wind Farms Operational and Under Construction** and those listed in **Table 6.52: Wind Farms considered in the Cumulative Assessment** later in this chapter.

Table 6.7: Wind Farms Operational and Under Construction

Wind Farm	Status[10]	Blade Tip Height (m)	No. of Turbines	Distance (km)[11]
Earlsburn[12]	Operational	110m	15	2.8km
Balafark Farm[13]	Operational	46m	1	5.6km
Craigengelt	Operational	125m	8	6.3km
West Cambushinnie	Operational	60.98m	1	22.2km
Braes of Doune	Operational	100m	36	22.8km

[10] Development status on the 1st October 2013.
[11] Distance between nearest turbine and the nearest turbine of Craigton and Spittalhill Wind Farm.
[12] Development includes the Fintry Community Wind Turbine.
[13] Single turbine scheme included in assessment due to its location within close proximity to Craigton and Spittalhill Wind Farm.

Wind Farm	Status[10]	Blade Tip Height (m)	No. of Turbines	Distance (km)[11]
Greendykeside	Operational	100m	2	23.6km
Burnfoot Hill	Operational	95m	13	27.8km
Cathkin Braes	Operational	125m	1	31.0km

6.75 The distribution of existing (operational and under construction) wind farm development across the study area is focussed on the lowland hills of the Gargunnock and Touch Hills adjacent to the site where the operational Earlsburn and Craigengelt Wind Farms appear as two separate developments, the Ochil Hills to the north-east where Burnfoot Hill lies within the 35km radius study area and marks the western extent of wind farm development within these hills and the Braes of Doune Wind Farm which lies north of the Forth valley across the open moorland above Doune. The lowland areas of the study area, including the Forth Valley and Forth Estuary are largely free of existing wind farm development, however a small number of smaller single wind turbine developments exist to the north-west and north-east of the site.

Landscape Related Designations

6.76 Valued landscapes are often recognised by policy designations. The landscape designations found within the study area are listed below and shown on **Figure 6.5** and **Figure 6.5**a.

- International designations (World Heritage Sites):
  - None.
- Nationally designated landscapes (National Parks, National Scenic Areas (NSAs), AONBs):
  - Loch Lomond and The Trossachs National Park;
  - River Earn (Comrie to St Fillans) National Scenic Area (NSA);
  - Loch Lomond NSA; and
  - The Trossachs NSA.
- Locally designated landscapes:
  - Fintry, Gargunnock and Touch Hills Area of Great Landscape Value (AGLV) (Stirling);
  - Denny Hills AGLV;
  - Western Ochils AGLV (Stirling);
  - Gartmorn AGLV;
  - Bo'Ness AGLV;
  - Trossachs and Breadalbane AGLV;
  - Slamannan Plateau AGLV;
  - River Devon AGLV;
  - Avon Valley AGLV;
  - Cleish Hills AGLV;
  - Upper Forth Special Landscape Area (SLA);
  - Lower Clyde and Calderglen SLA;
  - Middle Clyde Valley SLA;
  - Campsie Fells RSA (Glasgow and Clyde Valley Joint Structure Plan); and
  - Kilsyth Hills Regional Scenic Area (RSA) (Kilsyth Local Plan).
- Other designations include:
  - Inventory of Gardens and Designed Landscapes (IGDLs)[14]: Cardross House, Gargunnock House, Touch (see **Chapter 11: Archaeology and Cultural Heritage**);
  - Country Parks (CPs): Balloch Castle, Calder Glen, Cathkin Braes, Chatelherault, Dams to Darnley, Drumpellier, Garmtmorn, Gleniffer Braes, Mugdock, Muiravonside, Palacerigg, Plean, Polkemmet, Pollok and Strathclyde; and
  - Other archaeological sites as listed in **Chapter 11: Archaeology and Cultural Heritage**.

6.77 In addition to the areas listed in above, SNH identified Search Areas of Wild Land[xliv] (SAWL) (Scottish Natural Heritage, 2002) have more recently have produced maps that identify 'core areas' of wild land[15] (Scottish Natural Heritage, 2013[xlv]). None of these areas of wild land exist in the study area. Wild land areas are therefore not considered further.

6.78 The designations listed above indicate that many parts the study area are valued for their landscape, for moorland and valley landscapes, as well as designed landscapes. The fact that some areas of landscape are not designated does not mean that they do not have value.

Landscape Assessment

Landscape Baseline

Landscape Characterisation of the Study Area

6.79 The study area includes landscape character types from river estuaries to mountains, with a range of lowland valley types as well as upland fringe and uplands, described in a series of Landscape Character Assessments identified below.

6.80 The landscape character of the site and surrounding study area to the north and east is described within the Central Region Landscape Character Assessment and the Stirling and Grangemouth Landscape Character Assessment. The landscape character of the north-eastern part of the study area is described within the Tayside Landscape Character Assessment and the eastern and south-eastern periphery of the study area is described within the Fife, Clackmannanshire and, Lothian Landscape Character Assessments respectively.

6.81 The landscape character of the southern part of the study area is described within the Glasgow and Clyde Valley Landscape Character Assessment, while the western extent of the study is described within the Landscape Assessment of Argyll and Firth of Clyde.

6.82 The landscape character of the north-western part of the study area is predominantly described within the Loch Lomond and The Trossachs National Park Landscape Character Assessment (within the National Park Boundary).

6.83 There is a gap in the SNH dataset for LCTs, where the boundaries of LCAs do not meet. This area extends from the National Park boundary to Thornhill, Kippen Station and along the A811 to Balfron Station and part way to Drymen. This area is covered by the draft LCA contained in Stirling Council's *Proposed Supplementary Guidance SG28: Landscape Character Assessment*[xlvi] (outside the National Park Boundary).

Landscape Receptors

6.84 The landscape as a whole is a receptor in its own right. However, to distinguish where effects may be significant, the landscape is divided into parts, the site, and surrounding landscape character types (LCTs). The site, described above in paragraph 6.57, lies within the area covered by the Central Region Landscape Character Assessment, and is covered by the landscape character type (LCT) 10, Lowland Hills (Fintry, Gargunnock and Touch Hills).

6.85 The LCTs within 35km of the Development are illustrated on **Figure 6.4** and listed in **Table 6.8: Landscape Character Types considered as Landscape Receptors**. The theoretical inter-visibility with the Craigton and Spittalhill Wind Farm is described (see also **Figure 6.4a**). The theoretical inter-visibility with the Development (ZTV coverage) is used as a means of identifying which LCTs require further assessment, and which LCTs can be scoped out because they are unlikely to experience significant effects arising from Craigton and Spittalhill Wind Farm. Closer LCTs to the site, i.e. those within 15km of Craigton and Spittalhill Wind Farm are shown superimposed on the ZTV in **Figure 6.4a**. Key characteristics of LCTs to be assessed are set out in **Appendix 6.1: Landscape Baseline**.

[14] IGDLs include those located within the Archaeology and Cultural Heritage 10km Outer Study Area from Craigton and Spittalhill Wind Farm application boundary.

[15] This document was subject to consultation for the National Planning Framework, and does not therefore represent adopted core wild land areas. Core areas may be subject to change until the finalisation of the National Planning Framework in 2014.

Table 6.8: Landscape Character Types considered as Landscape Receptors

Landscape Character Type[16]	Theoretical visibility of Development (ZTV coverage)
Central Region LCA (1999)	
LH 10, Lowland Hills – Fintry, Gargunnock and Touch Hills	Yes, considered in the assessment
LH 11, Lowland Hills – Campsie Fells	Yes, considered in the assessment
LHF 14, Lowland Hill Fringes – Mugdock	No theoretical visibility, not considered further
LHF 15, Lowland Hill Fringes – East Touch Fringe	Very limited, no potential for significant effects, not considered further
LHF 17, Lowland Hill Fringes – Denny Muir	Very limited, no potential for significant effects, not considered further
LP 18, Lowland Plateaux – Kippen Muir	Yes, considered in the assessment
LRV 20, Lowland River Valleys – Teith	No theoretical visibility, not considered further
LRV 21, Lowland River Valleys – Carse of Forth	No theoretical visibility, not considered further
LRV 23, Lowland River Valleys – Lower Devon Carselands	No theoretical visibility, not considered further
LRV 25, Lowland River Valleys – Strath Blane	No theoretical visibility, not considered further
LRV 26, Lowland River Valleys – Endrick Water/Blane Water	No theoretical visibility, not considered further
LRV 27, Lowland River Valleys – Middle Endrick Water	No theoretical visibility, not considered further
LRV 28, Lowland River Valleys – Upper Carron	Yes, considered in the assessment
LRV 29, Lowland River Valleys – Middle Carron	No theoretical visibility, not considered further
LRV 30, Lowland River Valleys – Falkirk/Denny Urban Fringe	No theoretical visibility, not considered further
LRV 31, Lowland Valley Fringes – Forth/Teith	No theoretical visibility, not considered further
LRV 32, Lowland Valley Fringes – Teith/Forth/Allan	No theoretical visibility, not considered further
LRV 34, Lowland Valley Fringes –Forth/ Kippen Muir	Very limited, no potential for significant effects, not considered further
Glasgow and the Clyde Valley LCA (1999)	
1, Raised Beach	No theoretical visibility, not considered further
2, Floodplain	No theoretical visibility, not considered further
3, Urban Greenspace	No theoretical visibility, not considered further
4, Rolling Farmland	No theoretical visibility, not considered further
5, Plateau Farmland	No theoretical visibility, not considered further
6, Rugged Upland Farmland	No theoretical visibility, not considered further
7, Fragmented Farmland	No theoretical visibility, not considered further
8, Incised River Valleys	No theoretical visibility, not considered further
9, Green Corridors	No theoretical visibility, not considered further
10, Broad Valley Lowland	No theoretical visibility, not considered further
11, Broad Urban Valley	No theoretical visibility, not considered further
12, Upland River Valleys	No theoretical visibility, not considered further
16, Drumlin Foothills	No theoretical visibility, not considered further
18, Plateau Moorlands	Very Limited, no potential for significant effects, as beyond 15 km, not considered further
20, Rugged Moorland Hills	Yes, considered in the assessment
Loch Lomond and The Trossachs National Park LCA (2009)	
Rolling Farmland with Estates	Yes, but a very limited area over 10km away
Moss Farmland with Estates	Yes, but a very limited area over 10km away
Natural and Restored Moss	Yes, but a very limited area over 10km away
Forested Moorland	Yes, but a very limited area over 10km away
Loch Island	Yes, but a very limited area over 10km away
Lowland Lochs	Yes, but a very limited area over 10 km away
Stirling Proposed SPG (2012)[17]	
L2-L3, Flat Valley Floor	Yes, considered in the assessment
L6-L7, Rolling Valley Farmland	Yes, considered in the assessment
L14, Farmed Valley or Hill Fringe	Yes, considered in the assessment
L21, Lowland Valley Fringes	No theoretical visibility, not considered further
Tayside (1999)	
1b, Mid Highland Glens	No theoretical visibility, not considered further
1c, Lower Highland Glens	No theoretical visibility, not considered further
3, Highland Summits and Plateaux	Very Limited, no potential for significant effects, as beyond 15km, not considered further
6, Lowland Hills	Very Limited, no potential for significant effects, as beyond 15km, not considered further
8. Igneous Hills	No theoretical visibility, not considered further
10, Broad Valley Lowland	No theoretical visibility, not considered further

[16] Codes used are those published in the source Landscape Character Assessments

[17] This area is covered by the draft Landscape Character Assessment contained in Stirling Council's approved but as yet not adopted Supplementary Guidance (Stirling Council, 2012). For this assessment, the LCTs contained in the draft SG are used for this small area of the Forth Valley not covered within the Central Region LCA (ASH Consulting Group, 1999).

Landscape Character Type[16]	Theoretical visibility of Development (ZTV coverage)
15, Lowland Loch Basin	No theoretical visibility, not considered further
Argyll and the Firth of Clyde (1996)	
5, Open Ridgeland	No theoretical visibility, not considered further
13, Rolling Farmland with Estates	No theoretical visibility, not considered further
Lothians (1998)	
4, Lowland Hills and Ridges	Very Limited, no potential for significant effects, as beyond 30km, not considered further
5, Lowland Plateaux	Very Limited, no potential for significant effects, as beyond 30km, not considered further
7, Coastal Margins	Very Limited, no potential for significant effects, as beyond 30km, not considered further
Fife (1999)	
5, Lowland Hills and Valleys	No theoretical visibility, not considered further
11, Coastal Hills	No theoretical visibility, not considered further
4, Coastal Braes	No theoretical visibility, not considered further
15, Coastal Flats	No theoretical visibility, not considered further

6.86 From this analysis, landscape areas that require further analysis and assessment include the site, and eight LCTs detailed within **Table 6.8: Landscape Character Types considered as Landscape Receptors**. These are considered in the assessment section below.

Potential Landscape Effects

6.87 Likely significant landscape effects have been identified with reference to interactions between the Development and landscape receptors.

6.88 Based on the development described in **Chapter 4: Development Description**, the sources of effects that will occur during the construction and decommissioning of the development will include:

- activities and vehicular/personnel movements, including lighting, on the site and on local roads[18];
- the disturbance of areas of land and surface vegetation, including felling of a number of trees;
- the introduction or removal of infrastructure at ground level;
- the introduction of tracks, crane hardstandings at each turbine location and a substation;
- the construction and use of a works compound;
- the introduction of tall vertical structures (turbines and a monitoring mast) and the use of cranes; and
- the potential need for lighting during construction if work extends into hours of darkness (see **Chapter 4: Development Description**).

6.89 Likely changes relating to construction and decommissioning activities include changes to the physical nature (landcover/vegetation) and the perceived landscape character of the site as a result of all activities considered together.

6.90 The sources of effects that will occur during the operational development with a lifespan of 25 years will include the introduction of tall vertical structures with moving parts and infrastructure at ground level that includes tracks, substation and transformers at the base of each turbine (as described in **Chapter 4: Development Description**). These will give rise to the following changes:

- changes in physical nature (landcover/vegetation) and landscape character of the site as a result of all of the components of the Development considered together (turbines and all infrastructure); and
- changes to character of nearby LCTs as a result of all of the components of the proposed wind farm Development considered together (turbines and all infrastructure).

Mitigation

Mitigation by Design

6.91 Landscape considerations, including the appearance of the Craigton and Spittalhill Wind Farm from key locations and minimising the necessary footprint of the proposed Development infrastructure played a key role in the progression of the layout design for Craigton and Spittalhill Wind Farm. Additional mitigation measures, including the existing shared access proposals are set out in **Chapter 4: Development Description**. The design of the Development is described in **Chapter 3: Site Selection and Design Strategy**, and the landscape considerations are set out in that chapter. They are therefore not repeated here.

Mitigation during Construction and Decommissioning

6.92 The construction of the turbines and associated infrastructure will follow agreed Construction Method Statements[19], which will include arrangements for implementation of various aspects of the works such as vegetation and soil removal, storage and replacement and vegetation restoration, which will help to mitigate potential adverse effects during the works. These will be designed in agreement with STC and SNH as outlined in **Chapter 4: Development Description**.

6.93 The decommissioning activities will also follow the agreed Decommissioning Method Statements, and site restoration will be a key part of the works.

Mitigation during Operation

6.94 Measures to reduce landscape effects have been embedded into the design of the Development and the post-construction restoration proposals. Further mitigation across the wider landscape is not possible due to the inherent nature of wind farm developments.

Residual Landscape Effects

Construction and Decommissioning Effects

Construction Effects on the Site

6.95 Construction activities will give rise to changes to the landscape and visual amenity of the site itself during the 12 month construction period. Changes primarily relate to excavations and track construction, and the presence of tall cranes and partially built towers, whilst turbines are being erected. There will therefore be direct changes to the site relating to the activity on the site and the introduction of new features, as well as a perceived change from rough grazed moorland to an active construction site. Construction effects are judged to result in **short-term** and largely **reversible** effects on the site are outlined in

6.96 **Table 6.9: Construction Effects on the** Site**.**

Table 6.9: Construction Effects on the Site

Receptor	The proposed wind farm site
Susceptibility	The site is of open moorland, parts of the sloping landform forms part of the skyline from surrounding valleys and the Carse of Forth. There is a presence of human influence on the site (i.e. managed grazing, for further information on vegetation cover see **Chapter 9: Ecology**) and nearby in the form of Earlsburn and Craigengelt Wind Farms and coniferous forestry in the Carron Valley, therefore the susceptibility of the site is judged to be medium.

[18] No major road modifications are anticipated along the public access route, as detailed in Paragraph 12.20, Chapter 12: Access, Traffic and Transport.

[19] Draft Construction and Decommissioning Method Statements will be agreed post consent with STC and SNH.

Receptor	The proposed wind farm site
Value	The site is part of the Fintry, Gargunnock and Touch Hills AGLV designated landscape. The site is therefore judged to be of medium value.
Size and Scale	There will be large scale changes to the site, from open moorland and rough grazing to an active construction site with vehicular activity, excavations and track construction, and the presence of tall cranes and partially built towers.
Geographical Extent	The geographic extent of these direct effects will be localised and limited to the footprint of the site, but will affect almost all parts of the site. Some areas of the site will be restored to their former condition after construction.
Duration and Reversibility	The construction works are temporary during the 12 month construction phase (short term). Reversibility will be varied, from fully reversible ground disturbances (albeit that vegetation will take some time to recover) to irreversible infrastructure that forms part of the operational scheme, and some that will not be removed during decommissioning.
Effect and Significance	Although the changes to the site will bring unfamiliar activities and features to the area of moorland and rough grazing, they will affect a limited area and will be temporary. Considering the medium sensitivity of the site and the high magnitude of change, construction activities will give rise to **major**, significant effect for the site.

Construction Effects on Other Receptors

6.97 The changes will affect landscapes and visual receptors (viewpoints, settlements and routes) close to the site, from where construction activity and ground conditions will be discernible. The consideration of visual effects during the construction period is included within the assessment of individual viewpoints and effects on views from settlements and routes where potential visibility of these **short-term** and largely **reversible** effects may be experienced throughout the 12 month construction period.

6.98 Following construction, with the implementation of post-construction restoration measures, disturbed areas will be restored. Re-establishment of vegetation will take approximately three to five years, depending on the vegetation and soils, and levels of effect will decline over this period. Over time, a species balance which is typical of less disturbed areas will become established. An additional 30 hectares of scrub woodland is proposed as part of the grouse management measures which will further assist future landscape restoration following construction.

Decommissioning Effects on the Site

6.99 The changes will affect the landscape and visual receptors of the site, where decommissioning effects will occur from deconstruction/decommissioning activities on the site and changes to ground conditions will be discernible. Following decommissioning the site will be returned to open moorland, and rough grazing. The predicted landscape and visual effects on the site during decommissioning are set out below in **Table 6.10: Decommissioning Effects on the Site**.

Table 6.10: Decommissioning Effects on the Site

Receptor	The proposed wind farm site
Susceptibility	With the operational wind farm present in the landscape, the susceptibility of the site to decommissioning activities will be low.
Value	The site is part of the Fintry, Gargunnock and Touch Hills AGLV designated landscape. The site is therefore judged to be of medium value.
Size and Scale	Large scale changes from an operational wind farm site to an area of disturbed moorland following a period with vehicular activity, excavations and removal of onsite infrastructure elements, including the removal of the turbines and presence of tall cranes.
Geographical Extent	Direct effects localised to the site, the changes will take up a relatively small proportion of the total area of the site. Much of the site area will remain undisturbed, and disturbed areas will be restored to moorland and rough grazing after deconstruction and decommissioning of the wind farm.
Duration and Reversibility	Temporary during the 6 month decommissioning phase (short term). Fully reversible, unless it is determined to retain any infrastructure closer to the time of decommissioning.
Effect and Significance	Considering the medium sensitivity of the site and the high magnitude of change, decommissioning activities will give rise to **minor**, not significant effects for the site.

Operational Landscape Effects

6.100 This section describes the operational effects resulting from the Development on the site and on areas of the surrounding landscape classified into LCTs. All effects are **long-term** effects occurring during the operational period and the majority of operational effects identified will be **reversible**. Partially reversible or permanent landscape effects occurring after decommissioning of the wind farm are outlined within **Table 6.10: Decommissioning Effects on the Site** above.

Operational Landscape Effects on the Site

6.101 Landscape effects upon the site during the operational phase of the proposed Development are described in **Table 6.11: Operational Landscape Effects on the** Site below.

Table 6.11: Operational Landscape Effects on the Site

Receptor	The proposed wind farm site
Susceptibility	The site is of open moorland, parts of the sloping landform forms part of the skyline from surrounding valleys and the Carse of Forth. There is a presence of human influence on the site (i.e. managed grazing, for further information on vegetation cover see **Chapter 9: Ecology**) and nearby in the form of Earlsburn and Craigengelt Wind Farms and coniferous forestry in the Carron Valley, therefore the susceptibility of the site is judged to be medium.
Value	The site is part of the Fintry, Gargunnock and Touch Hills AGLV designated landscape. The site is therefore judged to be of medium value.
Size and Scale	There will be direct changes to the site relating to the physical loss of features (open moorland) and introduction of new features (turbines and infrastructure). The introduction of the wind farm will substantially alter the existing character of the site, through the change to a wind power generating site with turbines and infrastructure including access tracks.
Geographical Extent	Direct effects will be limited to the localised area of the site limited to the footprint of the turbines, access tracks and associated infrastructure, but will affect almost all parts of the site.
Effect and Significance	Overall, considering the medium sensitivity of the site and the high magnitude of change, the landscape effects of the operational wind farm on the site will be **major**, and therefore significant.

Landscape Character Types (LCTs)

6.102 Key characteristics of the LCTs across the study area, taken from the relevant landscape character assessments and fieldwork, are set out in **Appendix 6.1: Landscape Baseline**. LCTs with the potential for significant effects are identified in **Table 6.6: Landscape Character Types** considered as Landscape Receptors above, and other LCTs are scoped out. Operational (long term) effects on LCTs included in the assessment are set out below.

Table 6.12: Lowland Hills LCT

Receptor	Lowland Hills (Central Region LCA: 10 Fintry, Gargunnock and Touch Hills, 11, Campsie Fells)

Receptor	Lowland Hills (Central Region LCA: 10 Fintry, Gargunnock and Touch Hills, 11, Campsie Fells)
Description	Earlsburn and Craigengelt Wind Farms exist within this LCT (see **Figure 6.7a**); other wind farms are visible at a distance. The Lowland Hills are rounded hills and plateaux emerging abruptly from the lowlands around them, and with extensive views outwards as a result. The site lies within the Fintry, Gargunnock and Touch Hills area of this LCT, and will therefore have direct effects on this area. The Development will introduce turbines, tracks and other infrastructure in to the open moorland on the western side of the Backside Burn valley. While this will have a significant direct effect on the site (as set out above), it is notable that there are turbines, tracks and wind farm infrastructure present elsewhere in the area (Earlsburn and Craigengelt Wind Farms, see **Figure 6.7a**), so these will not be new features in the LCT.
Susceptibility	The susceptibility of this LCT is affected by the presence of existing wind farm developments within the area. However, due to the large scale, simple nature of the landform, the susceptibility is judged to be medium.
Value	Parts of the Lowland Hills LCT lie within the Fintry, Gargunnock and Touch Hills Area of Great Landscape Value (AGLV) and the LCT is therefore considered to be of medium value.
Size and Scale	The Development will be located within the area of this LCT in the Fintry Hills, bound by the Gargunnock Hills to the east, the Campsie Fells to the south. The effects on the landscape of the site are considered separately above in **Table 6.9: Operational Effects on the Site**. Beyond the site boundary, theoretical visibility of turbines will be extensive across approximately 3 km, with turbines visible in the hanging valley south of the Spout of Ballochleam. The presence of turbines will extend the influence of wind farm development on the landscape of the LCT, such that this part of the hills, to the north of the Carron Valley may be seen to become an area of 'Lowland Hills with wind farms'. Beyond 3km of the site the wind farm will increase the presence of wind farm development within the wider extents of the LCT, albeit that in many views it will appear alongside the existing turbines of the existing Earlsburn and Craigengelt Wind Farms. The Development will be almost imperceptible in views from other areas of the LCT, including the western extents of the Ochil Hills over 15km north-east of the site. The Campsie Fells area of the LCT will have limited views of the Development, with the limited ZTV coverage including some forested areas. The Development will be seen in the context of Earlsburn and Craigengelt Wind Farms to the east of the site. Overall, the scale of change will be large for the Fintry, Gargunnock and Touch Hills area of the LCT within 3km, but small beyond 3km for the Campsie Fells area of the LCT.
Geographical Extent	Extensive for areas of the LCT within 3 km, but limited and localised for areas of the LCT beyond 3km.
Effect and Significance	Overall, considering the medium sensitivity of the LCT and the high magnitude of change from the introduction of the Development, it is judged to give rise to a **moderate**, significant effect for the Fintry, Gargunnock and Touch Hills area of the LCT. Considering the low magnitude of change within the Campsie Fells area of the LCT, the landscape effect for this area of the LCT is judged to be **minor** and therefore not significant.

Table 6.13: Lowland Plateaux LCT

Receptor	Lowland Plateaux (Central Region LCA: 18 Kippen Muir)
Description	The Balafark Farm Turbine is located within the Kippen Muir plateau area, near the B822. Earlsburn and Craigengelt Wind Farms are visible from the LCT to the east of the minor road that runs south from Arnprior (see **Figure 6.7a**), and the Braes of Doune Wind Farm is visible from the area when looking north across the Carse of Forth (see **Figure 6.7b**). Views out from this LCT are often partially enclosed by deciduous tree cover and hedgerows within the LCT area. The Development will be seen as additional turbines on the hill horizon to the south-east, from the eastern end of the plateau area, where Earlsburn and Craigengelt Wind Farms are not currently visible. The introduction of the development will increase the sense of wind turbines being present on the backdrop to the LCT to the south (Braes of Doune Wind Farm is visible to the north). As the turbines will be seen behind the hill horizon, there will be a legible separation between the Development and the LCT.
Susceptibility	Given the presence of existing wind farms in the wider landscape around this area, overall the susceptibility to wind farm development outside the LCT is considered to be medium.
Value	Parts of the Lowland Plateaux LCT lie within the Fintry, Gargunnock and Touch Hills AGLV and the LCT is therefore considered to be of medium value.
Size and Scale	The Development will be visible from parts of this LCT north of the site, with turbines visible in framed views into the Spout of Ballochleam, appearing between the upland Fintry Hills to the west and Gargunnock Hills to the east. Turbines hubs and blades will appear above the hanging valley which forms a key feature on the skyline to the south. Visibility of existing wind farms (Earlsburn and Craigengelt) located within the neighbouring hills is limited from this LCT. The scale of change is judged to be small.
Geographical Extent	Limited and localised visibility possible from the elevated plateaux of this LCT to the north of the site, where views are possible southwards up to the Spout of Ballochleam.
Effect and Significance	Overall, considering the medium sensitivity of the LCT and the low magnitude of change, the introduction of the Development is judged to give rise to a **minor**, not significant effect on this LCT.

Table 6.14: Lowland River Valleys LCT

Receptor	Lowland River Valleys (Central Region LCA: 28, Upper Carron)
Description	The LCT encompasses the Carron Valley which lies between the Campsie Fells to the south and the Fintry, Gargunnock and Touch Hills to the north. Views out from this LCT are often partially enclosed by coniferous tree cover within the LCT area. The existing Earlsburn and Craigengelt Wind Farms lie to the north of the Upper Carron Valley area and are visible from this area of the LCT.
Susceptibility	Due to the extensive coniferous forest within this LCT and the existing wind farm development in the wider landscape around this area, the susceptibility to wind farm development outside the LCT is judged to be low.
Value	Parts of the Lowland River Valleys LCT lies within the Fintry, Gargunnock and Touch Hills AGLV, and adjacent to the Kilsyth Regional Scenic Area (RSA). The LCT is therefore considered to be of medium value.
Size and Scale	The Development will introduce a small group of turbines to the north of the LCT, visible from the Reservoir, the flanks of Cairnoch Hill and the hill slopes up to Meikle Bin. The hill slopes surrounding the Carron Valley are largely forested, so that there are limited locations where the development will be visible. These areas include from the open reservoir, tracks around the shore, and some tracks through the forest, as well as the open tops of Meikle Bin, Little Bin and Cairnoch Hill. From these locations, the existing wind farms of Earlsburn and Craigengelt are visible (see **Figure 6.7a**), and the development will be seen as a small group of turbines further from the LCT. The scale of change is judged to be small.
Geographical Extent	Visibility across the Carron Valley area of the LCT is limited by the presence of dense coniferous forestry; localised to areas south of the site where gaps in the pattern of coniferous forest allow views towards the Fintry Hills.
Effect and Significance	Overall, considering the medium sensitivity of the LCT and the low magnitude of change, the introduction of the Development is judged to give rise to a **minor**, not significant effect on this LCT.

Table 6.15: Rugged Moorland Hills LCT

Receptor	20 Rugged Moorland Hills (Glasgow and the Clyde Valley LCA)
Description	This LCT covers the southern part of the Campsie Fells. From the hill tops and high north facing slopes, Earlsburn and Craigengelt Wind Farms are visible (see **Figure 6.7a**), with Braes of Doune Wind Farm in the distance (see **Figure 6.7b**).

Receptor	20 Rugged Moorland Hills (Glasgow and the Clyde Valley LCA)
Susceptibility	Due to the extensive coniferous forest within this LCT and the existing wind farm development in the wider landscape around this area and upland nature of this LCT, the susceptibility to wind farm development outside the LCT is judged to be low.
Value	Parts of the Rugged Moorland Hills LCT lies within the Kilsyth Regional Scenic Area (RSA), and adjacent to the Fintry, Gargunnock and Touch Hills AGLV. The LCT is therefore considered to be of medium value.
Size and Scale	The Development will theoretically be visible from hill tops and high north facing slopes of this LCT to the south of the site, however due to the presence of the coniferous forest plantations within this LCT and adjacent LCTs, visibility of turbines will be limited to open areas of the LCT where existing views towards the uplands to the south are possible. Where open views are possible, over Lecket Hill and from the tops of Lairds's Hill, Garrel Hill and Tomtain (VP6), the Development will be seen in the context of Earlsburn and Craigengelt Wind Farms, outside the LCT but on hills within the same broad hill range. The scale of change is judged to be small.
Geographical Extent	Localised to the elevated hills which form the northern extent of the LCT, from where open views overlooking the Carron Valley towards the Fintry, Gargunnock and Touch Hills exist, and are not contained by the presence of coniferous forestry.
Effect and Significance	Overall, considering the medium sensitivity of the LCT and the low magnitude of change, the introduction of the Development is judged to give rise to a **negligible**, not significant effect on this LCT.

Table 6.16: Flat Valley Floor LCT

Receptor	Flat Valley Floor (Stirling Proposed SPG: L2, Carse West of Stirling, L3 Flanders Moss West)
Description	The 'Carse West of Stirling' area includes the flat valley floor to the north of the A811, and to the south of the A873, west of the B822, and east of the rolling Dyke Head area (L6). It includes the eastern part of Flanders Moss that is designated as an NNR, and surrounding farmland. From this area, Earlsburn and Craigengelt Wind Farms are not visible (see **Figure 6.7a**), but Braes of Doune Wind Farm is visible to the north-east from much of the area. The 'Flanders Moss West' area lies to the west of the B8034 and includes large forestry plantations. From this area, Earlsburn Wind Farm is visible on the horizon to the south-east (see **Figure 6.7a**), and Braes of Doune Wind Farm is visible to the north-east from much of the area (see **Figure 6.7b**).
Susceptibility	Given the presence of existing wind farms in the wider landscape around this area, overall the susceptibility to wind farm development outside the LCT is considered to be low
Value	Due to the proximity of the Flat Valley Floor LCT to the Trossachs and Breadalbane AGLV and the Loch Lomond and The Trossachs National Park, the LCT is considered to be of medium value.
Size and Scale	From the 'Carse West of Stirling' area, the Development will be seen as turbines on the horizon to the south, seen above the Spout of Ballochleam, a notable cleft in the horizon of the scarp when seen from the LCT. The Development will introduce wind turbines on the skyline in the backdrop to the LCT. As the turbines will be seen behind the hill horizon, there will be a legible separation between the development and the LCT. The turbines will be visible the distinctive skyline viewed from the flat carse. The scale of change from this area of the LCT is judged to be medium. From the 'Flanders Moss West' area, the development will be seen as turbines on the distinctive hill horizon to the south-east, seen in the context of Earlsburn Wind Farm turbines. The introduction of the Development will increase the number of wind turbines visible from the LCT. As the turbines will be seen behind the hill horizon, there will be a legible separation between the development and the LCT. The scale of change from the Carse West of Stirling area of the LCT is judged to be medium, and is judged to be small for the LCT as a whole.
Geographical Extent	Localised to areas of the low lying LCT, from where open views overlooking the Forth Valley towards the Fintry, Gargunnock and Touch Hills exist.
Effect and Significance	Overall, considering the medium sensitivity of the LCT and the medium magnitude of change for the 'Carse West of Stirling' area of the LCT, the introduction of the Development is judged to give rise to a **moderate**, significant effect for the 'Carse West of Stirling' area of the LCT. The low magnitude of change for the 'Flanders Moss West' area of the LCT is judged to result in a **minor**, not significant effect.

Table 6.17: Rolling Valley Farmland LCT

Receptor	L6, Rolling Valley Farmland – Dyke Head
Description	This area includes a rolling area of land emerging from the flat Carse of Stirling, to the east of the Lake of Menteith, and traversed by the B8034. Earlsburn Wind Farm is visible on the horizon to the south-east for parts of this area (see **Figure 6.7a**), and Braes of Doune Wind Farm is visible to the north-east (see **Figure 6.7b**).
Susceptibility	Given the presence of existing wind farms in the wider landscape around this area of the LCT, overall the susceptibility to wind farm development outside the LCT is considered to be low.
Value	Parts of the Flat Valley Floor LCT lie within the Trossachs and Breadalbane AGLV and adjacent to the Loch Lomond and The Trossachs National Park, therefore the LCT is considered to be of medium value.
Size and Scale	Where local screening by topography and woodlands allows, the development will be seen as turbines on the distinctive hill horizon to the south, seen above the Spout of Ballochleam. The introduction of the Development will increase the number of wind turbines visible from the LCT, but will not affect the key characteristics of the LCT. The scale of change is judged to be small.
Geographical Extent	The geographical extent of visibility of the Development from this LCT will be localised, limited by the presence of screening features (including intervening deciduous and coniferous woodland and hedgerows) within the strath.
Effect and Significance	Overall, considering the low sensitivity of the LCT and the barely perceptible magnitude of landscape change, the introduction of the Development is judged to give rise to a **negligible**, not significant effect on this LCT.

Table 6.18: Farmed Valley or Hill Fringe

Receptor	L14, Farmed Valley or Hill Fringe – Forth/Teith Valley Fringe
Description	This LCT covers the low ridge that lies between the Forth and Teith river valleys. The A873 skirts along the break of slope between the flat Carse of Forth and the ridge. From the open south facing slopes of the ridge, Earlsburn and Craigengelt Wind Farms are visible on the horizon of the Gargunnock Hills to the south of the flat Carse of Forth (see **Figure 6.7a**). The Braes of Doune Wind Farm is visible to the north from higher points on the ridge (see **Figure 6.7b**).
Susceptibility	Given the presence of existing wind farms in the wider landscape around this area of the LCT, overall the susceptibility to wind farm development outside the LCT is considered to be low.
Value	Due to the proximity of the Flat Valley Floor LCT to the Trossachs and Breadalbane AGLV and the Loch Lomond and The Trossachs National Park, the LCT is considered to be of medium value.
Size and Scale	The Development will be visible from the south facing slopes of this area. The Development will be seen as additional turbines on the horizon to the south, to the right (west) of Earlsburn Wind Farm. In the presence of the existing wind farms, the Development will introduce additional features to the skyline to the south, rather than new features. The introduction of the development in the view will not alter the key characteristics of this LCT. The scale of change is judged to be small.
Geographical Extent	The geographical extent of visibility of the Development from this LCT will be localised, limited by the presence of screening features (including intervening deciduous and coniferous woodland and hedgerows) within the strath.
Effect and Significance	Overall, considering the low sensitivity and low magnitude of landscape change, the introduction of the Development is judged to give rise to a **negligible**, not significant effect on this LCT.

Proposed Landscape Mitigation

6.103 Measures to reduce operational effects upon the landscape resource are embedded in the wind farm layout. This was one of the considerations in the development of the design strategy set out in **Chapter 3: Site Selection and Design Strategy**.

Residual Landscape Effects

6.104 Measures to reduce landscape effects are embedded into the design of the wind farm and the site restoration proposals. All residual effects are therefore as predicted in the assessment section above.

Visual Assessment

6.105 The methodology for the visual assessment has been set out in the methodology section above. This section includes the visual baseline and assessment sections.

Visual Baseline

Analysis of Visibility Patterns around the Study Area

6.106 The study area is described in the baseline section earlier in the chapter. On a regional scale, the central band across the study area includes the lowland hill ranges of the Fintry, Gargunnock and Touch Hills, the Campsie Fells, the Kilsyth Hills and the Ochil Hills, with the low lying straths of the Forth Valley to the north and the Glasgow and Clyde Valley to the south. To the north, the study area generally slopes downwards from the higher Munro summits of the Loch Lomond and The Trossachs National Park to the low lying strath of the Forth Valley, directly north of the site. On a local scale, views depend on local topographic conditions, and can be very constrained by narrow valleys or extensive forest plantations, or views can be extensive across the surrounding landscape. The ZTV in **Figure 6.1** shows where the Development will be visible, and also serves to illustrate the patterns of intervisibility across the study area.

6.107 The ZTV in **Figure 6.1** and **Figure 6.2** indicate the theoretical visibility of the wind farm to blade tip and hub height respectively. **Figure 6.1** shows the ZTV across the 35km study area; **Figures 6.1a** to **6.1i** provide the ZTV at 1:100,000 scale base map (on 1:50k raster).

6.108 From **Figure 6.1** and **Figure 6.2**, the following observations can be made about views of the Development from across the study area:

Within 5km

- visibility within 5km will be concentrated to the higher ground of the Fintry and Touch hills west and east of the site and across the north facing slopes of the Carron Valley; and
- no visibility is indicated from the settlements of Kippen and Fintry located to the north and west of the Development respectively.

Between 5-15km

- visibility within 15km is limited to the higher ground on the southern edges of the Carron Valley to the south of the site, including the hill summits of Earl's Seat (578m AOD), Meikle Bin (570m AOD) and Tomtain (453m AOD);
- to the north, north west visibility is indicated across the Forth Valley from the settlements of Port of Menteith and Ruskie, and the route of the A873, with visibility of turbines possible through the Spout of Ballochleam directly north of the site; and
- elsewhere within 15km visibility is screened by the surrounding topography of the Fintry and Touch Hills to the west and east of the site and the Campsie Fells and Kilsyth Hills, which lie on the southern edge of the Carron Valley to the south.

Between 15-35km

- beyond 15km from the site visibility will be limited to long distant views from the east along the Forth Estuary and elevated locations south and east of Falkirk and Grangemouth;
- to the north-east, visibility is indicated from the craggy summits and west facing slopes of the Ochil Hills north of Stirling;
- north of the site, visibility is indicated from the settlements of Aberfoyle and Callander and from the surrounding hill summits and south facing slopes, with visibility of turbines possible through the Spout of Ballochleam, including from the summits of Ben Ledi (878m AOD) and Ben Vorlich (985m AOD); and
- north-west of the site the ZTV indicates visibility from hill summits located within the Loch Lomond and The Trossachs National Park including Ben Lomond (974m AOD) and Ben Venue (727m AOD).

6.109 **Figure 6.6** shows the ZTV of the Development in combination with the ZTVs of grouped existing wind farms within the LVIA. The figure shows that:

- Visibility of existing wind farm developments is widespread across the study area and few locations have no theoretical visibility of currently operational or under construction wind farms. Areas with no existing visibility of wind farms within the study area are limited to lower lying areas to the west, including Strathblane and the settlements of Balfron, Drymen and Strathblane, areas to the south of the Kilsyth Hills and Campsie Fells and pockets of contained higher ground within the Ochil Hills and the Loch Lomond and The Trossachs National Park.
- Areas of the study area where the Development will be theoretically visible in isolation, with no visibility of existing wind farms are limited. These green areas are concentrated within 5km of the site, on south-west facing slopes of the Gargunnock Hills to the north-east and from the western slopes of Cairnoch Hill to the south-east of the site. Beyond 15km, visibility of the Development in isolation is limited.
- Theoretical visibility of the Development along with one to five other wind farms is indicated by the yellow and orange of the CZTV, and covers a proportion of the study area, with much of the study area within 7.5km experiencing combined or successive visibility of the Development with the operational Earlsburn and Craigengelt Wind Farms.
- The Development will be visible in conjunction with other wind farms across much of the study area, with visibility in combination with upwards of five other wind farms limited to upland areas to the south of the Carron Valley to the south of the site and hill summits and limited areas of higher ground located to the north-east within the Ochil Hills and hill summits within the Loch Lomond and The Trossachs National Park to the north and north-west.
- The blue areas of the CZTV indicate where there are extensive parts of the study area which have theoretically visibility of existing operational and/or under construction wind farms but which the Development will not be visible from. These areas include the lower lying eastern areas of the study area beyond the Touch Hills, the south of the study area which lies beyond the Campsie Fells and Kilsyth Hills and the western areas where visibility is limited by the presence of the Fintry and Kirkpatrick Hills.

6.110 The Development will introduce visibility of additional turbines located within the Fintry, Gargunnock and Touch Hills from a small proportion of the study area where turbines are not currently visible. The main relationships between the Development and other operational wind farms or wind farms under construction are with Earlsburn and Craigengelt and with the operational Braes of Doune Wind Farm. These relationships are indicated on **Figures 6.7a** and **Figure 6.7b** which are described below.

- **Earlsburn and Craigengelt (Figure 6.7a):** This paired ZTV indicates that a relatively large proportion of the study area has existing visibility of wind farm development, and the introduction of the Development will lead to visibility of an additional wind farm development from areas of the study area which have existing visibility of wind farms. Visibility of the Development in isolation are limited to areas north, north-west with visibility possible through the Spout of Ballochleam and from limited areas on west facing slopes within the Gargunnock Hills and Cairnoch Hill to the south-east of the site. The Development will therefore predominantly be viewed in the context of the operational Earlsburn and Craigengelt Wind Farms, and will introduce visibility of additional turbines located within the Fintry and Gargunnock Hills from a small proportion of the study area where turbines are not currently visible.
- **Braes of Doune (Figure 6.7b):** This paired ZTV indicates that a larger proportion of the study area has existing visibility of the Braes of Doune Wind Farm development, including extensive visibility from along the low lying strath of the Forth Valley, the settlement of Stirling and the key transport corridor of the M80 and M9/A9 to the east of the Fintry, Gargunnock and Touch Hills. Visibility of the Development in isolation are limited to areas north, north-west with visibility possible through the Spout of Ballochleam and from limited areas on west facing slopes within the Gargunnock Hills and Cairnoch Hill to the south-east of the site, and from areas located within the Carron Valley to the south of the site, although visibility in reality will be vastly reduced by the presence of coniferous forestry plantations. The Development will be viewed in combination with the existing Braes of Doune Wind Farm from areas of the Forth Valley where views exist up to the Spout of Ballochleam. The

Development will appear as a separate development to the Braes of Doune Wind Farm, appearing in a different lowland hill range, often almost imperceptible as turbine blades in views towards the elevated skyline.

Visual Receptors

6.111 Visual receptors are people. The assessment of visual effects considers the changes that people will see in views from various locations. Viewers can be local residents, tourists, walkers and recreational route users, road users, train travellers etc. Visual receptors are people.

Settlements

6.112 As settlements are generally located on lower ground and in valleys, views to the higher ground of the site above the Strath are generally restricted by the surrounding Gargunnock and Touch Hills and Fintry Hills to the east and west respectively, and the Campsie Fells and Kilsyth Hills to the south of the site. The theoretical visibility of the wind farm from settlements across the study area is illustrated by **Figure 6.1** and **Figure 6.2.**

6.113 Settlements within 5km of the Development are located within the low lying ground of the surrounding valleys, including Fintry and Kippen; however visibility from each of these settlements is screened by the topography of the Fintry and Touch Hills to the west and east of the site respectively. Dispersed farmsteads and individual or small groups of residential properties are located close to roads within the Carron Valley to the south and the Forth Valley to the north of the site.

6.114 Between 5km and 15km settlements are concentrated within the low lying Forth Valley to the north, the edge of Greater Glasgow beneath the Campsie Fells and Kilsyth Hills to the south and the edge of Stirling to the east. Settlements include Stirling, Denny, Thornhill, Gargunnock, Port of Menteith, Balfron, Strathblane, Milngavie, Lennoxtown, Kirkintilloch and Kilsyth.

6.115 Larger settlement between 15 km and 35 km are located along the route of the River Teith to the north, including Callander and Doune, with Dunblane and Bridge of Allan further north-east. To the east the settlements of Grangemouth, Alloa, Linlithgow Bridge and Falkirk surround the Forth Estuary. South of the Campsie Fells and Kilsyth Hills lies the northern edge of Greater Glasgow and outlying settlements, including Cumbernauld, Bishopbriggs and Bearsden. To the west of the study area lie the settlements of Clydebank, Alexandria, Dumbarton, Helensburgh and Port Glasgow, located along the River Clyde Estuary.

6.116 **Table 6.19: Analysis of Visibility from Settlements** lists the settlements within the study area, and the theoretical inter-visibility with the wind farm (ZTV coverage) is described, and used as a means of identifying which settlements require further assessment, and which settlements can be scoped out because they will not have views of the wind farm.

6.117 Visibility from a settlement is not uniform across the settlement. This is because views of the surrounding landscape from within the settlement are inevitably obscured by the buildings, structures, trees and vegetation of the settlement itself, and are dependent on the orientation of windows and vistas along streets. Where the ZTV indicates theoretical visibility within settlements, elevated vantage points of buildings are more likely to have views than locations at ground level.

Table 6.19: Analysis of Visibility from Settlements

Settlement	Theoretical visibility of Development (ZTV coverage)
Within 5 km	
Fintry	No theoretical visibility, not considered further
Kippen	No theoretical visibility, not considered further
5-15 km	
Gargunnock	No theoretical visibility, not considered further
Balfron	No theoretical visibility, not considered further
Thornhill	No theoretical visibility, not considered further
Drymen	No theoretical visibility, not considered further
Killearn	No theoretical visibility, not considered further
Buchlyvie	No theoretical visibility, not considered further
Port of Menteith	Theoretical visibility across much of the settlement (15 km away). There are limited locations where visibility of turbines will be possible due to the presence of deciduous woodland and dense hedgerows. Visual effects will be limited to properties with an elevated outlook along the A873. The settlement is considered in the assessment. A viewpoint on the B8034 south of Port of Menteith is used in the assessment, Viewpoint 7 along with a second viewpoint located on the A873, Viewpoint 8.
Doune	No theoretical visibility, not considered further
Kilsyth	No theoretical visibility, not considered further
Lennoxtown	No theoretical visibility, not considered further
Milton of Campsie	No theoretical visibility, not considered further
Strathblane	No theoretical visibility, not considered further
Milngavie	No theoretical visibility, not considered further
Kirkintilloch	No theoretical visibility, not considered further
Stirling	No theoretical visibility, not considered further
Denny	No theoretical visibility, not considered further
15-35 km	
Aberfoyle	Theoretical visibility across much of the settlement (approximately 20 km away). Visibility of turbines will be limited to properties on the south and south-east edge of the settlement, where open views south-east are possible towards the Fintry, Gargunnock and Touch Hills. Properties within the interior of the settlement will have limited or no views towards the Development Site due to the presence of intervening deciduous trees, coniferous forestry and built form. Settlement considered in the assessment.
Callander	Theoretical visibility across much of the settlement (approximately 20 km away). Visibility of turbines will be limited to properties on the elevated northern edge of the settlement, where properties within open views south occupy elevated positions on the slopes above the main settlement. Properties within the interior of the settlement will have limited or no views towards the Development Site due to the presence of intervening deciduous trees, coniferous forestry and built form. Settlement considered in the assessment.
Falkirk	Limited theoretical visibility from south-west extents of the settlement (25 km away). Visibility of turbines from this settlement will be limited to properties on the urban-rural fringe where open views are possible across surrounding agricultural land to the Kilsyth Hills and the Fintry, Gargunnock and Touch Hills beyond. The turbines will be visible in the context of the existing Earlsburn and Craigengelt Wind Farms. The settlement is considered in the assessment

Settlement	Theoretical visibility of Development (ZTV coverage)
Grangemouth	No theoretical visibility, not considered further
Linlithgow Bridge	Very limited, no potential for significant effects, as beyond 15 km, not considered further
Greater Glasgow, Motherwell, Hamilton, East Kilbride	No theoretical visibility, not considered further
Cumbernauld	No theoretical visibility, not considered further
Dunblane	No theoretical visibility, not considered further
Port Glasgow	No theoretical visibility, not considered further
Clydebank	No theoretical visibility, not considered further
Dumbarton	No theoretical visibility, not considered further
Alexandria	No theoretical visibility, not considered further
Helensburgh	No theoretical visibility, not considered further
Comrie	No theoretical visibility, not considered further
Alloa	No theoretical visibility, not considered further

6.118 From this analysis, settlements that require further analysis and assessment include Port of Menteith, Aberfoyle, Callander and Falkirk. These are considered in the assessment section below.

6.119 Views from residential properties are considered in the assessment of visual effects from viewpoints at B822 at Kippen Muir (VP5), B8034 nr. Arndale Park and Gardens (VP7) and A873 nr. Ruskie (VP8) and are also considered in the assessment of visual effects on settlements. Views from residential properties were not assessed individually.

Routes

6.120 Routes across the study area form a hierarchical network of road, rail and walking routes. Road and Rail routes use low lying areas or valleys and passes, but walking routes are more variable and can pass over hills and along ridges. The main roads across the study area include several motorways including; M80 (Glasgow - Stirling), the M9 (Linlithgow - Dunblane), the M74 (Larkhall – Glasgow), the M8 (A8) (Glasgow – Greenock) and the M77 (Glasgow – Kilmarnock). Several A-roads are located within the study area, including the A9 (Dunblane - Auchterarder), the A881 (Stirling - Alexandria), the A84 (Stirling - Lochearnhead), the A82 (Glasgow – Tarbet), A91 (Stirling – Pool of Muckhart), A81 (Glasgow – Callander), A873 (Braeval – Blair Drummond) and the A821 (Aberfoyle – Callander). Smaller B-roads which lie within the vicinity of the site include the B818 (Denny - Killearn) and the B822 (Callander - Lennoxtown), and a network of minor roads across the lowland areas and Straths create a network of roads to the north and south of the site.

6.121 Two railway lines run across the study area, between Linlithgow and Falkirk, and Glasgow and Auchterarder.

6.122 Long distance recreational routes across the study area include the Rob Roy Way, West Highland Way, and other long distance routes. Sections of the National Cycle Network, including the NCN 7 which runs between Glasgow and Inverness, NCN 76 which runs between St Andrews and Stirling and NCN 754 which runs between Bowling and the Falkirk Wheel are also located within the study area. The Forth and Clyde Canal is also located within the study area.

6.123 Core paths in the vicinity of the site are considered in **Chapter 13: Socio-Economics**, and are shown on **Figure 13.1: Core Paths and Rights of Way**.

6.124 Based on an analysis of theoretical visibility, using the ZTV and set out in **Table 6.20: Analysis of Visibility from Routes**, several of the routes can be scoped out of the assessment because there is no theoretical visibility, or very limited theoretical visibility at some distance from the site, such that there is no likelihood of significant visual effects occurring.

Table 6.20: Analysis of Visibility from Routes

Route	Theoretical visibility of Development (ZTV coverage)
Roads	
M80 - Glasgow to Stirling	No theoretical visibility, not considered further
M9 - Linlithgow to Dunblane	Very limited, no potential for significant effects, not considered further
M74 - Larkhall to Glasgow	No theoretical visibility, not considered further
M8 (A8) - Glasgow to Greenock	No theoretical visibility, not considered further
M77 - Glasgow to Kilmarnock	No theoretical visibility, not considered further
A811 - Stirling to Alexandria	No theoretical visibility, not considered further
A84 - Stirling to Lochearnhead	Yes, considered in assessment; Limited theoretical visibility from a short section of this route around Callander.
A82 - Glasgow to Tarbet	Very limited, no potential for significant effects, not considered further
A91 - Stirling to Pool of Muckhart	No theoretical visibility, not considered further
A9 - Dunblane to Auchterarder	No theoretical visibility, not considered further
A81 - Glasgow to Callander	Yes, considered in assessment; Limited theoretical visibility from sections of this route between Aberfoyle and Callander, although the presence of coniferous forestry along some sections of the route will limit views towards the site.
A821 - Aberfoyle to Callander	Yes, considered in assessment; Limited theoretical visibility from sections of this route between Aberfoyle and Callander on the south facing elevated sections of the Dukes Pass, although the presence of coniferous forestry along some sections of the route will limit views towards the site.
A873 - Braeval to Blair Drummond	Limited, considered in assessment; A viewpoint on the A873 is used in the assessment, Viewpoint 8.
A809 - Milngavie to Drymen	None, not considered further
B818 - Denny to Killearn	Limited, considered in assessment; Limited theoretical visibility from sections of this route through the Carron Valley, although the presence of coniferous forestry along some sections of the route will limit views towards the site.
B822 - Callander to Lennoxtown	Yes, considered in assessment; Limited theoretical visibility from sections of this route within the Forth valley to the north of the site; A viewpoint on the B822 is used in the assessment, Viewpoint 5.

Route	Theoretical visibility of Development (ZTV coverage)
B8034 - Port of Menteith to Arnprior	Yes, considered in assessment; Limited theoretical visibility from sections of this route between Port of Menteith and Arnprior, although the presence of broad leaved woodland and field boundary trees along sections of the route will limit views towards the site; A viewpoint on the B8034 is used in the assessment, Viewpoint 7.
Minor road - Todholes to Borestone	Yes, considered in assessment; Limited theoretical visibility from a section of the route close to the site, where existing wind farm developments area already key features in views; A viewpoint on this route is used in the assessment, Viewpoint 2.
Minor road - Craigend to Mains of Boquihan	Limited, considered in assessment; Limited theoretical visibility from sections of this route within the Forth valley to the north of the site.
Minor road - Callander to Buchany	Very limited, no potential for significant effects, not considered further
Railways	
Linlithgow to Falkirk	Very limited, no potential for significant effects, not considered further
Glasgow to Auchterarder	No theoretical visibility, not considered further
Recreational routes	
West Highland Way	No theoretical visibility, not considered further
Rob Roy Way	Limited, considered in assessment; Limited visibility from a short unforested section of the Rob Roy Way north-east of Aberfoyle, where glimpsed views towards the site are possible; A viewpoint from the Rob Roy Way is used in the assessment, Viewpoint 9.
NCN 7 Inverness to Glasgow via Pitlochry	Limited, considered in assessment
NCN 76 St Andrews to Stirling (Round the Forth)	Very limited, no potential for significant effects, not considered further
NCN 754 Bowling to the Falkirk Wheel (Forth & Clyde)	Very limited, no potential for significant effects, not considered further
Forth & Clyde Canal	No theoretical visibility, not considered further

6.125 From this analysis, routes that require further analysis and assessment include the A81, A821, A873, B818, B822, B8034, the minor road between Todholes and Borestone and the minor road between Craigend and Mains of Boquihan, the Rob Roy Way and NCN 7. These are considered in the assessment section below.

Viewpoints

6.126 In addition to the settlement and routes across the study area, viewpoints were selected to represent and assess the visual effects of the proposal that will be seen by various groups of people (visual receptors). The viewpoint list is a representative selection of locations agreed with the statutory consultees. It is not an exhaustive list of locations from which the Development will be visible. Fifteen viewpoints were selected across the 35km study area through desk study, site work and discussions with statutory consultees including; SNH and Loch Lomond and The Trossachs National Park Authority. These viewpoints are all publicly accessible and include:

- representative viewpoints selected to represent the experience of different types of receptor;
- specific viewpoints selected because they are key and sometimes promoted viewpoints within the landscape; and
- illustrative viewpoints chosen specifically to demonstrate a particular visual effect of specific issue.

6.127 The viewpoints were selected to represent a range of receptors, viewing directions, distances and elevations. The viewpoints are listed in **Table 6.21: Viewpoints**, and shown on **Figure 6.8**. The baseline descriptions for these viewpoints are located with the assessment for each, to avoid repetition of information.

Table 6.21: Viewpoints

Viewpoint		Grid Reference	Distance (km)[20]
1	Minor Road nr. Easter Cringate	NS 690 868	2.7km
2	Sir John de Graham's Castle	NS 681 858	2.8km
3	Carleatheran	NS 687 918	3.9km
4	Meikle Bin	NS 667 821	6.1km
5	B822 at Kippen Muir	NS 630 928	4.7km
6	Tomtain	NS 721 814	8.7km
7	B8034 nr. Arndale Park and Gardens	NS 599 972	10.1km
8	A873 nr. Ruskie	NN 631 007	12.0km
9	Rob Roy Way	NN 564 031	16.9km
10	Ben Ledi	NN 562 097	22.8km
11	Shieldhill	NS 891 765	25.2km
12	Ben Cleuch	NN 902 006	26.5km
13	Ben Vorlich	NN 629 189	29.8km
14	Ben Lomond	NN 367 028	32.3km
15	Meall an-t Seallaidh	NN 542 233	36.2km

Potential Visual Effects

6.128 Potential visual effects that will occur as a result of the introduction of the Development include the introduction of tall vertical structures with moving parts into views towards the Site, and views of infrastructure at ground level including tracks, substation and transformers at the base of each turbine (as described in **Chapter 4: Development Description**) where the site itself is visible. Visibility of the Development will progressively increase during the construction phase (as turbines are erected), be at its maximum during operation and will reduce during the decommissioning phase (as turbines are removed).

[20] Distance between viewpoint and the nearest turbine of the Development

Mitigation

Mitigation by Design

6.129 Landscape and visual considerations, including the appearance of the Development from key locations, played a key role in the progression of the layout design for the Development. Additional mitigation measures, including the existing shared access proposals are set out in **Chapter 4: Development Description**. The design of the Development is described in **Chapter 3: Site Selection and Design Strategy**, and the visual considerations are set out in that chapter. They are therefore not repeated here.

Mitigation during Construction and Decommissioning

6.130 The construction of the turbines and associated infrastructure will follow agreed Construction and Decommissioning Method Statements[21], which will include arrangements for implementation of various aspects of the works such as vegetation and soil removal, storage and replacement and vegetation restoration, which will help to mitigate potential adverse effects during the works. These will be designed in agreement with STC and SNH as outlined in **Chapter 4: Development Description**.

6.131 The decommissioning activities will also follow agreed Construction and Decommissioning Method Statements, and site restoration will be a key part of the works.

Mitigation during Operation

6.132 Measures to reduce landscape and visual effects have been embedded into the design of the Development and the post-construction restoration proposals. Further mitigation across the wider landscape is not possible due to the inherent nature of wind farm developments.

Residual Visual Effects

6.133 The assessment of visual effects considers the appearance of the wind farm, and how it will change existing views. Visual effects are assessed by examining effects on views from static locations (viewpoints) and also considering views from settlements, or when travelling through the area (sequential views). The assessment considers the 'maximum case scenario' in terms of visibility, but it is important to note that visibility may be considerably reduced by screening afforded by buildings and filtered by woodland, particularly from built-up and lowland areas. Views from along roads and in rural areas are often limited by woodland and hedgerows. The degree of filtering of views may vary seasonally where trees are deciduous. The likely extent of screening is noted for each effect assessed

6.134 This assessment considers effects resulting from the introduction of the Development (including turbines and infrastructure) into views seen from the surrounding area, considered through the assessment of visual effects on settlements, routes and viewpoints. All effects are long term, and are considered to be largely reversible as turbines and visible above ground infrastructure will be removed during the decommissioning phase. Some visible tracks and hardstanding may be left in place, but this will be subject to agreement.

Visual Effects on Settlements

6.135 An analysis of the theoretical and likely actual visibility of the Development from settlements across the study area, particularly those closer to the Site, is set out in **Table 6.19: Analysis of Visibility from Settlements**. The settlements that require assessment of effects include Port of Menteith, Aberfoyle, Callander and Falkirk. Operational (long term) visual effects from settlements are discussed below. Views from several settlements are also represented by viewpoints included in **Table 6.21: Viewpoints**.

Table 6.22: Port of Menteith

Port of Menteith			
Representative Viewpoint	VP7: B8034 nr. Arndale Park and Gardens and VP8: A873 nr. Ruskie	**Distance to nearest turbine**	13.8km
Location and existing view	This settlement lies to the north-west of the site on the edge of the lowland strath of the Forth Valley. The settlement lies on the route of the A81 and consists of properties located along the route of the road to the north of the Lake of Menteith, often orientated with a southerly aspect towards the Lake. The distant skyline of the Fintry and Gargunnock Hills are visible in intermittent views from this linear settlement; however views are often filtered or screened by woodland cover and deciduous woodland and field boundary trees. The operational Braes of Doune Wind Farm is theoretically visible from this settlement.		
Susceptibility	Residents are assumed to have high susceptibility to changes in views from their properties.		
Value	Residents are assumed to value the views from the settlement. Port of Menteith is therefore considered to be of high value.		
Size and Scale	Theoretically visibility of the Development is indicated by the ZTV; however actual visibility will be limited from this settlement due to the presence of mixed woodland located around the Lake of Menteith and deciduous field boundary trees across pasture fields south of the A81. Glimpsed views of turbine blades and hubs appearing through the Spout of Ballochleam may be possible from some properties within this dispersed settlement; however the Development will be largely imperceptible in most views from the settlement. No ancillary infrastructure will be perceptible from this settlement. The scale of change is judged to be small.		
Geographical Extent	Visibility of the Development will be localised from the outer extents of the settlement and will be largely imperceptible from the interior of the settlement.		
Effect and Significance	Although this is a sensitive settlement close to the site, there will be little or no visibility. Considering the high sensitivity and low magnitude of visual change, the introduction of the Development will give rise to a **minor**, not significant visual effect on receptors (people) within this settlement.		

Table 6.23: Aberfoyle

Aberfoyle			
Representative Viewpoint	VP9: Rob Roy Way	**Distance to nearest turbine**	17.6km
Location and existing view	This settlement lies to the north-west of the site on the route of the A821 and the River Forth, to the east of Loch Ard and within the surrounding forestry of the Queen Elizabeth Forest Park. Built development is predominantly focussed along the low lying valley floor with properties often orientated to face the A821 which passes through the centre of the settlement. Views from the settlement are contained by coniferous forestry located to the north, west and south, however views east, south-east along the Forth Valley are possible from the eastern periphery of the settlement. The operational Earlsburn, Craigengelt and Braes of Doune Wind Farms are theoretically visible from this settlement.		
Susceptibility	Residents are assumed to have high susceptibility to changes in views from their properties.		
Value	Residents are assumed to value the views from the settlement. Aberfoyle is therefore considered to be of high value.		
Size and Scale	Theoretical visibility indicated by the ZTV likely to be screened by the presence of intervening screening from deciduous tree cover and coniferous forestry plantations to the south-east of the settlement. Where visibility of turbine blades may exist, the Development will be visible alongside the existing operational turbines of Earlsburn Wind Farm and will not introduce new features to the long distance views available from the settlement. The scale of change is judged to be small.		
Geographical Extent	Visibility of the Development will be localised from the outer extents of the settlement and will be largely imperceptible from the interior of the settlement.		
Effect and Significance	Although this is a sensitive settlement close to the site, there will be little or no visibility of the turbines. Considering the high sensitivity and low magnitude of visual change, the introduction of the Development will give rise to a **negligible**, not significant visual effect on receptors within this settlement.		

[21] Draft Construction and Decommissioning Method Statements will be agreed post consent with STC and SNH.

Table 6.24: Callander

Callander			
Representative Viewpoint	VP10: Ben Ledi	**Distance to nearest turbine**	18.2km
Location and existing view	The settlement of Callander lies to the north of the site on the River Teith, and is dissected by the A84 which runs south-east, north-west through the settlement. The centre of the settlement lies within the low lying valley floor to the north of the River, with recent residential development leading to expansion of the settlement to the east along the river. Views south and north from the settlement are contained by localised topography and the presence of coniferous forestry, including that of Lennieston Muir which screens views towards the Forth Valley and the Fintry, Gargunnock and Touch Hills beyond. The operational Earlsburn, Craigengelt and Braes of Doune Wind Farms are theoretically visible from this settlement.		
Susceptibility	Residents are assumed to have high susceptibility to changes in views from their properties.		
Value	Residents are assumed to value the views from the settlement. Callander is therefore considered to be of high value.		
Size and Scale	The Development will be imperceptible from this settlement due to the presence of coniferous forestry located across Lennieston Muir to the south of the settlement. Potential visibility of turbine blades from south facing upper storey windows of properties located within the settlement may be possible; however visibility of the Development will be alongside the existing turbines of Earlsburn Wind Farm. The scale of change is therefore judged to be small.		
Geographical Extent	The geographical extent of visibility from this settlement is very localised, limited to upper storey windows of a small number of properties within the settlement.		
Effect and Significance	Although this is a sensitive settlement, there will be little or no visibility of the turbines. Considering the high sensitivity and barely perceptible magnitude of visual change, the introduction of the Development will give rise to a **negligible**, not significant visual effect on receptors within this settlement.		

Table 6.25: Falkirk

Falkirk			
Representative Viewpoint	VP11: Shieldhill	**Distance to nearest turbine**	24.6km
Location and existing view	This large settlement lies to the south-east of the site, south-west of the Forth Estuary. The settlement forms part of a larger urban area which consists of several surrounding settlements located adjacent to the M9 and M876. Residential development is expansive to the south of the settlement, with slightly elevated views possible across the surrounding area. Views from the settlement are across the surrounding urban conurbations, the Forth Estuary, with distant views possible to the Ochil Hills to the north and the Touch and Gargunnock Hills to the west, north-west. The operational Earlsburn, Craigengelt and Braes of Doune Wind Farms are theoretically visible from this settlement.		
Susceptibility	Residents are assumed to have high susceptibility to changes in views from their properties.		
Value	Residents are assumed to value the views from the settlement. Falkirk is therefore considered to be of high value.		
Size and Scale	Although theoretical visibility is indicated by the ZTV, actual visibility of the proposed turbines will be imperceptible from this settlement due to the presence of intervening tree cover, built form and the existing operational turbines of Earlsburn and Craigengelt Wind Farms which will are visible from some locations within the settlement, appearing above the skyline formed by the Touch Hills and Gargunnock Hills. No ancillary infrastructure is likely to be perceptible from this settlement. The scale of change is therefore judged to be small.		
Falkirk			
Geographical Extent	The geographical extent of visibility will be very localised from this settlement limited to glimpsed views of turbine blades, appearing beyond the existing operational turbines and thus not increasing the proportion of the view affected by the presence of wind turbines.		
Effect and Significance	Although this is a sensitive settlement, there will be little or no visibility of the turbines. Considering the high sensitivity and barely perceptible magnitude of visual change, the introduction of the Development will give rise to a **negligible**, not significant visual effect on receptors within this settlement.		

Visual Effects on Routes

6.136 An analysis of the theoretical and likely actual visibility of the Development from routes across the study area, particularly those closer to the site, is set out in **Table 6.20: Analysis of Visibility from Routes**. The routes that require assessment of effects include the A84, A81, A821, A873, B818, B822, B8034, the minor road between Todholes and Borestone, the minor road between Craigend and Mains of Boquihan, the Roby Roy Way long distance footpath and a section of the NCN 7. These are each considered below.

6.137 Many of the routes pass residential properties, and while the assessment for the route (or section of the route) can be used as a proxy for the visual effect on views from these properties, it should be recognised that properties often have screening vegetation in their gardens, or are set in woodland which may limit visibility of the Development.

Table 6.26: A84 Stirling to Lochearnhead

A84 Stirling to Lochearnhead			
Representative Viewpoint	None	**Distance from route to nearest turbine**	11.2km
Description of route and existing view	This road route crosses the study area south-east to north-west between Stirling and Lochearnhead. The route follows the lower northern slopes of the Forth Valley, east to west from Stirling to Blairdrummond Moss, before heading north to Doune where it follows the route of the River Teith west to Callander. From Callander the route ascends northwards over the Pass of Lenny and around the east side of Loch Lubnaig and north along Strathyre before ascending steeply through Glen Ogle. Views from the route between Stirling and Doune are focussed along the lowland Strath of the Forth Valley, often enclosed by the presence of deciduous woodland and field boundary trees located along the route. The Braes of Doune Wind Farm is visible to the north of the route, from a large section of the route. Some short sections of the route between Doune and Callander offer open views across the Strath towards the escarpments of the Gargunnock and Fintry Hills at an oblique angle to the south. North from Callander views from the route become contained by the steep rising topography and coniferous forestry to the east and west. Sequential visibility of the operational Earlsburn, Craigengelt and Braes of Doune Wind Farms is theoretically possible from sections of this route.		
Susceptibility	The A84 is a busy trunk road experienced by road users often travelling at speed, and although it is used by tourists, road users tend not to be focused on the wider views and surroundings, and are judged to have a low susceptibility to changes in the view. However the highest susceptibility group of road users on this route are tourists accessing the Loch Lomond and The Trossachs National Park, who are assumed to have high susceptibility to changes in views from routes.		
Value	This is a busy road linking the main communication corridor of the M9/A9 and M80 to the Loch Lomond and the Trossachs National Park. The route is considered to be of medium value.		
Size and Scale	Potential visibility of the Development will be limited to a short section of this route as it passes through Callander, limited to distant views of turbine blades above the skyline of the Fintry Hills to the south-east. Due to the presence of intervening screening provided by built form within the settlement of Callander and the coniferous forestry located to the south of the River Teith, actual visibility of turbine blades is unlikely from this route. The scale of change is therefore judged to be small.		
Geographical Extent	Localised along a short section of the route within the Loch Lomond and The Trossachs National Park.		

A84 Stirling to Lochearnhead	
Effect and Significance	Although this is a popular road route, there will be little or no visibility of the turbines from a large proportion of the route. Considering the medium sensitivity and the barely perceptible magnitude of visual change, the introduction of the Development will give rise to a **negligible**, not significant visual effect on receptors travelling on this route.

Table 6.27: A81 Glasgow to Callander

A81 Glasgow to Callander			
Representative Viewpoint	None	**Distance from route to nearest turbine**	13.0km
Description of route and existing view	This road route crosses the study area from north to south between Callander and Greater Glasgow, crossing the Forth Valley west of Flanders Moss before passing to the west of the Fintry Hills, through Strathblane and southwards around the southern slopes of the Campsie Fells into Greater Glasgow. Views towards the site from the southern and western sections of the route are limited by the steep topography of the Campsie Fells and Fintry Hills, which screen existing visibility of Earlsburn and Craigengelt Wind Farms. North of the Fintry Hills, views from the route are along the Forth Valley west and east from the route, with views towards the distant hill summits to the north and the escarpment of the Fintry and Gargunnock Hills to the south. Sequential visibility of the operational Earlsburn, Craigengelt and Braes of Doune Wind Farms is potentially possible from sections of this route.		
Susceptibility	The A81 is a busy trunk road experienced by road users often travelling at speed, and often by used by tourists. The highest susceptibility group of road users on this route are tourists, who are assumed to have high susceptibility to changes in views from routes.		
Value	This is a busy road linking the greater Glasgow conurbation to the south with the Loch Lomond and the Trossachs National Park. The route is considered to be of medium value.		
Size and Scale	Visibility of the Development is potentially possible from a short section of this route between Braeval and Loch Rusky, in views south-east towards the Fintry and Gargunnock Hills. Turbines will appear through the Spout of Ballochleam and introduce visibility of turbines on the skyline above the scarp; however views will be at an oblique angle to the route with intermittent screening from deciduous woodland and field boundary trees and coniferous forestry plantations located along the route. The scale of change is therefore judged to be small locally for the section of the route between Braeval and Loch Rusky, where turbines will become new features in the available views towards the scarp and imperceptible for the route as a whole.		
Geographical Extent	Localised along a short section of the route within the Loch Lomond and the Trossachs National Park.		
Effect and Significance	Although this is a popular road route, there will be little or no visibility of the turbines from a large proportion of the route. Considering the medium sensitivity and the low magnitude of visual change from some short sections, the introduction of the Development will give rise to a **minor**, not significant visual effect, locally within the Loch Lomond and the Trossachs National Park and a **negligible** not significant visual effect, for the route as a whole, on receptors travelling on this route.		

Table 6.28: A821 Aberfoyle to Callander

A821 Aberfoyle to Callander			
Representative Viewpoint	None	**Distance from route to nearest turbine**	18.3km
Description of route and existing view	This route crosses higher ground to the west of the Menteith Hills between Aberfoyle and Callander via the Duke's Pass, to the north-west of the site. The route passes through the Queen Elizabeth Forest Park and the Achray Forest, ascending steeply through coniferous forestry. The route descends towards Brig o' Turk passing to the north of Loch Achray and Loch Venachar and east into the settlement of Callander. Views from the route are largely contained by the coniferous forestry of the Achray Forest and the undulating topography as the route passes over the higher ground east of Ben Venue. The operational Earlsburn, Craigengelt and Braes of Doune Wind Farms are potentially visible in sequential views from sections of this route.		
Susceptibility	The A821 is experienced by road users often travelling at speed, and often used by tourists visiting the Loch Lomond and the Trossachs National Park. The highest susceptibility group of road users on this route are tourists, who are assumed to have high susceptibility to changes in views from routes.		
Value	This is a popular road through the Loch Lomond and the Trossachs National Park and provides access to the 3 Lochs Forest Drive through the Achray Forest. The route is considered to be of high value.		
Size and Scale	Theoretical visibility of the Development is indicated by the ZTV from the steep section of the route known as the Duke's Pass, however actual visibility will be screened by the presence of built form at the western extent of Aberfoyle and the coniferous forestry of the Queen Elizabeth Forest Park. The scale of change is therefore judged to be small for a short section of the route.		
Geographical Extent	Very localised along a short section of the route within the Loch Lomond and the Trossachs National Park.		
Effect and Significance	Although this is a popular road route with tourist visitors, there will be little or no visibility of the turbines from a large proportion of the route. Considering the high sensitivity and the barely perceptible magnitude of visual change, the introduction of the Development will give rise to a **negligible**, not significant visual effect on receptors travelling on this route.		

Table 6.29: A873 Braeval to Blair Drummond

A873 Braeval to Blair Drummond			
Representative Viewpoint	VP8: A873 nr. Ruskie	**Distance from route to nearest turbine**	11.2km
Description of route and existing view	This road route runs east to west along the lowland Strath of the Forth Valley between the junction with the A84 at Blairdrummond Moss and the A81 east of Port of Menteith, to the north-east of the site. The route passes through the settlement of Thornhill and the small linear settlements of Ruskie and Blairhoyle, occupying a slightly elevated position above the arable and pasture farmland which lies to the south of the route. Views from the route are possible east and west along the Forth Valley, with distant views of the Ochil Hills to the east and the larger hill summits of Ben Venue and Ben Lomond to the west. Oblique views south from the route towards the steep escarpment of the Gargunnock and Fintry Hills are possible from much of this route, screened intermittently by deciduous trees. The operational Braes of Doune Wind Farm is visible in views to the north-east when travelling west along this route. Visibility of the operational Braes of Doune Wind Farm is potentially possible from sections of this route.		
Susceptibility	The A873 is a popular road experienced by road users often travelling at speed, and although it is used by tourists, road users tend not to be focused on the wider views and surroundings, and are judged to have a low susceptibility to changes in the view. However the highest susceptibility group of road users on this route are tourists accessing the Loch Lomond and the Trossachs National Park, who are assumed to have high susceptibility to changes in views from routes.		
Value	This is a popular road linking the main communication corridor of the M9/A9 and M80 to the Loch Lomond and the Trossachs National Park. The route is considered to be of medium value.		

A873 Braeval to Blair Drummond	
Size and Scale	The Development will potentially be visible above the skyline of the Gargunnock and Fintry Hills escarpment from a proportion of this route between Port of Menteith and Easter Borland, appearing as turbine blades and hubs at an oblique angle to the south, south-east. The scale of change is therefore judged to be small.
Geographical Extent	Localised along a short elevated section of the route within the Forth Valley, east of the Loch Lomond and the Trossachs National Park.
Effect and Significance	Although this is a popular road route with tourist visitors, there will be little or no visibility of the turbines from a large proportion of the route. Given the medium sensitivity of the route and the low magnitude of visual change, the introduction of the Development will give rise to a **minor**, not significant visual effect on receptors travelling on this route.

Table 6.30: B818 Denny to Killearn

B818 Denny to Killearn			
Representative Viewpoint	VP2: St. John de Graham's Castle	**Distance from route to nearest turbine**	2.2km
Description of route and existing view	This road route runs between Denny and Killearn, passing through the Carron Valley and the settlement of Fintry. The route ascends from the east at Denny, following the River Carron to the head of the Carron Valley Reservoir, south-east of the site before descending alongside Endrick Water to the settlement of Fintry. The route then heads west below the northern slopes of Ballikinrain Muir to meet the A875 east of Killearn. Views from the route are contained within the Carron Valley by the Gargunnock Hills to the north and the Campsie Fells to the south, with the main focus of views south and west across Carron Valley Reservoir, with the distinguishable hill summits of Meikle Bin and Tomtain visible on the skyline beyond the Carron Valley Forest. The operational wind farms of Earlsburn and Craigengelt are visible in existing views from sections of this route between Carron Bridge and Todholes.		
Susceptibility	Road users on this route are few, but include recreational users accessing the Carron Valley and residents of local properties and are considered to have medium susceptibility to changes in views.		
Value	The minor route passes through the Fintry, Gargunnock and Touch Hills AGLV and is therefore considered to be of medium value.		
Size and Scale	The Development will be largely screened in views from this route by the Fintry Hills to the south-west of the proposed turbines; however the ZTV indicates theoretical visibility of the Development from a short section of this route on the northern shore of the Carron Valley Reservoir. Due to the presence of the adjacent coniferous forestry which covers Cairnoch Hill to the north; no visibility of the proposed turbines will be possible from this route. The scale of change is therefore judged to be small.		
Geographical Extent	Very localised along a short elevated section of the route within the Carron Valley, although visibility is limited by the presence of coniferous forestry.		
Effect and Significance	There will be little or no visibility of the turbines from a large proportion of this route, where visibility is often screened by the presence of coniferous forestry. Considering the medium sensitivity and the barely perceptible magnitude of visual change, the introduction of the Development is judged to give rise to a **negligible**, not significant visual effect on receptors travelling on this route.		

Table 6.31: B822 Callander to Lennoxtown

B822 Callander to Lennoxtown			
Representative Viewpoint	VP5: B822 at Kippen Muir	**Distance from route to nearest turbine**	4.7km
Description of route and existing view	This road route crosses the study area from south to north between Greater Glasgow and the A81 south of Callander. The route passes over the Campsie Fells via the Crow Road from Lennoxtown before descending into the Carron Valley to the south of the site and west around the Fintry Hills into the Forth Valley, before heading north-east to the settlement of Kippen. The route offers open views from the elevated ground of the Campsie Fells, south across Greater Glasgow, north across the Fintry, Gargunnock and Touch Hills and east across the Carron Valley. From the northern section of the route visibility is focussed north towards the hill summits located on the southern edge of the Loch Lomond and The Trossachs National Park, and east along the Forth valley. Sequential visibility of the operational Earlsburn, Craigengelt and Braes of Doune Wind Farms is possible from sections of this route.		
Susceptibility	Road users on this route are few, but include recreational users accessing the Carron Valley and residents of local properties and are considered to have medium susceptibility to changes in views.		
Value	The minor route passes through the Fintry, Gargunnock and Touch Hills AGLV and is therefore considered to be of medium value.		
Size and Scale	The Development will be visible from a short section of the route where it crosses Kippen Muir to the north-west of the site, when travelling east along the route. Turbines will be visible through the Spout of Ballochleam to the south-east, appearing as a small cluster of turbines above the skyline. Views will be intermittently screened along this section of the route by the presence of deciduous trees and dense gorse scrub to the south of the road. The Development will be screened from the other sections of the route by the topography of the Fintry Hills to the south, and west of the site. The scale of change is therefore judged to be small.		
Geographical Extent	Very localised along a short section of the route where it crosses Kippen Muir within the Forth Valley and views are possible to the Spout of Ballochleam to the south.		
Effect and Significance	Although this is a popular road route, there will be little or no visibility of the turbines from a large proportion of the route. The introduction of the Development will give rise to a **minor**, not significant visual effect locally for a short section of the route across Kippen Muir, where a low magnitude of visual change is predicted, and **negligible**, where the magnitude of visual change is barely perceptible for the route as a whole, on receptors travelling on this route.		

Table 6.32: B8034 Port of Menteith to Arnprior

B8034 Port of Menteith to Arnprior			
Representative Viewpoint	VP7: B8034 nr. Arndale Park and Gardens	**Distance from route to nearest turbine**	7.5km
Description of route and existing view	This road route runs north-south between the Port of Menteith and the B822 at Arnprior. The route is predominantly lined by deciduous woodland and field boundary trees, which screen views out with the route corridor. Some views existing west and east along the Forth Valley, across enclosed pasture farmland. Visibility of the skyline formed by the Gargunnock and Fintry Hills is possible from short sections of the route south of Cardross Bridge, with glimpsed views of the escarpment often partially screened and filtered by deciduous broadleaved tree cover. The operational Earlsburn and Braes of Doune Wind Farms are potentially visible in sequential views from sections of this route.		
Susceptibility	Road users on this route are few, but include recreational users accessing the Port of Menteith and residents of local properties, and are considered to have medium susceptibility to changes in views.		
Value	This minor route does not pass through any sensitive landscapes and is therefore considered to be of low value.		

B8034 Port of Menteith to Arnprior	
Size and Scale	The turbines of the Development will potentially be visible from a short section of this route when travelling south, between Cardross Bridge and Arnprior appearing as a small cluster of turbines through the Spout of Ballochleam. The change in view will affect a small geographical extent of the route and the turbines will form a relatively small feature in the available view, appearing intermittently where glimpsed views of the skyline to the south are possible. The scale of change is therefore judged to be small locally and imperceptible for the route as a whole.
Geographical Extent	Very localised along a short section of the route between Cardross Bridge and Arnprior, where views south are possible to the Spout of Ballochleam.
Effect and Significance	Although this is a popular road route, there will be little or no visibility of the turbines from a large proportion of the route. Given the medium sensitivity of the route, the introduction of the Development will give rise to a **minor**, not significant visual effect locally for a short section of the route between Cardross Bridge and Arnprior where a low magnitude of change is predicted and a **negligible**, not significant visual effect for the route as a whole, where a barely perceptible magnitude of visual change is predicted on receptors travelling on this route.

Table 6.33: Minor road Todholes to Borestone

Minor road Todholes to Borestone			
Representative Viewpoint:	VP1: Minor Road nr. Easter Cringate	**Distance from route to nearest turbine:**	2.7km
Description of route and existing view	This minor road runs from Todholes south of the site, east to Borestone on the southern edge of Stirling. The route passes around the grazed moorland edge of the Touch Hills to the east of the site, and passes between the operational wind farms of Craigengelt to the south and Earlsburn to the north of the route. Views from route are predominantly focussed south towards the Carron Valley to the distant summits of Meikle Bin and Tomtain which form distinguishable features on the skyline. Views north across the Touch, Gargunnock and Fintry Hills exist from much of the central and western sections of the route, with the rising topography often screening views to the elevated plateau of these hills. The operational Earlsburn and Craigengelt are potentially visible in sequential views from sections of this route.		
Susceptibility	Road users on this route are few, but include recreational users accessing the Port of Menteith and residents of local properties. This route is experienced by road users, with the key focus of views being the road ahead. Although the route will be predominantly used by local residents living within close proximity of the Development, existing visibility of the operational Earlsburn and Craigengelt Wind Farms is already possible from a large proportion of this route and receptors are therefore considered to have medium susceptibility to changes in views.		
Value	This minor road passes through the Fintry, Gargunnock and Touch Hills AGLV and is therefore considered to be of medium value.		
Size and Scale	The turbines of the Development will be visible from a short section of this route between Easter Cringate and Todholes; however the moving turbines will appear alongside the existing Earlsburn Wind Farm extending visibility of turbines westwards across the valley of Endrick Water. Visibility from this section of the route will be further reduced by the presence of young coniferous forestry located to the north of the route which will increase in size during the proposed operational life of the Development. The scale of change is therefore judged to be small locally and imperceptible for the route as a whole.		
Geographical Extent	Very localised along a short section of the route close to the site.		
Effect and Significance	Although this is a popular road route, there will be little or no visibility of the turbines from a large proportion of the route. Considering the medium sensitivity of the receptors on this route, the introduction of the Development will give rise to a **minor**, not significant visual effect for a short section of the route close to the site, where a low magnitude of visual change is predicted and a **negligible**, not significant visual effect for the route as a whole, where a barely perceptible magnitude of visual change is predicted, for receptors travelling on this route.		

Table 6.34: Minor road Craigend to Mains of Boquihan

Minor road Craigend to Mains of Boquihan			
Representative Viewpoint	VP5: B822 at Kippen Muir	**Distance from route to nearest turbine**	2.7km
Description of route and existing view	This minor road runs west to east along the Pow Burn and Boquhan Burn, within the shadow of the Fintry and Gargunnock Hills between the B822 to the north-west and the A811 to the north-east of the site. The Fintry and Gargunnock Hills escarpment rises up steeply to the south, of the route, with the skyline split by the Spout of Ballochleam. Views from the route are predominantly west and east along the steep slopes of the escarpment; however the skyline of the scarp forms an important feature in views to the south. The operational Braes of Doune Wind Farm is potentially visible in sequential views from sections of this route.		
Susceptibility	This route is experienced by road users travelling to and from residential properties within close proximity to the north of the site. Views from this route are therefore judged to be of medium susceptibility.		
Value	This minor road passes through the Fintry, Gargunnock and Touch Hills AGLV and is therefore considered to be of medium value.		
Size and Scale	The Development will be visible from a short section of this route to the north-west of the site, where visibility of moving turbines within the hanging valley created by the Spout of Ballochleam will be possible on the skyline of the scarp. Turbine blades will break the skyline near the base of the spout, introducing visibility of wind turbines to the skyline. this change will be present over a limited geographical extent, and the turbine blades of the Development will occupy only a small proportion of the available view. The scale of change is therefore judged to be small locally and imperceptible for the route as a whole.		
Geographical Extent	Very localised along a short section of the route north of the site, where views are possible towards the Spout of Ballochleam.		
Effect and Significance	Although this is a popular road route, there will be little or no visibility of the turbines from a large proportion of the route. Considering the medium sensitivity of users of this route, the introduction of the Development will give rise to a **minor**, not significant visual effect for a short section of the route close to the site, where a low magnitude of visual change is predicted and a **negligible**, not significant visual effect for the route as a whole, where a barely perceptible magnitude of visual change is predicted.		

Table 6.35: Rob Roy Way

Rob Roy Way			
Representative Viewpoint	VP9: Rob Roy Way	**Distance from route to nearest turbine**	16.9km
Description of route and existing view	The Rob Roy Way long distance footpath crosses the study area from north to south between Drymen and Pitlochry. The route follows the minor road between Drymen and Gartmore at its nearest point to the site. Views from a large proportion of the route are contained by coniferous forestry; however some glimpsed views south towards the Gargunnock and Fintry Hills exist from sections of the route which cross the higher ground of the Menteith Hills to the north-west of the site. The operational Earlsburn, Craigengelt and Braes of Doune Wind Farms are potentially visible from sections of this route.		
Susceptibility	Recreational walkers on the Rob Roy Way are focused on views of their surroundings and are therefore considered to have high susceptibility to changes in views.		
Value	This recreational long distance footpath route passes through the Loch Lomond and the National Park and the Trossachs and Breadalbane AGLV, and is a long distance walking route highlighted on maps. The route is therefore considered to be of high value.		

Rob Roy Way	
Size and Scale	Theoretical visibility of the Development from this long distance footpath is limited to a short section of the route Aberfoyle eastwards across the Menteith Hills, as indicated by the ZTV. Due to the presence of built form and woodland cover within Aberfoyle and the coniferous forestry located across the Menteith Hills, actual visibility of the Development is likely to be contained and limited to a very short section of the route, with the moving turbines forming a minor feature on the distant skyline to the south, alongside the existing turbines of Earlsburn Wind Farm. The scale of change is therefore judged to be low locally and imperceptible for the route as a whole.
Geographical Extent	Localised along a short section of the route where views south across the Forth Valley to the Fintry, Gargunnock and Touch Hills are possible.
Effect and Significance	Although this is a popular recreational long distance walking route, there will be little or no visibility of the turbines from a large proportion of the route. Considering the high sensitivity of receptors on this route, the introduction of the Development will give rise to a **minor**, not significant visual effect locally, for a short section of the route where a low magnitude of change is predicted and a **negligible**, not significant visual effect for the route as a whole, where a barely perceptible magnitude of visual change is predicted.

Table 6.36: NCN 7 Inverness to Glasgow via Pitlochry (Lochs and Glens)

NCN 7 Inverness to Glasgow via Pitlochry (Lochs and Glens)			
Representative Viewpoint	None	**Distance from route to nearest turbine**	12.5km
Description of route and existing view	National Cycle Route (NCN) 7 crosses the study area north-south to the west, north-west of the site, following the route of the A811 through Drymen at its closest point. Receptors include cyclists and road users travelling north and south along this route. The site is visible from a short section of this route to the south-east, appearing beyond through the Spout of Ballochleam which splits the Fintry Hills and Gargunnock Hills. The operational Earlsburn, Craigengelt and Braes of Doune Wind Farms are potentially visible from sections of this route.		
Susceptibility	Cyclists on NCN7 are largely recreational users, whose attention is often on views of their surroundings and are therefore considered to have high susceptibility to changes in views.		
Value	The route is a national cycle route and is therefore considered to be of high value.		
Size and Scale	The ZTV indicates theoretical visibility of the Development from a short section of this cycle route which follows the route of the A821 north from Aberfoyle, however actual visibility will be screened by the presence of built form at the western extent of Aberfoyle and the coniferous forestry of the Queen Elizabeth Forest Park. The scale of change is therefore judged to be imperceptible for the route as a whole.		
Geographical Extent	Localised to sections of the route.		
Effect and Significance	Although this is a popular cycle route with recreational users and tourists, there will be little or no visibility of the turbines from a large proportion of the route. Given the high sensitivity of recreational receptors on this route and the barely perceptible magnitude of visual change, the introduction of the Development is judged to give rise to a **negligible**, not significant visual effect, for receptors travelling on this route.		

Visual Effects on Viewpoints

6.138 The potential operational (long term) effects on views and visual amenity from specific representative viewpoints, as outlined in **Table 6.21: Viewpoints** are detailed below.

6.139 Visualisation figures (**Figure 6.9** to **Figure 6.24**) accompany each viewpoint by means of a photograph of the existing view, a wireframe illustrating the wind farm and photomontage (each is presented as both a 50° and 90° angle of view). Information about the viewpoint, photography and photomontage is included on each figure and is not repeated in the text.

Table 6.37: Viewpoint 1 – Minor Road nr. Easter Cringate

Viewpoint 1 - Minor Road nr. Easter Cringate			
Grid Reference	NS 690 868	**Figure Number**	Figure 6.9
LCT	10, Lowland Hills (CTR)	**Landscape Designation**	Fintry, Gargunnock and Touch Hills AGLV
Direction of view	West, north-west	**Distance to nearest turbine**	2.7km
Number of hubs theoretically visible	7	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	Viewpoint located on the minor road between Todholes and North Third Reservoir to the west of the property of Easter Cringate. The viewpoint lies within the Fintry, Gargunnock and Touch Hills AGLV and receptors include road users, hill walkers and farm workers in the surrounding vicinity of the viewpoint. Views east and west from the viewpoint are along the route of the minor road which follows the shallow valley between Cairnoch Hill (413m AOD) and Craigengelt Hill (368m AOD) to the south and Hart Hill (437m AOD) to the north. The summits of the western Fintry Hills and Campsie Fells form the skyline to the west above the settlement of Fintry and the Carron Valley in the middle ground. To the east, views are restricted by the rising moorland slopes to the east and north of the Earl's Burn. Views south from the viewpoint are across areas of recently felled coniferous forestry to the forested Cairnoch Hill which forms the skyline to the south. To the north of the minor road recently planted coniferous forestry forms the foreground of the view across manipulated ground and remnants of spoil tipping[22], with the rising moorland and rough grazing of Cringate Muir forming the skyline across which a number of the operational turbines of Earlsburn Wind Farm appear. The operational wind farms of Earlsburn and Craigengelt are visible from this viewpoint to the north and east respectively.		
Susceptibility	The viewpoint represents views experienced by a small number of potential viewers, including road users travelling along the minor road and farm workers in the surrounding fields. The viewpoint offers some scenic quality; however there are man-made elements in the available view, including a small wood pole telecommunication line and the operational turbines of Earlsburn Wind Farm. The viewpoint is therefore judged to be of medium susceptibility.		
Value	The viewpoint represents users, including local residents, of the minor road between Todholes and Borestone and is located within the Fintry, Gargunnock and Touch Hills AGLV. The viewpoint is therefore considered to be of medium value.		
Size and Scale	The Development will be visible to the north-west of the viewpoint with turbines visible beyond the rough grazing in the foreground and above the grazed moorland which forms the skyline in the middle distance. Although the wireframe illustrates theoretical visibility of all seven turbines from this viewpoint, due to localised variations in the topography as a result of tipping and manipulation of the rough grazing in the middle distance, visibility of turbines is limited to the hubs and blades of three turbines which break the skyline in the centre of the view, with the higher ground of the Fintry Hills rising up to the west. The operational turbines of Earlsburn are visible in the middle distance of views to the north and appear perceptibly larger than the moving turbines of the Development from this viewpoint. The turbines of the Development will appear as a separate group to those of Earlsburn and the geographical extent of the change will be limited to a short section of the minor road to the east and west, with coniferous forestry screening views further west along the road. The Development will form a small feature in the view, however it will extend visibility of turbines west across the skyline of the Gargunnock Hills into the Fintry Hills. No ancillary infrastructure will be visible from this viewpoint. The scale of change is judged to be medium from this viewpoint.		
Geographical Extent	Localised as this viewpoint represents views from the minor road to the south, south-east of the site.		

[22] The wireframe model from this viewpoint (Figure 6.10.2-3) doesn't show the localised variations in topography present on site as a result of spoil tipping.

Viewpoint 1 - Minor Road nr. Easter Cringate	
Effect and Significance	Considering the medium sensitivity of receptors and the medium magnitude of visual change to views from this location, the introduction of the Development will give rise to a **moderate**, significant visual effect on receptors at this viewpoint, given the proximity to the site and the additional visibility of turbines west across the Fintry Hills alongside the existing Earlsburn Wind Farm.

Table 6.38: Viewpoint 2 – Sir John de Graham's Castle

Viewpoint 2 - Sir John de Graham's Castle			
Grid Reference	NS 681 868	**Figure Number**	Figure 6.10
LCT	28, Lowland River Valleys (CTR)	**Landscape Designation**	Fintry, Gargunnock and Touch Hills AGLV
Direction of view	North, north-west	**Distance to nearest turbine**	2.8km
Number of hubs theoretically visible	1	**Number of turbines with blades theoretically visible**	2
Viewpoint location and existing view	This viewpoint is located at the remnants of the Sir John de Graham's Castle motte located north of the B818 on the western flanks of Cairnoch Hill and within the Fintry, Gargunnock and Touch Hills AGLV, south of the Development. Receptors include visitors and hill walkers in the surrounding vicinity of the viewpoint, and road users travelling on the adjacent roads. The viewpoint is enclosed by coniferous forestry which surrounds the motte and restricts views from of the immediate middle ground. The motte occupies an elevated position and facilitates views above the surrounding tree line formed by the forestry. To the south views are possible across the surrounding forestry to Carron Valley Reservoir to the forested southern slopes of the valley and the open moorland summit of Meikle Bin (570m AOD) and Little Bin (443m AOD). To the west the summit of Earl's Seat (578m AOD) forms a distinguishable feature on the west of the Campsie Fells. Views east are enclosed by the nearby forestry which covers the rising slopes of Cairnoch Hill to the east of the viewpoint. Views north and north-west from the viewpoint are towards the skyline formed by the Fintry and Gargunnock and Touch Hills, with a number of the operational turbines of Earlsburn Wind Farm visible above the skyline of rough grazing and open moorland. To the west of the shallow valley formed by Endrick Water to the north, the slopes of the Fintry Hills ascend to the west. The operational Earlsburn Wind Farm is visible from this viewpoint to the north.		
Susceptibility	Views will be experienced by a small number of potential viewers, including visitors to the remnants of the motte and walkers. Road users on the minor road to the north and the B818 to the south may experience similar views; however visibility is likely to be largely screened by the presence of coniferous forestry. The viewpoint offers some scenic quality however views out with the coniferous forestry surrounding the motte will likely reduce as the forestry matures and there are man-made elements, including Earlsburn Wind Farm in the available view. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.		
Value	The viewpoint represents recreational visitors to the Sir John de Graham's Castle motte, road users on the B818 and recreational users of the wider Carron Valley. The viewpoint is located within the Fintry, Gargunnock and Touch Hills AGLV, and is therefore considered to be of medium value.		
Size and Scale	Limited visibility of the Development will be possible from this viewpoint, with two turbines blades visible above the grazed moorland ridge formed by the Fintry Hills north of Todholes Farm. The moving turbine blades of the Development appear at a similar scale to the turbines of Earlsburn Wind Farm, however they will introduce development to the Fintry Hills west of the valley of Endrick Water and the Gargunnock Hills. Visibility of turbine blades will likely become screened as the coniferous forestry north of the viewpoint matures. The geographical extent of the change is limited to the elevated motte within the centre of the clearing, and the panoramic views to the west, south and east of the viewpoint are unaffected by the development. No ancillary infrastructure will be visible from this viewpoint. The scale of change is judged to be small from this viewpoint.		

Viewpoint 2 - Sir John de Graham's Castle	
Geographical Extent	Very localised as this viewpoint represents views from the motte, however similar views are possible from other locations within Carron Valley where not contained by coniferous forestry.
Effect and Significance	Considering the medium sensitivity of receptors at this viewpoint and the low magnitude of visual change in views, the introduction of the Development will give rise to a **negligible**, not significant visual effect on receptors at this viewpoint, as coniferous forestry which surrounds the viewpoint is due to be retained, screening views towards the Development.

Table 6.39: Viewpoint 3 - Carleatheran

Viewpoint 3 - Carleatheran			
Grid Reference	NS 687 918	**Figure Number**	Figure 6.11
LCT	10, Lowland Hills (CTR)	**Landscape Designation**	Fintry, Gargunnock and Touch Hills AGLV
Direction of view	South-west	**Distance to nearest turbine**	3.9km
Number of hubs theoretically visible	5	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	This viewpoint lies at Carleatheran Cairn (485m AOD) within the Gargunnock Hills to the north-east of the Development, and within the Fintry, Gargunnock and Touch Hills AGLV Receptors include hill walkers and farm workers in the surrounding vicinity of the viewpoint. The hill lies in close proximity to the settlements of Kippen and Gargunnock and is popular with local residents and hill walkers, with 360° panoramic views available which can also be experienced from similar surrounding hills. The viewpoint lies within an area of open moorland and rough grazing with open views available in every direction, across the upland plateau formed by the Touch Hills to the east, the Gargunnock Hills to the west, rising up from Lees Hill to Stronend beyond the Spout of Ballochleam on the western edge of the Fintry Hills. Views south from the viewpoint are across the undulating open moorland which surrounds Earlsburn Reservoirs with the operational wind farms of Earlsburn and Craigengelt visible to the west and south of the reservoirs respectively, appearing across the skyline in front of the distant hills of Meikle Bin and Tomtain are distinguishable on the southern edge of the Carron Valley. Views to the north are across the settled Strath of the Forth Valley with the Menteith Hills and the larger summits located within the Loch Lomond and The Trossachs National Park. The operational wind farms of Earlsburn, Greendykeside and Craigengelt are visible to the south of this viewpoint, and the operational Braes of Doune and Burnfoot Hill Wind Farms are visible in views across the Forth Valley to the north-east.		
Susceptibility	Views will be experienced by a small number of potential viewers which will include hill walkers and farm workers working within the surrounding moorland. The viewpoint offers some scenic views, with long distance views possible across the Strath to the north to the distant hill summits beyond, however existing operational wind turbines are present in views south and south-west from the viewpoint. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.		
Value	The viewpoint represents recreational walkers within the Gargunnock Hills. The viewpoint is located within the Fintry, Gargunnock and Touch Hills AGLV, and is therefore considered to be of medium value.		

Viewpoint 3 - Carleatheran	
Size and Scale	The Development will be visible to south-west of the viewpoint, with turbine blades and hubs appearing above the undulating plateau of the Gargunnock Hills, partially screened by the presence of Ling Hill. The turbines will be backclothed against the grazed moorland of the Fintry Hills to the west, with the distant hills of the Campsie Fells and Kilpatrick Hills forming the distant skyline beyond. The Development will introduce wind turbines to the currently undeveloped Fintry Hills, although they will occupy a relatively small proportion of the available view. Panoramic views to the north across the Forth Valley unaffected by visibility of the Development. The Development will appear consist with the current pattern of wind farm development across the Gargunnock and Touch Hills, with turbines appearing at a similar scale to those of Earlsburn and Craigengelt Wind Farms to the south. Similar views will be experienced across a relatively small geographical extent to the east and west of the viewpoint, where existing wind farms are already key features within the available view. No ancillary infrastructure will be visible from this viewpoint. The scale of change is judged to be medium from this viewpoint.
Geographical Extent	This viewpoint represents the views seen from a localised area of the Gargunnock and Touch Hills to the north, north-east of the site.
Effect and Significance	The introduction of the Development will give rise to a **moderate**, significant visual effect on receptors at this viewpoint, given the medium sensitivity of the receptors, the medium magnitude of visual change to views, the proximity to the site, and the introduction of additional visibility of turbines west across the Fintry Hills alongside the existing Earlsburn Wind Farm.

Table 6.40: Viewpoint 4 - Meikle Bin

Viewpoint 4 - Meikle Bin			
Grid Reference	NS 667 821	**Figure Number**	Figure 6.12
LCT	28, Lowland River Valleys (CTR)	**Landscape Designation**	Fintry, Gargunnock and Touch Hills AGLV
Direction of view	North	**Distance to nearest turbine**	6.1km
Number of hubs theoretically visible	1	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	This viewpoint lies at the popular summit of Meikle Bin (570m AOD) on the southern of the Carron Valley Forest at the convergence of the Kilsyth Hills to the south and the Campsie Fells to the west. The viewpoint lies within the Fintry, Gargunnock and Touch Hills AGLV and represents views experienced by hill walkers and other recreational users, and offers 360° panoramic views which can also be experienced from similar surrounding hills. The immediate foreground from the viewpoint is formed by open moorland covering the craggy summit of the hill, overlooking the coniferous forestry of Carron Valley Forest to the north and east, and Birkenburn Reservoir and the open moorland of the Campsie and Kilsyth Hills to the south and south-west. West of the viewpoint coniferous forestry is located across the slopes of the upper River Garron and the slopes surrounding the summit of Dongoil (424m AOD). Long distance views south are possible to the northern edge of Greater Glasgow located to the south of the Campsie Hills and south-east to Lothian and east towards the Forth Estuary. The distinguishable summits of Ben Ledi and Ben Lomond are visible on the distant skyline to the north-west. The Fintry, Gargunnock and Touch Hills form the skyline from north to north-east from the viewpoint with the open moorland covered hills appearing above the Carron Valley in the middle ground of the view. The operational wind farms of Earlsburn and Craigengelt are visible to the west and east of Cairnoch Hill respectively and the operational Braes of Doune Wind Farm is visible in long distance views across the Forth Valley to the north-east. The operational wind farms of Earlsburn, Craigengelt and Braes of Doune are visible to the north-east of this viewpoint.		

Viewpoint 4 - Meikle Bin	
Susceptibility	Views will be experienced by a small number of potential viewers which will include hill walkers and farm workers working within the surrounding moorland. The viewpoint offers scenic panoramic views; however existing operational wind turbines are present in views north and north-east from the viewpoint. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.
Value	This viewpoint represents recreational walkers within the Campsie Fells on the southern edge of the Carron Valley. The viewpoint is located within the Fintry, Gargunnock and Touch Hills AGLV, and is therefore considered to be of medium value.
Size and Scale	Turbines of the Development will be visible from this viewpoint, with turbine blades appearing above the grazed moorland ridge of the Fintry Hills, above Loch Walton. The turbines will occupy a relatively small proportion of the available panoramic views from this viewpoint, backclothed against the grazed moorland of the Gargunnock Hills, with the operational turbines of Earlsburn and Craigengelt Wind Farms forming the key features on the skyline across the Carron Valley to the north-east. The operational turbines of Braes of Doune Wind Farm are visible on the distant skyline to the north-east. The Development will affect a small geographical extent, with similar views of turbine blades experienced from surrounding summits and ridges to the east and west, on the southern side of the Carron Valley. No ancillary infrastructure will be visible from this viewpoint. The scale of change is judged to be small from this viewpoint.
Geographical Extent	This viewpoint represents the views seen from a localised area of the Campsie Fells to the south of the site.
Effect and Significance	Considering the medium sensitivity of the receptors and the low magnitude of visual change in views, the introduction of the Development will give rise to a **minor**, and therefore not significant visual effect on receptors at this viewpoint, given the distance to the site, and the visibility of existing wind farm development within the view.

Table 6.41: Viewpoint 5 - B822 at Kippen Muir

Viewpoint 5 - B822 at Kippen Muir			
Grid Reference	NS 630 928	**Figure Number**	Figure 6.13
LCT	18, Lowland Plateaux (CTR)	**Landscape Designation**	Fintry, Gargunnock and Touch Hills AGLV
Direction of view	South-east	**Distance to nearest turbine**	4.7km
Number of hubs theoretically visible	5	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	This viewpoint lies adjacent to the B822 at Kippen Muir, north of the Development in the shadow of the Spout of Ballochleam which splits the Fintry and Gargunnock Hills. The viewpoint lies within the Fintry, Gargunnock and Touch Hills AGLV and represents views experienced by road users travelling on the B822 and similar views experienced from residential properties located within close proximity. The viewpoint offers views north towards the skyline formed by the Fintry and Gargunnock Hills, with the Spout of Ballochleam creating a distinguishable feature on the horizon. The steep topography of Standmilane Craig and Lees Hill to the south-east screen views of the operational Earlsburn and Craigengelt Wind Farms and the Fintry Hills rising to Stronend Cairn to the west, form a key feature in the view. Views east and west along the B822 and north towards the Menteith Hills are enclosed by the presence of dense Gorse vegetation and deciduous trees, with stands of coniferous forestry beyond screening views along the Forth Valley in both directions, however some views across the Strath towards the distant hills to the north-east are possible, with the middle ground of the views screened by variations in localised topography of Kippen Muir. The operational wind farms of Braes of Doune and Burnfoot Hill are potentially visible from this viewpoint.		

Viewpoint 5 - B822 at Kippen Muir	
Susceptibility	The viewpoint will be experienced by a low number of potential viewers, predominantly road users travelling at speed along the B822 and by farm workers working in the adjacent fields. The viewpoint offers some scenic quality but opportunities for long distance views are relatively limited by the presence of localised screening. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.
Value	This viewpoint represents road users on the B882 and views of receptors travelling through the strath below the Fintry, Gargunnock and Touch Hills. The viewpoint is located within the Fintry, Gargunnock and Touch Hills AGLV, and is therefore considered to be of medium value.
Size and Scale	The Development will appear in views south-east from this viewpoint, appearing through the Spout of Ballochleam which splits the higher ground of the Gargunnock Hills to the east and the Fintry Hills to the west. The steep escarpments either side of the Spout of Ballochleam focus views towards the spout on the skyline, where the turbines of the Development are visible within the smooth valley bottom. Turbine hubs and blades are clearly visible above the skyline, appearing as a small compact group of turbines within the hanging valley. Although only a small proportion of the available view will be affected by visibility of the Development, the wind farm will introduce visibility of moving turbines within the higher ground overlooking the Forth Valley, where the focus of views is towards the Spout of Ballochleam. No ancillary infrastructure will be visible from this viewpoint. The scale of change is judged to be medium from this viewpoint.
Geographical Extent	The change in views will be experienced from a relatively limited geographical extent, and turbines will appear distant from the viewpoint.
Effect and Significance	The introduction of the Development will give rise to a **moderate**, and therefore significant visual effect on receptors at this viewpoint, given the medium sensitivity of the receptors and the medium magnitude of change to the view, the distance to the site, and the introduction of visibility of turbines into views south to the Spout of Ballochleam.

Table 6.42: Viewpoint 6 - Tomtain

Viewpoint 6 - Tomtain			
Grid Reference	NS 721 814	**Figure Number**	Figure 6.14
LCT	20, Rugged Moorland Hills (STC)	**Landscape Designation**	Kilsyth RSA
Direction of view	North-west	**Distance to nearest turbine**	8.7km
Number of hubs theoretically visible	7	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	This viewpoint is located at the summit of Tomtain (453m AOD) within the Kilsyth RSA on the southern edge of the Carron Valley Forest, representing the views of hill walkers and farm workers working in the surrounding moorland. The viewpoint offers 360° panoramic views from the unforested summit, with the craggy slopes on the south of the summit offering steep views down across the Kilsyth Hills to Kilsyth and Greater Glasgow beyond, and open views east, south-east towards the Forth Estuary and Lothian. The middle ground of views north from the viewpoint is across the coniferous forestry of the Carron Valley to the reservoir below, with the higher ground of the Gargunnock and Touch Hills beyond. Views north-west along the Carron Valley Reservoir lead to the steep south facing slopes of the Fintry Hills. The operational turbines of Earlsburn and Craigengelt are visible across the open moorland to the north of the Carron Valley, and long distance views to the Ochil Hills are possible to the north-east. The operational wind farms of Earlsburn and Craigengelt are visible to the north-east of this viewpoint.		

Viewpoint 6 - Tomtain	
Susceptibility	Views will be experienced by a small number of potential viewers which will include hill walkers, recreational users and farm workers working within the surrounding grazed moorland. The viewpoint offers scenic panoramic views; however existing operational wind turbines are present in views north and north-east from the viewpoint. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.
Value	This viewpoint represents recreational walkers within the Kilsyth Hills on the southern edge of the Carron Valley. The viewpoint is located within the Fintry, Gargunnock and Touch Hills AGLV, and is therefore considered to be of medium value.
Size and Scale	The Development will be visible in views north-west from this viewpoint, with partial turbine towers, hubs and blades appearing above the rising ridge of the Fintry Hills, north of the Carron Valley Reservoir. The turbines will appear in the shallow valley of Endrick Water visible on the skyline between the Fintry Hills to the west and the elevated plateau of the Gargunnock Hills to the east. Turbine blades will overlap in views from this viewpoint, with the Development appearing as a compact group of turbines on the skyline. The operational Earlsburn and Craigengelt Wind Farms are visible to the east of the Development, appearing as distinctly separate developments across the Carron Valley in the middle ground, with the turbines of Craigengelt appearing perceptibly closer to the viewpoint. The Development will affect a small proportion of the available panoramic views from this viewpoint, but will nevertheless extend wind farm development west into the currently undeveloped Fintry Hills. No ancillary infrastructure will be visible from this viewpoint. The scale of change is judged to be medium from this viewpoint.
Geographical Extent	The change in views will be experienced from a localised geographical extent, and turbines will appear distant from the viewpoint.
Effect and Significance	The introduction of the Development will give rise to a **moderate**, and therefore significant visual effect on receptors at this viewpoint and from similar upland areas within the Kilsyth Hills to the west, given the medium sensitivity of receptors, the medium magnitude of visual change to views, the distance to the site, and the extending of wind farm development west into the Fintry Hills.

Table 6.43: Viewpoint 7 - B8034 nr. Arndale Park and Gardens

Viewpoint 7 - B8034 nr. Arndale Park and Gardens			
Grid Reference	NS 599 972	**Figure Number**	Figure 6.15
LCT	L6, Rolling Valley Farmland (Stirling SPG)	**Landscape Designation**	None
Direction of view	South-east	**Distance to nearest turbine**	10.1km
Number of hubs theoretically visible	5	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	This viewpoint is located just south of Cardross Bridge on the B8034 within the lowland settled Strath of the Forth Valley. The viewpoint represents views experienced by road users travelling south on the B8034, farm workers working in adjacent arable and pasture fields and similar views experienced from the grounds of the nearby Cardross House and Arndale Park and Gardens. Views north from the viewpoint are contained by the deciduous woodland located along the River Forth and the rising topography on the north bank of the river. Long distance views west and east across hedgerow enclosed farmland are interrupted by boundary trees and areas of mixed woodland located along the Strath in both directions; however the Ochil Hills are visible above the treeline to the east in the far distance north of Stirling. Views south towards the Fintry and Gargunnock Hills are partially screened by the presence of deciduous woodland located along the route of the B8034 in the middle ground, however the Spout of Ballochleam is a distinguishable feature on the skyline beyond the treeline, with the skyline to the east formed by the steep northern slopes of the Touch Hills which shadow the southern side of the Forth Valley. No operational wind farms are potentially visible from this viewpoint.		

Viewpoint 7 - B8034 nr. Arndale Park and Gardens	
Susceptibility	The viewpoint will be experienced by a low number of potential viewers, predominantly road users travelling south along the B822 and by farm workers working in the adjacent arable and pasture fields. The viewpoint offers some scenic quality and views towards the site through the Spout of Ballochleam. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.
Value	This viewpoint represents road users on the B8034 and views of receptors travelling through the strath below the Fintry, Gargunnock and Touch Hills. The viewpoint is therefore judged to be of low value.
Size and Scale	The Development will appear on the skyline to the south-east of this viewpoint, appearing within the hanging valley formed by the Spout of Ballochleam which splits the Fintry Hills to the west and the Gargunnock Hills to the east. The turbines will occupy a small proportion of the available view and will be partially screened by intervening missed woodland located along the B8034 to the south of the viewpoint. Nevertheless the Spout of Ballochleam is a key distinguishable feature when viewed from within the Forth Valley to the north and the Development will become a key feature in views along the escarpment formed by the Fintry Hills and the Gargunnock Hills. Although the turbines will form a key feature on the southern skyline, these views will be experienced from a limited geographical extent and will often be screened by the localised intervening tree cover within the Forth Valley. No ancillary infrastructure will be visible from this viewpoint. The scale of change is judged to be medium from this viewpoint.
Geographical Extent	The change in views will be experienced from a relatively localised geographical extent, and turbines will appear distant from the viewpoint and small features in the view.
Effect and Significance	Considering the medium sensitivity of the receptors and the medium magnitude of change in views, the introduction of the Development will give rise to a **moderate**, and therefore significant visual effect on receptors at this viewpoint, given the distance to the site, and the introduction of turbines into views south through the Spout of Ballochleam.

Table 6.44: Viewpoint 8 - A873 nr. Ruskie

Viewpoint 8 - A873 nr. Ruskie			
Grid Reference	NN 631 007	**Figure Number**	Figure 6.16
LCT	L14, Farmed Valley or Hill Fringe (Stirling SPG)	**Landscape Designation**	None
Direction of view	South, south-east	**Distance to nearest turbine**	12.0km
Number of hubs theoretically visible	0	**Number of turbines with blades theoretically visible**	3
Viewpoint location and existing view	This viewpoint is located on the route of the A873 at Ruskie, between Port of Menteith and Thornhill. The viewpoint represents views experienced by road users travelling east and west along the A873, with oblique views possible towards the site beyond the Spout of Ballochleam. The viewpoint also represents the views of residential properties located along the A873 to the east and west of the viewpoint. Views north from the viewpoint, up the ascending slopes of the Menteith Hills are screened by the presence of deciduous woodland located along the north of the road, and the coniferous forestry beyond. Views are possible along the valley to the east and west, with the Ochil Hills visible in the distance to the east and the Loch Ard Forest visible to the east. The settled Strath of the Forth Valley, with arable and pasture farmland forming the lower slopes and floor of the valley, lies to the south of the viewpoint with tree lined field boundaries and clusters of mixed woodland dispersed across the valley floor. Views across the valley are focussed on the steep escarpments of the Fintry, Gargunnock and Touch Hills which form a band of higher ground above the Forth Valley, the elevated skyline interrupted to the south of Kippen by the presence of the Spout of Ballochleam. No operational wind farms are visible from this viewpoint.		

Viewpoint 8 - A873 nr. Ruskie	
Susceptibility	The viewpoint will be experienced by a moderate number of potential viewers, predominantly road users travelling east and west along the A873, farm workers working in the arable and pasture fields of the Strath and nearby residential properties. The viewpoint offers some scenic quality and offers open views towards the site through the Spout of Ballochleam. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.
Value	This viewpoint represents road users, including tourists on the A873 and views of receptors travelling along the Forth Valley between the Loch Lomond and the Trossachs National Park and Stirling to the east. The viewpoint is therefore judged to be of medium value.
Size and Scale	Turbine blades of the Development will appear on the skyline directly south of this viewpoint, appearing above the steep escarpment on the north of the Gargunnock Hills, with the Spout of Ballochleam and Fintry Hills rising to Stronend to the west of the spout. The Development will form a minor feature on the distant skyline; however the wind farm will introduce visibility of wind turbines and their associated movement from this area of the Forth of Forth, experienced across a small geographical extent. The scale of change is judged to be small from this viewpoint.
Geographical Extent	The change in views will be experienced from a localised geographical extent, and turbines will appear distant from the viewpoint and small features in the view.
Effect and Significance	Considering the medium sensitivity of receptors on this route and the low magnitude of change in views, the introduction of the Development will give rise to a **minor**, not significant visual effect on receptors at this viewpoint, given the distance to the site and the transitory nature of the likely receptors.

Table 6.45: Viewpoint 9 - Rob Roy Way

Viewpoint 9 - Rob Roy Way			
Grid Reference	NN 564 031	**Figure Number**	Figure 6.17
LCT	Transitional - Forested Parallel Ridge(LLT)	**Landscape Designation**	Loch Lomond and The Trossachs National Park, Trossachs and Breadalbane AGLV
Direction of view	South, south-east	**Distance to nearest turbine**	16.9km
Number of hubs theoretically visible	7	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	This viewpoint is located on the route of the long distance footpath of the Rob Roy Way, north of the Port of Menteith, which runs between Drymen and Pitlochry and crosses the southern flanks of the Menteith Hills. The viewpoint represents the views of hill walkers and other recreational users, and is located within the Loch Lomond and The Trossachs National Park. Views from much of the Rob Roy Way are enclosed by coniferous forestry and the viewpoint represents a rare clearing in the surrounding forestry located across the Menteith Hills offering views south across the Forth Valley towards the Fintry and Gargunnock Hills. The middle ground of the view is down the shallow valley of Pot of Glenny, where the Glenny Burn flows south into the Lake of Menteith below. The site can be seen beyond the Spout of Ballochleam, which appears as a notch in the horizon, separating the Fintry Hills to the west and the Gargunnock Hills to the east. Middle distance views to the north, east and west are contained by the presence of coniferous forestry to the west and east and the craggy escarpment's of the Menteith Hills to the north. The settled lowland Strath of the Forth Valley is not visible from this viewpoint. The operational Earlsburn Wind Farm is visible to the south of this viewpoint.		

Viewpoint 9 - Rob Roy Way	
Susceptibility	The viewpoint will be experienced by a low number of potential viewers using the Rob Roy Way as a recreational route. The viewpoint offers some scenic quality and offers long distance views towards the site through the Spout of Ballochleam. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.
Value	This viewpoint represents recreational users of the long distance footpath. The viewpoint is located within the Loch Lomond and the Trossachs National Park and the Trossachs and Breadalbane AGLV. The viewpoint is therefore judged to be of high value.
Size and Scale	The Development will be visible from this viewpoint, appearing on the distant horizon formed by the Gargunnock and Fintry Hills to the south-east, alongside the existing turbines of Earlsburn. When operational the moving turbines will appear above skyline formed by the steep escarpment of these hills, with the Forth Valley not perceptible below. The turbines will appear as a small feature in the view and occupy a small proportion of the available view from this viewpoint. Similar views will be experienced from a limited geographical extent, to craggy summits within the Menteith Hills surrounding the viewpoint, limited by the presence of coniferous forestry. No ancillary infrastructure or construction activity is likely to be perceptible from this viewpoint. The scale of change is judged to be small from this viewpoint.
Geographical Extent	The viewpoint represents widespread available views from the Roby Roy Way, however the change in views will be experienced from a localised geographical extent, and turbines will appear distant from the viewpoint and small features in the view.
Effect and Significance	Considering the high sensitivity of the receptors on this route and the low magnitude of change to views, the introduction of the Development will give rise to a **minor**, not significant visual effect on receptors at this viewpoint. The distance to the site, the transitory nature of the likely receptors and the presence of existing wind farm developments within the view, all reduce the potential effect from this viewpoint.

Table 6.46: Viewpoint 10 - Ben Ledi

Viewpoint 10 - Ben Ledi			
Grid Reference	NN 562 097	**Figure Number**	Figure 6.18
LCT	Highland - Hill (LLT)	**Landscape Designation**	Loch Lomond and The Trossachs National Park, Trossachs and Breadalbane AGLV
Direction of view	South-east	**Distance to nearest turbine**	22.8km
Number of hubs theoretically visible	7	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	This viewpoint is located at the summit of Ben Ledi (878m AOD), situated within the Loch Lomond and The Trossachs National Park above Loch Venachar and the A821 to the north-west of the site. The viewpoint is a popular hill summit with hill walkers and represents the long distance views experienced from the National Park by these recreational users. 360° panoramic views are possible from this viewpoint, with views west along Loch Katrine and the surrounding hill summits, views east down to Callander and to the Ochil Hills in the far distance. The settled Strath of the Forth Valley lies to the south and south-east of the viewpoint, with enclosed farmland and woodland located across the lower slopes and valley floor. The steep northern slopes of the Fintry, Gargunnock and Touch Hills are visible along the southern edge of the Strath, with the operational turbines of Earlsburn and Craigengelt Wind Farm visible backclothed against the hills located on the south of the Carron Valley. The operational wind farms of Earlsburn, Craigengelt and Greendykeside are visible to the south-east of this viewpoint.		

Viewpoint 10 - Ben Ledi	
Susceptibility	The viewpoint will be experienced by a relatively low number of potential recreational users (hill walkers) visiting this hill summit. The viewpoint offers 360° panoramic views of high scenic quality and offers long distance views towards the site through the Spout of Ballochleam. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.
Value	This viewpoint represents recreational hill walkers. The viewpoint is located within the Loch Lomond and the Trossachs National Park and the Trossachs and Breadalbane AGLV. The viewpoint is therefore judged to be of high value.
Size and Scale	The Development will be visible to the south-east of this viewpoint, with the turbines appearing as a group located to the south of the Spout of Ballochleam, within the Fintry Hills. The operational moving turbines will appear alongside the existing operational wind farms of Earlsburn and Craigengelt, at a similar scale from this distant viewpoint. The turbines will appear as a separate additional development west of the Gargunnock Hills, occupying a small proportion of the available view and will be experienced over a relatively limited extent. No ancillary infrastructure is likely to be perceptible from this viewpoint. The scale of change is judged to be barely perceptible from this viewpoint.
Geographical Extent	Widespread, as similar views can be seen from other summits and south-east facing slopes and ridges around Ben Ledi.
Effect and Significance	The introduction of the Development will give rise to a **minor**, not significant visual effect on receptors at this viewpoint, given the medium-high sensitivity of the receptors, the barely perceptible magnitude of change, the distance to the site and the presence of existing wind farm developments within the view.

Table 6.47: Viewpoint 11 - Shieldhill

Viewpoint 11 - Shieldhill			
Grid Reference	NS 891 765	**Figure Number**	Figure 6.19
LCT	19, Lowland Plateaux (CTR)	**Landscape Designation**	None
Direction of view	North-west	**Distance to nearest turbine**	25.2km
Number of hubs theoretically visible	0	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	Viewpoint located on the minor road west of the settlement of Shieldhill, south of Falkirk, south-east of the site. The viewpoint represents the views of road users travelling along this minor road, farm workers within the adjacent pasture fields and similar views experienced from residential properties on the western and northern periphery of Shieldhill. Views from the viewpoint are across rough grazing and pasture fields enclosed post and wire fences and intermittent hedgerows. Views south and west are contained by the presence of built form and deciduous hedgerows and trees located along either side of the minor road. Long distance views north, north-east are possible across the settled Forth Estuary, with the settlements of Denny, Falkirk and Grangemouth covering the middle ground to the east of the Kilsyth Hills, and Stirling lying beyond to the south of the Ochil Hills. The operational wind farms of Earlsburn and Craigengelt are visible across the Gargunnock Hills which form the skyline beyond the slopes of the Kilsyth Hills to the north-west, and the Braes of Doune Wind Farm is visible in long distance views north-west, appearing between the western flanks of the Ochil Hills and the eastern flanks of the Touch Hills. The operational wind farms of Earlsburn, Craigengelt, Greendykeside and Braes of Doune are visible to the north-west, west and north east of this viewpoint.		

Viewpoint 11 - Shieldhill	
Susceptibility	The viewpoint will be experienced by a moderate number of potential viewers, predominantly road users travelling east and west along the minor road, farm workers working in the adjacent fields and nearby residential properties on the periphery of Shieldhill. The viewpoint offers some scenic quality with views towards the Kilsyth Hills and Campsie Fells, however a multitude of man-made features are visible in the existing view including operational wind farms, large urban settlements and Grangemouth Refinery on the Forth Estuary. It is judged that receptors represented by this viewpoint are of low susceptibility to changes in views.
Value	This viewpoint represents views from the urban conurbation of Falkirk and is therefore judged to be of low value.
Size and Scale	The Development will theoretically be visible from this viewpoint in long distance views to the north-west. Turbine blades will be visible above the skyline of the Kilsyth Hills which form the southern edge of the Carron Valley rising up from the settlement of Denny which lies east of Carron Bridge. The operational turbines of Craigengelt and Earlsburn Wind Farms lie to the east of the Development in the view, occupying an elevated position and breaking the skyline above the Gargunnock Hills. The turbines of Craigengelt are the key focus of views towards the skyline, alongside the turbines of the Development appear as a small feature to the left of the view. The Development appears consistent with the existing pattern of wind farm development, extending visibility of turbine blades and their associated movement over a small proportion of the available view. No ancillary infrastructure will be perceptible from this viewpoint. The scale of change is judged to be barely perceptible from this viewpoint.
Geographical Extent	The change in views will be experienced from a localised geographical extent, and turbines will appear distant from the viewpoint and small features in the view.
Effect and Significance	The introduction of the Development will give rise to a **negligible**, not significant visual effect on receptors at this viewpoint, given the low sensitivity of the receptors and the low magnitude of change in views, the distance to the site, the limited likely visibility of the proposed turbines and the presence of existing wind farm developments within the view.

Table 6.48: Viewpoint 12 - Ben Cleuch

Viewpoint 12 - Ben Cleuch			
Grid Reference	NN 902 006	**Figure Number**	Figure 6.20
LCT	6, Lowland Hills (CTR)	**Landscape Designation**	Ochil Hills AGLV (Clackmannanshire)
Direction of view	West, south-west	**Distance to nearest turbine**	26.5km
Number of hubs theoretically visible	4	**Number of turbines with blades theoretically visible**	7

Viewpoint 12 - Ben Cleuch	
Viewpoint location and existing view	This viewpoint is located at the summit of Ben Cleuch (721m AOD) within the Ochil Hills north of Stirling to the north-east of the site. The viewpoint lies within the Western Ochils AGLV and is a popular hill summit with hill walkers and recreational users. The viewpoint offers 360° panoramic views across the elevated moorland summits of the Ochil Hills and down to the Forth Estuary to the south, the Forth Valley to the west and Strathallan to the north-west. The settlements of Alloa, Grangemouth and Falkirk are visible along the Forth Estuary; however Stirling and Dunblane lie beneath the steep slopes of the western Ochils and are not visible from the viewpoint. Across the Forth Valley to the south-west lies the eastern extent of the Touch Hills with the operational turbines od Earlsburn and Craigengelt backclothed against the surrounding open moorland and coniferous forestry. To the north-west of the viewpoint, long distance visibility of the hill summits of Ben Vorlich and Ben Ledi form a key feature of the view from this viewpoint. The operational wind farms of Braes of Doune to the north-west and Burnfoot Hill to the north are visible from the viewpoint, with the turbines of Burnfoot Hill appearing beneath the viewpoint, contained within the surrounding hills. The operational wind farms of Earlsburn, Craigengelt, Braes of Doune, Burnfoot Hill and Greendykeside are visible from this viewpoint.
Susceptibility	The viewpoint will be experienced by a relatively low number of potential recreational users (hill walkers) visiting this hill summit. The viewpoint offers 360° panoramic views of high scenic quality and offers long distance views towards the site across the Touch and Gargunnock Hills and backclothed against the Fintry Hills beyond. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.
Value	This viewpoint represents recreational hill walkers. The viewpoint is located within the Ochil Hills AGLV. The viewpoint is therefore judged to be of medium value.
Size and Scale	The Development will potentially be visible to the south-west of this viewpoint, with turbine blades and hubs appearing alongside the operational turbines of Earlsburn Wind Farm. The turbines are backclothed against the topography of the Fintry Hills to the west, with turbine towers largely screened by the moorland plateau of the Touch and Gargunnock Hills in the middle ground of the view. The Development will be viewed as an extension to the Earlsburn Wind Farm, and will occupy a small proportion of the available panoramic views from this viewpoint and similar changes in view will be experienced from a limited geographical extent. Rotational movement of turbine blades will be largely imperceptible at this distance and no ancillary infrastructure is likely to be perceptible from this viewpoint. The scale of change is judged to be barely perceptible from this viewpoint.
Geographical Extent	Widespread, as similar views can be seen from other summits and west facing slopes around Ben Cleuch.
Effect and Significance	The introduction of the Development will give rise to a **minor**, not significant visual effect on receptors at this viewpoint, given the medium sensitivity of receptors, the barely perceptible magnitude of visual change, the distance to the site and the presence of existing wind farm developments within the view.

Table 6.49: Viewpoint 13 - Ben Vorlich

Viewpoint 13 - Ben Vorlich			
Grid Reference	NN 629 189	**Figure Number**	Figure 6.21
LCT	Highland - Hill (LLT)	**Landscape Designation**	Loch Lomond and the Trossachs National Park
Direction of view	South, south-east	**Distance to nearest turbine**	29.8km
Number of hubs theoretically visible	7	**Number of turbines with blades theoretically visible**	7

Viewpoint 13 - Ben Vorlich	
Viewpoint location and existing view	This viewpoint is located at the summit of Ben Vorlich (985m AOD) situated within the Loch Lomond and The Trossachs National Park. The viewpoint is a popular hill summit with hill walkers and represents long distance views experienced from the National Park by these recreational users. The viewpoint offers 360° panoramic views from the summit, with views north across Loch Earn towards Ben Lawers and its surrounding summits, views east along Strathearn towards the settlement of Perth and south-east across Strathallan towards the Ochil Hills and the Forth Estuary. The main focus of views is west, north-west to the interior of the National Park with the hill summits of Ben More and Ben Lomond visible to the north-west and south-west respectively. Views south are across the settled Strath of the Forth Valley to the steep northern escarpments of the Touch, Gargunnock and Fintry Hills, split by the Spout of Ballochleam to the north of the site, which is largely imperceptible at this distance. The operational wind farms of Braes of Doune, Earlsburn, Craigengelt and Greendykeside are visible to the south-east and south of this viewpoint.
Susceptibility	The viewpoint will be experienced by a relatively low number of potential recreational users (hill walkers) visiting this hill summit. The viewpoint offers 360° panoramic views of high scenic quality and offers long distance views towards the site across the Touch and Gargunnock Hills and backclothed against the Fintry Hills beyond. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.
Value	This viewpoint represents recreational hill walkers. The viewpoint is located within the Loch Lomond and the Trossachs National Park and the Trossachs and Breadalbane AGLV. The viewpoint is therefore judged to be of high value.
Size and Scale	The Development will potentially be visible to the south-west of this viewpoint, with turbine blades and hubs appearing alongside the operational turbines of Earlsburn Wind Farm. The turbines are backclothed against the topography of the Fintry Hills to the west, with turbine towers largely screened by the moorland plateau of the Touch and Gargunnock Hills in the middle ground of the view. The Development will be viewed as an extension to the Earlsburn Wind Farm, and will occupy a small proportion of the available panoramic views from this viewpoint and similar changes in view will be experienced from a limited geographical extent. Rotational movement of turbine blades will be largely imperceptible at this distance and no ancillary infrastructure will be perceptible from this viewpoint. The scale of change is judged to be barely perceptible from this viewpoint.
Geographical Extent	Widespread, as similar views can be seen from other summits and south facing slopes around Ben Vorlich.
Effect and Significance	The introduction of the Development will give rise to a **minor**, not significant visual effect on receptors at this viewpoint, given the medium-high sensitivity of receptors, the barely perceptible magnitude of visual change, the distance to the site and the presence of existing wind farm developments within the view.

Table 6.50: Viewpoint 14 – Ben Lomond

Viewpoint 14 - Ben Lomond			
Grid Reference	NN 367 028	**Figure Number**	Figure 6.22
LCT	Highland - Hill (LLT)	**Landscape Designation**	Loch Lomond and the Trossachs National Park Loch Lomond NSA
Direction of view	South-east	**Distance to nearest turbine**	32.3km
Number of hubs theoretically visible	4	**Number of turbines with blades theoretically visible**	7

Viewpoint 14 - Ben Lomond	
Viewpoint location and existing view	This viewpoint is located at the summit of Ben Lomond (974m AOD) situated within the Loch Lomond and The Trossachs National Park. The viewpoint is the most popular Munro hill summit, due to its accessibility from the major conurbations of the Central Belt and is frequented by a large number of hill walkers. The viewpoint represents long distance views experienced from the National Park by these recreational users. The viewpoint offers 360° panoramic views from the summit, with the coniferous forestry of Loch Ard Forest forming the middle ground of the views towards the site to the west the Forth Valley. The open moorland and rough grazed Fintry, Gargunnock and Touch Hills form a bank of higher ground to the south of the Forth Valley with the forested slopes of and summits of the Carron Valley and Campsie Fells located directly south. The operational wind farms of Earlsburn and Craigengelt are visible across the central Gargunnock Hills with turbines breaking the skyline above the hills with the urban areas of West Lothian visible beyond. The Greater Glasgow conurbation is visible between the Fintry Hills and the Kilpatrick Hills in views south-east from the viewpoint and Loch Lomond forms the key feature in views south-west towards the Clyde Estuary beyond. The operational wind farms of Braes of Doune, West Cambushinnie, Burnfoot Hill, Earlsburn, Craigengelt and Greendykeside are visible to the south-east and east of this viewpoint.
Susceptibility	The viewpoint will be experienced by a high number of potential recreational users (hill walkers) visiting this hill popular summit. The viewpoint offers 360° panoramic views of high scenic quality and offers long distance views towards the site located within the Fintry Hills. A number of man-made features, including operational wind farms are visible in views from this viewpoint. It is judged that receptors represented by this viewpoint are of high susceptibility to changes in views.
Value	This viewpoint represents recreational hill walkers. The viewpoint is located within the Loch Lomond and The Trossachs National Park and the Loch Lomond NSA. The viewpoint is therefore judged to be of high value.
Size and Scale	The Development will potentially be visible from this distant viewpoint, with turbine blades and hubs appearing above the skyline of the western Fintry Hills. The operational wind farms of Earlsburn and Craigengelt are visible from this viewpoint, occupying a large proportion of the skyline above the Gargunnock Hills, above the steep escarpments which descend into the Forth Valley to the north. The Development will extend visibility of turbines towards the western edge of the escarpment which is formed by the Fintry Hills, appearing to the right of the Spout of Ballochleam which splits the Gargunnock and Fintry Hills to the north of the Development. The Development will overlap with the existing Craigengelt and Earlsburn Wind Farms and will be viewed as one amalgamation of wind turbines from this viewpoint, and will not introduce new features to the view south-east from the viewpoint. Rotational movement of turbine blades will be largely imperceptible at this distance. The Development will therefore form a small element in the available panoramic views from this viewpoint and result in a barely perceptible scale change in views.
Geographical Extent	Widespread, as similar views can be seen from other summits and east, south-east facing slopes around Ben Lomond.
Effect and Significance	The introduction of the Development will give rise to a **negligible**, not significant visual effect on receptors at this viewpoint, notwithstanding the high sensitivity of receptors, the barely perceptible magnitude of change to views, the distance to the site and the presence of existing wind farm developments within the view.

Table 6.51: Viewpoint 15 - Meall an-t Seallaidh

Viewpoint 15 - Meall an-t Seallaidh			
Grid Reference	NN 542 233	**Figure Number**	Figure 6.23
LCT	Highland - Hill (LLT)	**Landscape Designation**	Loch Lomond and The Trossachs National Park, Trossachs and Breadalbane AGLV
Direction of view	South, south-east	**Distance to nearest turbine**	36.2km

Viewpoint 15 - Meall an-t Seallaidh			
Number of hubs theoretically visible	7	**Number of turbines with blades theoretically visible**	7
Viewpoint location and existing view	This viewpoint is located at the summit of Meall an-t Seallaidh (852m AOD) located within the Loch Lomond and The Trossachs National Park and within the Balquhidder core wildness area. The viewpoint and the surrounding ridges and summits are popular with hill walkers and recreational users and the viewpoint therefore represents long distance views experienced from the National Park by these recreational users. The viewpoint offers 360° panoramic views across the National Park to the north, west and south and along Loch Earn to the east towards the head of Strathearn. Views south from the viewpoint towards the site are focussed along Strathyre and the forested slopes of Strathyre Forest, with the craggy summit of Ben Ledi clearly distinguishable to the west above Loch Lubnaig. The Fintry, Gargunnock and Touch Hills are distinguishable above the lowland Strath of the Forth Valley, with the summits of Meikle Bin and Tomtain visible on the skyline beyond. The operational turbines of Earlsburn and Craigengelt Wind Farms are visible above these hills, with the distant hills south of Greater Glasgow forming the distant horizon. The operational wind farms of Braes of Doune, Earlsburn, Craigengelt and Greendykeside are visible to the south-east and east of this viewpoint.		
Susceptibility	The viewpoint represents a relatively low number of potential recreational users (hill walkers) visiting this hill summit and the surrounding ridges and summits. The viewpoint offers 360° panoramic views of high scenic quality and offers long distance views towards the site located within the Fintry Hills. A number of man-made features, including operational wind farms are visible in views from this viewpoint. It is judged that receptors represented by this viewpoint are of medium susceptibility to changes in views.		
Value	This viewpoint represents recreational hill walkers. The viewpoint is located within the Loch Lomond and The Trossachs National Park and the Trossachs and Breadalbane AGLV. The viewpoint is therefore judged to be of high value.		
Size and Scale	The Development will potentially be visible in views south-east from this viewpoint towards the northern escarpments of Gargunnock and Fintry Hills. Turbines of the Development will not introduce new features to the available view and will appear to the west of the existing operational turbines of Earlsburn and Craigengelt Wind Farms with the towers of the most easterly turbines partially screened by Lees Hill and Ling Hill, which form the eastern flank of the Spout of Ballochleam. The western turbines will be visible backclothed against the open moorland of the Fintry Hills, and turbines will not break the distant skyline of the Campsie Fells beyond from this viewpoint. Although the Development will extend visibility of turbines across the skyline of the Gargunnock and Fintry Hills, the turbines will occupy a small proportion of the panoramic views available from this distant viewpoint. Rotational movement of turbine blades will be largely imperceptible at this distance. The scale of change is judged to be low from this viewpoint.		
Geographical Extent	Widespread, as similar views can be seen from other summits and south, south-east facing slopes and ridges around Meall an-t Seallaidh.		
Effect and Significance	The introduction of the Development will give rise to a **minor**, not significant visual effect on receptors at this viewpoint, notwithstanding the medium-high sensitivity of receptors, the barely perceptible magnitude of visual change to views, the distance to the site and the presence of existing wind farm developments within the view.		

Mitigation of Visual Effects

Operation

6.140 Measures to reduce visual effects are embedded into the proposed wind farm layout. Reducing effects on views was one of the considerations in the development of the design strategy set out in **Chapter 3: Site Selection and Design Strategy**

Residual Visual Effects

Operation

6.141 Measures to reduce landscape and visual effects are embedded into the design of the wind farm and the site restoration proposals. Further mitigation is not possible due to the inherent nature of wind farm developments. All residual effects are therefore as predicted in the assessment section above.

Cumulative Assessment

Cumulative Landscape and Visual Methodology

6.142 The CLVIA considers the potential effects of the addition of the Development, against a baseline landscape that includes wind farms that may or may not be present in the landscape in the future, i.e. wind farms that are consented but not yet built, and/or undetermined planning applications.[23] The wind farms are assumed to be present in the landscape for the CLVIA.

6.143 The methodology for the CLVIA follows that of the LVIA set out at the beginning of this chapter, which considered the introduction of Craigton and Spittalhill Wind Farm to a baseline which includes existing (operational and under construction) wind farms. The scale and size of cumulative change focusses on:

- the arrangement of wind farms in the landscape or view, e.g. developments seen in one direction or part of the view (combined views), or seen in different directions (successive views in which the viewer must turn) or developments seen sequentially along a route;
- the relationship between the scale of the wind farms, including turbine size and number;
- the position of the wind farms in the landscape, e.g. in similar landscape or topographical context;
- the position of the wind farms in the view, e.g. on the skyline or against the backdrop of land; and
- the distances between wind farms, and their distances from the viewer.

Cumulative Baseline

6.144 A number of proposed wind farm developments are located within the 35km study area of the Development, which are of variable status and therefore represent different levels of certainty. These proposed developments are considered in the cumulative assessment of landscape and visual effects.

6.145 Cumulative wind farm developments forming part of the baseline for the CLVIA include consented schemes and those that are valid but undetermined applications or applications at appeal/public inquiry, listed in **Table 6.52: Wind Farms considered in the Cumulative Assessment**, as well as those that form part of the LVIA baseline (see **Table 6.7: Wind Farms Operational and Under Construction**). The locations of all of the wind farms considered in the CLVIA are shown on **Figure 6.24**. Although each of these wind farms is included in the baseline for the CLVIA, the assessment is focused on the relationship of the proposed wind farm Development with the closest wind farms to the Site.

Table 6.52: Wind Farms considered in the Cumulative Assessment

Wind Farm	Status[24]	Blade Tip Height (m)	No. of Turbines	Distance (km)[25]
Earlsburn North	Consented[26]	115m	9	1.7km
Durrieshill Wind Turbine	Consented	79m	1	12.7km
Tod Hill Farm	Consented	125m	4	18.1km
Rosehill Farm	Application Submitted	99.5m	3	20.0km

[23] No Pre-application design/scoping stage schemes were included in the CLVIA following consultation with STC, SNH and LLTNPA, however several pre-application design/scoping stage schemes are shown on Figure 6.24.
[24] Development status on the 1st October 2013.
[25] Distance between nearest turbine and the nearest turbine of the Development
[26] Construction due to begin early 2013.

Wind Farm	Status[24]	Blade Tip Height (m)	No. of Turbines	Distance (km)[25]
Greengairs	Consented	125m	9	23.3km
Greengairs East	Application Submitted	125m	8	24.1km
Merkins[27]	Application Submitted	120m	10	24.6km
ASDA Depot	Consented	125m	1	24.6km
Rhodders	Appeal/Public Inquiry	120m	9	26.8km
Easter Drumclair	Application Submitted	76m	1	26.9km
Bracco	Application Submitted	100m	3	27.6km
Burnfoot Hill Extension	Consented	102m	2	28.3km
Burnhead	Consented	127m	13	29.3km
Frandy Hill[28]	Appeal/Public Inquiry	120m	7	30.2km
Cathkin Braes	Consented	125m	1	30.9km
Birnie Hill	Application Submitted	120m	3	32.3km
Logoch Farm	Consented	66.6m	1	33.9km
Blantyre Muir Extension	Consented	115m	3	35.6km
Blantyre Muir	Consented	115m	3	35.6km

6.146 Pre-application Design/Scoping sites are not considered in the assessment, but are shown on **Figure 6.24**, and listed below.

- Loaninghead;
- Callendar Estate;
- Limerigg;
- Dunsyston;
- Devilla;
- Tochie Burn; and
- Hartwood.

6.147 The additional consented and proposed wind farms listed above and considered in the CLVIA are distributed across the study area. The distribution of wind farm developments will further strengthen the existing pattern of development within the Gargunnock and Touch Hills with the introduction of Earlsburn North Wind Farm. A number of other developments have been consented to the east of the Kilsyth Hills, located within the lowland carse surrounding the M9 and M90 between Stirling and Grangemouth and a cluster of developments have been consented on the southern edge of Greater Glasgow, which will be imperceptible from north of the large urban conurbation due to the presence of intervening urban built form. Within the Ochil Hills to the north-east, the proposed Burnfoot Hill Extension, Frandy Hill and Rhodders Wind Farms will create a cluster of developments. Additional proposed developments are located in the Kilpatrick Hills to the south-west, within the western Forth valley to the north-west, along the industrial corridor of the Forth Estuary to the east and to the north-east of the Greater Glasgow conurbation to the south-east of the Development. A number of single turbine developments are proposed across the study area, which do not fit within the pattern of existing or consented wind farm development.

[27] Merkins Wind Farm was refused planning consent by West Dunbartonshire Council on 23rd October 2013 following the cut-off date for the CLVIA (1st October 2013). The inclusion of the wind farm inclusion in the CLVIA baseline does not affect the effects identified.

[28] Frandy Hill Wind Farm was refused planning consent by Scottish Ministers on 2nd October 2013 following the cut-off date for the CLVIA (1st October 2013). The inclusion of the wind farm inclusion in the CLVIA baseline does not affect the effects identified.

Receptors of Cumulative Effects

6.148 The receptors of cumulative effects are the landscape, where one or more wind farms form features in the landscape, and people (visual receptors) who may see more than one wind farm when moving round the landscape or at static locations. As cumulative effects can be experienced as sequential views of different wind farms, effects on views from routes are important.

Potential Cumulative Effects

6.149 Potential cumulative effects include:

- combined effects, when developments are seen in one direction or part of the view;
- successive effects, when developments are seen in different directions (the viewer must turn to see them); or
- sequential effects, when developments are seen sequentially along a route, but not necessarily all visible from the same locations.

6.150 For cumulative effects, there is also the perceived patterns of wind farm development, such that a viewer may be aware of other wind farms in the area, even if they are not visible from the static location or route the viewer is on.

Mitigation

6.151 Landscape and visual considerations, including the relationship of the Development with other wind farms nearby, played a key role in the progression of the layout design for the Development. Consideration included the size and layout of the turbines. It is considered that 125m to blade tip is in keeping with current existing and proposed wind farms, and the layout forms a group of turbines that is consistent with the general pattern of development across the immediate study area, located alongside existing and proposed wind farm schemes considered in the CLVIA. The Development relates directly to the adjacent wind farm schemes of Earlsburn (operational) and Earlsburn North (consented), and closely to Craigengelt Wind Farm (operational) and it was therefore designed to be a coherent development alongside these wind farm schemes, displaying similar locational design, layout design and comparable turbine dimensions in terms of the scale and size of the turbines proposed. The design of the Development is described in **Chapter 3: Site Selection and Design Strategy**.

Residual Effects

Patterns of Development and Cumulative Landscape Effects

6.152 The pattern of development across the area out to 60 km from the site is described using maps collated by SNH[xlvii] and RenewablesUK[xlviii] as well as data collated in **Table 6.52: Wind Farms considered in the Cumulative Assessment**.

6.153 There is a trend for existing or consented development to occur within the lowland hills of the immediate study area, with operational and consented developments located within 10km of the site in the Gargunnock and Touch Hills (such as Earlsburn, Earlsburn North and Craigengelt Wind Farms). To the north-east, wind farm development is concentrated within the upland areas of the Ochil Hills north of Stirling (such as Burnfoot Hill and Burnfoot Hill Extension, and Green Knowes Wind Farms) and the Braes of Doune Wind Farm can be found across Strathallan on the lowland side of the highland boundary fault to the north-west. Across the lower lying areas of the study area there are more numerous but smaller developments, included single turbine domestic and commercial developments. The trends for current wind farm proposals also follow this pattern, with clear avoidance of the Loch Lomond and The Trossachs National Park and the designated landscapes of the Loch Lomond, Trossachs and River Earn (Comrie to St Fillans) NSAs.

6.154 Within the study area of 35km of the site, wind farm development tends to follow the Lowland Hills/Igneous Hills/Lowland Hill Fringes LCTs in the central and northern areas and the Lowland Plateaux/Plateau Farmland/Plateau Moorlands LCTs, to the south and east of the central lowland Campsie Fells and Kilsyth and Kiilpatrick Hills, south of the site (see **Figure 6.4** and **Figure 6.24**). A number of

single turbine and small wind farm developments are exceptions to this trend, located in lowland river valley areas of the Forth Valley and Strathallan.

6.155 As a result of the trends described above, wind farms are becoming more common features in lowland hills and upland landscapes across the study area. Higher elevation LCTs are more likely to have views of wind farms in the wider landscape from hill summits, and visibility of wind farms in upland LCTs located beyond the 35km study area may be possible from hill summits within the study area. From lower elevation LCTs, wind farms are features in the backdrop views of higher ground, and there are also occasional wind farms within lower elevation LCTs (small scale domestic developments of turbines of less than 50 m blade tip height have not been studied in this assessment outside of 5km of the site[29]).

6.156 The Development, located in the Lowland Hills LCT, will follow the trend identified above. It will be located in the Fintry Hills directly adjacent to the Earlsburn (operational) and Earlsburn North (consented) Wind Farms, and within 6.5km of the Craigengelt Wind Farm (operational). The Development may therefore be seen to be part of the pattern of wind farm development within the immediate Lowland Hills LCT and the wider pattern of existing and proposed wind farm development across the study area, albeit extending development of wind farms west across the Fintry, Gargunnock and Touch Hills. In spite of this, it is judged that the Development will be seen and perceived as part of the pattern of developments that exists within the lowland hills which lie above the settled areas of the study area.

6.157 The introduction of the Development will increase in the number of wind farms present within the area made up of the Lowland Hills LCT, but it is judged that there will not be further significant cumulative effects on those LCTs (compared with those identified in the LVIA), in the cumulative scenario. This is because there is an existing trend of development in these areas, and the Development will be closely linked, both geographically and visually, to the operational Earlsburn and consented Earlsburn North Wind Farms, and visually to the operational Craigengelt Wind Farm which are located within the Lowland Hills LCT, such that there will not be a further change in overall character of the Lowland Hills LCT as a result of the introduction of the Development. Locally the area of the Lowland Hills LCT covered by the site and the immediate locality of the LCT within the Fintry, Gargunnock and Touch Hills will experience a **moderate**, and therefore significant cumulative landscape effect as a result of the introduction of the Development, extending the influence of wind energy development within the LCT.

Cumulative Landscape Effects on the Development Site

6.158 Cumulative landscape effects on the Development site are outlined in **Table 6.53: Cumulative Effects on the Site** below.

Table 6.53: Cumulative Effects on the Site

Receptor	Description of Cumulative Landscape Effects on site
Site	Earlsburn and Earlsburn North Wind Farms lie adjacent to the Development Site within the same LCT to the east, north-east, other wind farms are visible at a distance. There will be direct changes to the site relating to the physical loss of features (open moorland) and introduction of new features (turbines and infrastructure). The introduction of the wind farm will substantially alter the existing character of the Development Site, through the change to a wind power generating site with turbines and infrastructure including access tracks. The Development will be seen, as for the LVIA, Earlsburn and Craigengelt Wind Farms and the presence of Earlsburn North Wind Farm will not alter the scale of landscape change to the Development Site. The scale of cumulative change is judged to be large. Overall, the cumulative landscape effects of the operational wind farm on the Development Site will be **major**, and therefore significant.

Cumulative Landscape Effects on LCTs

6.159 Cumulative landscape effects on LCTs considered within the LVIA are outlined in **Table 6.54: Cumulative Landscape Effects on LCTs** below.

Table 6.54: Cumulative Landscape Effects on LCTs

LCT	
Lowland Hills **(Central Region LCA: 10 Fintry, Gargunnock and Touch Hills, 11, Campsie Fells)**	Earlsburn North Wind Farm lies within the LCT, within the Fintry, Gargunnock and Touch Hills area, other wind farms are visible at a distance. Earlsburn North Wind Farm lies to the north-west of Earlsburn Wind Farm, closer to the site. The Development will extend the influence of wind farm developments on the hills, but may not be seen as a discrete group of turbines, but rather as part of a group of turbines round Earlsburn, albeit on the other side of the Backside Burn. It is judged that the area of 'Lowland Hills with wind farms', which will occur with the presence of Earlsburn North Wind Farm, will be extended but not created by the development. The scale of cumulative change is judged to be small. The Campsie Fells area of the LCT will have limited views of the Development, which will be seen in the context of Earlsburn and Craigengelt Wind Farms, and in front of, and indistinguishable from, Earlsburn North Wind Farm. The scale of cumulative change to this area of the LCT is judged to be largely imperceptible. Overall the cumulative landscape effect of the Development will be **moderate** and therefore significant locally for the Fintry, Gargunnock and Touch Hills area of the LCT, and **negligible** and therefore not significant for the Campsie Fells area.
Lowland Plateaux (Central Region LCA: 18 Kippen Muir)	Earlsburn North Wind Farm will be visible from much of the plateau area, and is closer to the LCT than Earlsburn Wind Farm. The Development will be seen as additional turbines on the hill horizon to the south-east, from the eastern end of the plateau area, where Earlsburn North Wind Farm is currently visible, and will extend visibility of turbines slightly. The introduction of the development will increase the sense of wind turbines being present on the backdrop to the LCT to the south, but will not alter the key characteristics of the LCT. The scale of change is judged to be largely imperceptible. Overall, the cumulative landscape effect of the Development will be **negligible,** and therefore not significant.
Lowland River Valleys **(Central Region LCA: 28, Upper Carron)**	Earlsburn North Wind Farm is visible from much of the reservoir and surrounding hill slopes, and is seen adjacent to Earlsburn Wind Farm. The Development will be seen from the limited locations identified above, but in the context of the larger group of turbines created by Earlsburn and Earlsburn North Wind Farms. The development will be seen to the left (west) of Earlsburn North Wind Farm, and from some locations will not be seen as a discrete development. The scale of cumulative change is judged to be largely imperceptible. Overall, the cumulative landscape effect of the Development will be **negligible,** and therefore not significant.
20 Rugged Moorland Hills **(Glasgow and the Clyde Valley LCA)**	Earlsburn North Wind Farm is present to the north of Earlsburn Wind Farm. The Development will be seen, as for the LVIA, in the context of Earlsburn North, Earlsburn and Craigengelt Wind Farms from limited locations. The scale of cumulative change is judged to be imperceptible. Overall, the cumulative landscape effect of the Development will be **negligible,** and therefore not significant.
Flat Valley Floor **(Stirling Proposed SPG: L2, Carse West of Stirling, L3 Flanders Moss West)**	Earlsburn North Wind Farm is visible on the horizon above and to the east of the Spout of Ballochleam, for both the 'Carse West of Stirling' and 'Flanders Moss West' areas. Merkins and Rhodders Wind Farms may be visible at a distance from the LCT. From the 'Carse West of Stirling' area, the development will be seen above the Spout of Ballochleam, to the right (west) of Earlsburn North Wind Farm. In the presence of Earlsburn North Wind Farm, the development will introduce additional features to the skyline to the south, rather than new features. The scale of cumulative change is judged to be small. From the 'Flanders Moss West' area, the development will be seen as additional turbines in front of, and indistinguishable from, the Earlsburn North turbines. The scale of cumulative change to the character area is judged to be largely imperceptible. Overall, the cumulative landscape effect of the Development will be **minor**, and therefore not significant locally for the 'Carse West of Stirling' area and **negligible,** and therefore not significant for the 'Flanders Moss West' area.

[29] An exception to this is the inclusion of Balafark Farm Wind Turbine (46 m to blade tip) in the assessment.

LCT	
L6, Rolling Valley Farmland – Dyke Head	Earlsburn North Wind Farm is present on the Gargunnock Hills horizon in front of Earlsburn Wind Farm. Merkins and Rhodders Wind Farms may also be visible at a distance from the LCT. The Development will be seen above the Spout of Ballochleam, to the right (west) of Earlsburn North Wind Farm. In the presence of Earlsburn North Wind Farm, the scale of cumulative change is judged to be imperceptible. Overall, the cumulative landscape effect of the Development will be **negligible,** and therefore not significant.
L14, Farmed Valley or Hill Fringe – Forth/Teith Valley Fringe	Earlsburn North Wind Farm is present on the Gargunnock Hills horizon in front of Earlsburn Wind Farm. Merkins and Rhodders Wind Farms may also be visible at a distance from the LCT. The Development will be seen, as for the LVIA, in the context of Earlsburn North, Earlsburn and Craigengelt Wind Farms from south facing slopes. The scale of cumulative change is judged to be imperceptible. Overall, the cumulative landscape effect of the Development will be **negligible,** and therefore not significant.

Cumulative Visual Effects

6.160 Combined and successive visibility of the Development with other wind farms is illustrated in **Figures 6.25a, 6.25b** and **6.25c**. These figures illustrate that there is extensive visibility of wind farms across the study area in the absence of the Development (all colours except green). The introduction of Craigton and Spittalhill Wind Farm will extend visibility of turbines into areas where currently no wind farms are visible (green areas) as is shown on **Figure 6.25a**. Visibility from these latter areas however, is largely influenced by the presence of forestry, broadleaf woodland, and therefore actual visibility is unlikely to be as extensive, limited to areas where views south through the Spout of Ballochleam are possible, and where views of Earlsburn and Earlsburn North Widen Farms are not currently possible. For most locations with theoretical visibility of the Development, there is theoretical, if not actual visibility of other turbines.

6.161 Key areas of combined or successive visibility of the proposed wind farm Development with other wind farms (overlap of ZTVs) include:

- the elevated areas of the Lowland Hills LCT to the east, west and south of the site, where visibility of Earlsburn, Earlsburn North and Craigengelt Wind Farms is available in close proximity;
- visibility of the Development alongside Earlsburn North and Earlsburn Wind Farms from the Forth Valley and specifically the Carse of Forth, in views south through the Spout of Ballochleam; and
- elevated slopes and hill summits to the north, north-west from within the Loch Lomond and The Trossachs National Park, where the Development will be indiscernible from the adjacent turbines of Earlsburn and Earlsburn North Wind Farms.

6.162 The paragraphs below sets out the cumulative assessment of combined and successive views from static locations such as settlements and viewpoints, using those locations considered in the LVIA.

Analysis of the Cumulative Paired ZTVs

6.163 The main relationship between the Development and consented or proposed wind farms considered in the CLVIA is with the nearest wind farms of Earlsburn, Earlsburn North and Craigengelt. **Figure 6.25b** shows the ZTV of the Development in combination with the Earlsburn, Craigengelt and Earlsburn North Wind Farms. The figure shows that:

- visibility of the Development in isolation will be limited to a small proportion of the study area, located within the Forth Valley to the south-east of Kippen;
- the yellow and orange shaded areas of the ZTV indicate the areas of the study area where the Development will be visible in combined or successive views with the operational wind farms of Earlsburn and Craigengelt and the consented Earlsburn North Wind Farm, where the turbines of the development will often appear as an extension to the existing pattern of wind farm development;
- the combined ZTV illustrates that areas which lie beneath the northern slopes of the Fintry, Gargunnock and Touch Hills have no visibility of the Development or the turbines of Earlsburn, Craigengelt, Earlsburn North, this extends southwards across Greater Glasgow to the south of the Campsie Fells and Kilsyth Hills and to the west across Strathblane and the Kilpatrick Hills;
- the blue areas of the combined ZTV indicate where there are extensive parts of the study area which have theoretically visibility of the operational Earlsburn and Craigengelt Wind Farms and the consented Earlsburn North Wind Farm, but from which the Development will not be visible from. These include large areas of the east, west and north-east of the study area.

6.164 **Figure 6.25c** shows the Development in combination with the ZTV of Earlsburn North Wind Farm. The figure shows that:

- **Earlsburn North (Figure 6.25c):** This paired ZTV indicates that visibility of the consented Earlsburn North wind farm in isolation, shown in blue, is widespread across the north-eastern, eastern and western lower lying areas of the study area, where visibility of the Fintry, Gargunnock and Touch Hills is possible. The introduction of the Development will introduce visibility of wind turbines to a relatively small area within the Forth Valley south-west of Kippen and some contained areas within the Carron Valley to the south-east, as indicated by the areas of green on the ZTV. The areas shown in yellow indicate the areas of the study area where the Development will be seen in combination with the consented Earlsburn North Wind Farm.

Settlements

6.165 Cumulative visual effects from settlements considered within the LVIA are outlined in **Table 6.55: Cumulative Effects from Settlements** below.

Table 6.55: Cumulative Effects from Settlements

Settlement	Description of Cumulative Visual Effects
Port of Menteith	Merkins and Earlsburn North Wind Farms will theoretically be visible from this settlement. The consented Earlsburn North Wind Farm will introduce potential visibility of turbine blades above the skyline of the Gargunnock Hills, therefore the turbines of the Development will not appear as new features in the available views from this settlement and the magnitude of cumulative change is judged to be small, reduced from that identified within the LVIA. Merkins Wind Farm may be visible at a distance from this settlement, but will be largely imperceptible at this distance and will not alter the cumulative assessment. Overall, the cumulative effect of the Development will be **negligible** and therefore not significant.
Aberfoyle	Merkins and Earlsburn North Wind Farms will theoretically be visible from this settlement. It is judged that there will be no further significant effect arising from the proposed wind farm Development as visibility of Merkins Wind Farms is unlikely from this settlement and visibility of Earlsburn North Wind Farm will be screened by local built form, woodland and coniferous forestry plantations.
Callander	Merkins and Earlsburn North Wind Farms will theoretically be visible from this settlement. It is judged that there will be no further significant effect arising from the Development as visibility of Merkins Wind Farms is unlikely from this settlement and visibility of Earlsburn North Wind Farm will be screened by local built form, woodland and coniferous forestry plantations.
Falkirk	A number of cumulative wind farm developments, including Earlsburn north, will be visible from this settlement. It is judged that there will be no further significant effect arising from the Development as visibility of the Development will be in the context of the Earlsburn North Wind Farm alongside the existing pattern of wind energy development within the Lowland Hills north-west of the settlement at a distance of over 24 km.

Viewpoints

6.166 Cumulative visual effects from viewpoints considered within the LVIA are outlined in **Table 6.56: Cumulative Effects from Viewpoints** below.

Table 6.56: Cumulative Effects from Viewpoints

Viewpoint		Description of Cumulative Visual Effects
VP1	**Minor Road nr. Easter Cringate** (see **Figure 6.26a-c**)	The consented Earlsburn North Wind Farm will theoretically be visible in combined views from this viewpoint. No other proposed wind farms will be visible from this location. A number of the consented Earlsburn North turbines will be visible from this viewpoint appearing at a similar scale to those of the Development, with turbine hubs and blades appearing above the skyline between Earlsburn North and the Development. The presence of these additional turbines in combined views will reduce the change in view as a result of the development; therefore the scale of cumulative change is judged to be small. The visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **minor**, and therefore not significant.
VP2	**Sir John de Graham's Castle** (see **Figure 6.27**)	The consented Earlsburn North Wind Farm will theoretically be visible in combined views from this viewpoint. No other proposed wind farms will be visible from this location. The turbines of the consented Earlsburn North Wind Farm are visible on the skyline north of the viewpoint, appearing In combined views, between the operational turbines of Earlsburn and the Development. Earlsburn North will effectively be viewed as an extension to Earlsburn from this viewpoint, with turbines appearing at a similar scale above the skyline of the Gargunnock Hills. The two additional turbine blades of the Development will appear at a similar scale to those of Earlsburn North, but will occupy a small proportion of the skyline in comparison to the consented development. The scale cumulative change is therefore judged to be small, reduced from that identified in the LVIA. The visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **negligible**, and therefore not significant.
VP3	**Carleatheran** (see **Figure 6.28a-c**)	The consented and proposed Earlsburn North, Blantyre Muir and Blantyre Muir Extension, Rhodders, Burnhead, Greengairs East, Greengairs, Bracco and Birnie Hill Wind Farms will theoretically be visible in combined views from this viewpoint. The consented Earlsburn North Wind Farm will appear directly to the south-west, between the viewpoint and the Development in combined views. The turbines will appear perceptibly closer than the turbines of Earlsburn and the Development, breaking the skyline above the Gargunnock Hills. The turbines Craigton and Spittalhill Wind Farm may be viewed as a potential extension to Earlsburn North from this viewpoint and will not introduce development to a new proportion of the view, appearing beyond the consented turbines. The proposed wind farms of Burnhead, Bracco, Greengairs, Greengairs East and Birnie Hill are potentially visible in successive views to the south-east from this viewpoint. Visibility of these additional wind farm developments in the available views to the south is judge to reduce the change in view experienced as a result of the Development. The scale of cumulative change from this viewpoint is judged to be small. The visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **negligible**, and therefore not significant.
VP4	**Meikle Bin** (see **Figure 6.29a-d**)	The consented and proposed Earlsburn North, Blantyre Muir and Blantyre Muir Extension, Rhodders, Burnhead, Greengairs East, Greengairs, Bracco and Birnie Hill Wind Farms will theoretically be visible in combined views from this viewpoint. The consented Earlsburn North Wind Farm will appear to the north of the viewpoint as an extension to the west of Earlsburn Wind Farm. The turbine blades of the Development will appear directly in front of the most westerly Earlsburn North turbines and as such will be viewed as one development in combined views from this viewpoint. A number of additional proposed wind farms will be visible in views south-east from this viewpoint, with several proposals creating a cluster of developments situated to the east and west of the operational Greendykeside Wind Farm. The scale of cumulative change from this viewpoint is judged to be small. The visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **negligible**, and therefore not significant.
VP5	**B822 at Kippen Muir** (see **Figure 6.30a-f**[30])	If constructed the consented wind farm of Earlsburn North and the proposed Rhodders Wind Farm will theoretically be visible from this viewpoint, however visibility of other proposed wind farms will not be possible. Several turbines of the consented Earlsburn North Wind Farm will be visible above the skyline formed by the Gargunnock Hills to the east of the Spout of Ballochleam in combined views from this viewpoint. This consented development will introduce visibility of wind turbines located within the Gargunnock Hills from the Forth Valley to the north, and therefore the introduction of the Development will not introduce new features to the available view, with existing visibility of turbines already possible from a similar geographical extent. The proposed Rhodders Wind Farm will theoretically be visible to the north-west from this viewpoint, however due to the presence of localised screening from deciduous woodland and gorse scrub, no visibility of this proposed wind farm is likely. The scale of cumulative change is therefore judged to be reduced from the LVIA to small. The visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **minor**, and therefore not significant.
VP6	**Tomtain** (see **Figure 6.31a-c**)	The consented and proposed wind farms of Earlsburn North, Burnhead, Greengairs, Greengairs East, Bracco, Birnie Hill and Rhodders will theoretically be visible in combined and successive views from this viewpoint. Earlsburn North Wind Farm will be visible to the west of Earlsburn Wind Farm, appearing as an extension from this viewpoint. The Development will remain visible as a separate wind farm visible across the skyline to the west; therefore it is judged that the change in view identified in the LVIA will not be reduced as a result of introducing Earlsburn North. Burnhead, Bracco, Greengairs, Greengairs East and Birnie Hill will potentially be visible in successive views south-east of this viewpoint. The scale of cumulative change is judged to be small. The visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **minor**, and therefore not significant.
VP7	**B8034 nr. Arndale Park and Gardens** (see **Figure 6.32a-e**[31])	If constructed the consented wind farm of Earlsburn North will theoretically be visible from this viewpoint, however visibility of other proposed wind farms will not be possible. Several turbines of the consented Earlsburn North Wind Farm will be visible above the skyline formed by the Gargunnock Hills to the east of the Spout of Ballochleam in combined views from this viewpoint. The turbines of this consented development will introduce visibility of wind above the southern skyline above the Forth Valley, and therefore the addition of the Development will not introduce new features to the available view. The turbines of the Development will be visible from a similar geographical extent as Earlsburn North and the two developments will be often seen in combination. The scale of cumulative change is therefore judged to be reduced from the LVIA to small. The visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **minor**, and therefore not significant.

[30] An additional photomontage is provided for Viewpoint 5 to illustrate the CLVIA due to the presence of Earlsburn North Wind Farm (consented) close to the site.
[31] An additional photomontage is provided for Viewpoint 7 to illustrate the CLVIA due to the presence of Earlsburn North Wind Farm (consented) close to the site.

Viewpoint		Description of Cumulative Visual Effects
VP8	**A873 nr. Ruskie** (see **Figure 6.33a-e**[32])	The consented and proposed wind farms of Earlsburn North and Merkins will theoretically be visible from this viewpoint. Turbine blades of the consented Earlsburn North Wind Farm will appear above the skyline to the south of the viewpoint and will introduce visibility of wind turbines from the Forth Valley. The addition of the Development will not introduce new features to the available view from this viewpoint; however the turbines will extend visibility of turbines above the skyline to the south of the Forth Valley. From this viewpoint, the Development and Earlsburn North may be viewed as one development. The proposed Merkins Wind Farm will potentially be visible in views south-west across the Forth Valley, with turbines visible to the north of the Kilpatrick Hills. The presence of the Merkins Wind Farm in successive views will increase visibility of wind farm development. Overall the scale of cumulative change is judged to be small. The visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **negligible**, and therefore not significant.
VP9	**Rob Roy Way** (see **Figure 6.34a**)	The consented wind farm of Earlsburn North will theoretically be visible from this viewpoint. Earlsburn North Wind Farm will be visible from this viewpoint, with turbines appearing to the east of the Development in the view, with turbine blades and hubs appearing above the skyline of the Gargunnock Hills at a similar scale to the turbines of the Development. The addition of Earlsburn North Wind Farm will increase the proportion of the skyline affected by turbines, which will reduce the magnitude of change in views as a result of the introduction of Craigton and Spittalhill Wind Farm, the scale of cumulative change is therefore judged to be small. Overall, the visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **negligible**, and therefore not significant.
VP10	**Ben Ledi** (see **Figure 6.35a-b**)	The consented and proposed wind farms of Earlsburn North, Blantyre Muir, Blantyre Muir Extension, Greengairs, Greengairs East, Burnhead, Bracco, Birnie Hill and Merkins will theoretically be visible in combined views from this viewpoint. The introduction of the consented Earlsburn North Wind Farm will appear as a clear extension to Earlsburn Wind Farm from this viewpoint, extending development westwards across the Gargunnock Hills. A number of other Developments will potentially be visible from this viewpoint, including Merkins Wind Farm to the south within the Kilpatrick Hills, and Burnhead, Bracco, Greengairs, Greengairs East and Birnie Hill to the south-east beyond the Kilsyth Hills. The presence of Earlsburn North Wind Farm, when introducing the Development will lead to the Development subsequently appearing as part of a larger amalgamation of wind turbines within the Gargunnock and Fintry Hills, resulting in a reduced magnitude of cumulative change. The introduction of the Development alongside Earlsburn North will therefore lead to a reduction on the magnitude of change identified in the LVIA. The scale of cumulative change is judged to be small. Overall, the visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **negligible**, and therefore not significant.
VP11	**Shieldhill**	Cumulative visual effects are not assessed from this viewpoint.
VP12	**Ben Cleuch** (see **Figure 6.36a**)	The consented and proposed wind farms of Earlsburn North, Todd Hill Farm, Blantyre Muir and Blantyre Muir Extension, Burnfoot Hill Extension, Frandy Hill, Greengairs, Greengairs East, Burnhead, Bracco and Birnie Hill will theoretically be visible in combined and successive views from this viewpoint. The consented Earlsburn North Wind Farm will be visible from this viewpoint, with turbines appearing to the north of the Earlsburn Wind Farm, which will be viewed as a consistent extension to this operational scheme. The turbines of the Development will appear directly behind the turbines of Earlsburn North in views from this viewpoint and will not extend visibility of turbines across the Gargunnock and Fintry Hills. A number of other consented schemes will be visible in successive views from this viewpoint, with the turbines of the Tod Hill Farm Community Wind Co-operative visible to the south-west located in the lowland Carse surrounding the Forth estuary. A number of proposed wind farms may be visible to the south-west of the viewpoint located on the north-eastern edge of Greater Glasgow. The Development will appear as one amalgamation of turbines alongside Earlsburn North and Earlsburn, and therefore the change in view is judged to be reduced from that identified in the LVIA. The scale of cumulative change is therefore judged to be small. Overall, the visual effect of the Development in the LVIA will be reduced, and the cumulative visual effect will be **negligible**, and therefore not significant.
VP13	**Ben Vorlich**	Cumulative visual effects are not assessed from this viewpoint.
VP14	**Ben Lomond**	Cumulative visual effects are not assessed from this viewpoint.
VP15	**Meall an-t Seallaidh**	Cumulative visual effects are not assessed from this viewpoint.

Sequential Cumulative Effects

6.167 Sequential cumulative effects are considered for the routes across the Study Area that were assessed in the LVIA, these are outlined in **Table 6.57 Cumulative Effects from Routes** below.

Table 6.57: Cumulative Effects from Routes

Route	Description of Sequential Cumulative Visual Effects
A84 Stirling to Lochearnhead	Sequential visibility of the consented Earlsburn North Wind Farm to the east of the Development Site and the proposed Merkins Wind Farm, appearing to the south-west of the study area, will theoretically be possible from this route. Visibility of turbine blades of Earlsburn North may be possible from sections of this route between Doune and Callander; however the Development will remain screened by Lees Hill and Ling Hill. Combined visibility of the Development alongside Earlsburn North may be possible from a limited section of the route through Callander, however visibility of turbine blades of both developments are likely to be screened by intervening tree cover and built form within Callander. Merkins Wind Farm may be visible to the south-west from limited sections of this route. The scale of cumulative change is judged to be small. Overall, the sequential cumulative visual effect of the Development will be **negligible** for the route as whole, and therefore not significant.
A81 Glasgow to Callander	Sequential visibility of the consented Earlsburn North Wind Farm to the east of the Development Site and the proposed Merkins Wind Farm, appearing to the south-west of the study area, will theoretically be possible from this route. The consented Earlsburn North Wind Farm will potentially be visible from short sections of this route between Braeval and Loch Rusky, introducing visibility of wind turbines above the skyline of the Gargunnock Hills. Merkins Wind Farm may be visible to the south-west from limited sections of this route. The proposed Development will appear alongside the turbines of Earlsburn North from similar sections of the route, and will therefore not introduce new features to the available views from the route. The scale of cumulative change is therefore judged to be small. Overall, the sequential cumulative visual effect of the Development will be **negligible** for the route as whole, and therefore not significant.

[32] An additional photomontage is provided for Viewpoint 8 to illustrate the CLVIA due to the presence of Earlsburn North Wind Farm (consented) close to the site.

Route	Description of Sequential Cumulative Visual Effects
A821 Aberfoyle to Callander	Sequential cumulative visual effects are not assessed from this route.
A873 Braeval to Blair Drummond	Sequential visibility of the consented Earlsburn North Wind Farm to the east of the Development Site and the proposed Merkins Wind Farm, appearing to the south-west of the study area, will theoretically be possible from this route. The consented Earlsburn North Wind Farm will introduce visibility of turbine blades above the skyline of the Gargunnock Hills escarpment in views from this route. The addition of the Development alongside Earlsburn North will not introduce visibility of new features to views of the Gargunnock Hills from this route and visibility of the Development will affect a limited geographical extent. Merkins Wind Farm may be visible in the distance to the south-west of the Fintry Hills escarpment from sections of this route, therefore the scale of cumulative change is judged to be small, further reduced from that identified in the LVIA. Overall, the sequential cumulative visual effect of the Development will be **negligible** for the route as whole, and therefore not significant.
B818 Denny to Killearn	The consented Earlsburn North Wind Farm will theoretically be visible in sequential views from this route. Earlsburn North Wind Farm will not extend visibility of wind turbines to additional sections of this route and therefore will not alter the assessment in the LVIA. The scale of cumulative change is therefore judged to be small, further reduced from the assessment in the LVIA. Overall, the sequential cumulative visual effect of the Development will be **negligible** for the route as whole, and therefore not significant.
B822 Callander to Lennoxtown	The consented Earlsburn North Wind Farm will theoretically be visible in sequential views from this route. Earlsburn North Wind Farm will introduce visibility of turbines to a similar section of the route across Kippen Muir, north of the Gargunnock and Fintry Hills and therefore will reduce the change in views identified in the LVIA, with the turbines of the Development appearing alongside the consented turbines of Earlsburn North Wind Farm. The scale of cumulative change is therefore judged to be small, reduced from the LVIA. Overall, the sequential cumulative visual effect of the Development will be **negligible** for the route as whole, and therefore not significant.
B8034 Port of Menteith to Arnprior	Sequential visibility of the consented Earlsburn North Wind Farm and proposed Merkins Wind Farm will theoretically be possible from this route. The consented turbines of Earlsburn North Wind Farm will be visible above the skyline of the Gargunnock Hills escarpment, with blades tips breaking the elevated skyline in views south from this route. Visibility of the consented turbines will be possible from a similar geographical extent to those of the proposed Development, and the two wind farms will often appear in combination. The proposed Merkins Wind Farm will be visible in limited glimpsed views when travelling south along this route. The scale of cumulative change is therefore judged to be small. Overall, the sequential cumulative visual effect of the Development will be **negligible** for the route as whole, and therefore not significant.
Minor road Todholes to Borestone	The consented Earlsburn North Wind Farm will theoretically be visible in views from this route. Earlsburn North Wind Farm will increase the number of turbines visible from this route when travelling east and west, with turbines appearing directly adjacent to the proposed Development and visibility of the consented turbines will be possible from a similar geographical extent to those of the proposed Development, where the wind farms will often appear in combination. The scale of cumulative change is judged to be small. Overall, the sequential cumulative visual effect of the Development will be **negligible** for the route as whole, and therefore not significant.
Minor road Craigend to Mains of Boquihan	The consented Earlsburn North Wind Farm will theoretically be visible in views from this route. The introduction of visibility of Earlsburn North will not introduce visibility of the developments in combination, however successive views of turbine blades above the skyline will exist, and the turbine blades may be viewed as one development when travelling east along this route. The assessment of the Development from the LVIA will not alter, therefore the scale change is judged to be small locally and largely imperceptible for the route as a whole. Overall, the sequential cumulative visual effect of the Development will be minor locally and **negligible** for the route as whole, and therefore not significant.
Rob Roy Way	Sequential cumulative visual effects are not assessed from this route.
NCN 7 Inverness to Glasgow via Pitlochry	Sequential cumulative visual effects are not assessed from this route.

Summary of Cumulative Relationships

6.168 The closest wind farms to the proposed Development are Earlsburn, Earlsburn North and Craigengelt Wind Farms. The higher areas of the Fintry Hills are located to the west of the Development and the Campsie Fells and Kilsyth Hills are located to the south and south-east respectively, which limit cumulative visibility with other existing, consented and proposed wind farms. Earlsburn North Wind Farm is the closest wind farm to the east, northeast and has an largely overlapping ZTV with the Proposed Wind Farm Development. In general, the proposed wind farm Development will be seen as a extension to the existing turbines of Earlsburn and Earlsburn North Wind Farm set to the west on the slightly lower eastern edge of the Fintry Hills in the hanging valley south of the Spout of Ballochleam, but following the same trend of wind energy development seen across the lowland hills of the study area, with wind farms located in Lowland Hills and Igneous Hills LCTs. The Development will nevertheless introduce additional visibility of wind turbines from areas to the north of the Development Site where views of other existing, consented and proposed wind farms are not possible. The Development will be visible from these locations above the skyline through the Spout of Ballochleam to the north of the Development Site.

Mitigation of Cumulative Effects

6.169 Measures to reduce cumulative effects upon the landscape, views and visual amenity are embedded into the wind farm layout. The visual relationship of Craigton and Spittalhill Wind Farm with Earlsburn and Earlsburn North was a key consideration in the development of the design strategy set out in **Chapter 3: site Selection and Design Strategy**.

Residual Cumulative Effects

6.170 Since all mitigation measures are embedded within the scheme design, the residual effects will remain as set out above.

Implications for Designated Landscapes

6.171 Designated landscapes across the study area are set out in **Appendix 6.1: Landscape Baseline**. This section describes the implications of the proposed wind farm Development for designated areas in the Study Area. Designated Landscapes considered are listed below and are shown on **Figure 6.5** and **Figure 6.5a**, and observations are drawn from the assessment sections for landscape, visual and cumulative effects above.

- Loch Lomond and The Trossachs National Park;
- Trossachs NSA;

- Fintry, Gargunnock and Touch Hills Area of Great Landscape Value (AGLV)[33] or Southern Hills Local Landscape Area (LLA5) (Stirling);
- Western Ochils AGLV[34] or Western Ochils Local Landscape Area (LLA3) (Stirling);
- Campsie Fells Regional Scenic Area (RSA) (Glasgow and Clyde Valley Joint Structure Plan);
- Kilsyth Hills RSA (Kilsyth Local Plan)

Loch Lomond and The Trossachs National Park

6.172 The Loch Lomond and The Trossachs National Park[35] boundary is located approximately 13 km to the north-west of the proposed Development Site, the southern boundary of the National Park is defined by the forested lowland hills which form the transitional landscape between the low lying strath of the Forth Valley and the upland hills within the interior of the National Park to the north, north-west.

6.173 The Special Qualities associated with the National Park are outlined in the Technical Appendix to the National Park Plan (2006)[xlix] and the Scottish Natural Heritage (SNH) Commissioned Report, No.376.[l] The National Park is defined into ten different areas, each with specific Special Qualities. The Special Landscape Qualities associated with the National Park are outlined in the 2006 report and include:

- *A world-renowned landscape famed for its rural beauty;*
- *Wild and rugged highlands contrasting with pastoral lowlands;*
- *Water in its many forms;*
- *The rich variety of woodlands;*
- *Settlements nestled within a vast natural backdrop;*
- *Famous through-routes;*
- *Tranquillity;* and
- *The easily accessible landscape splendour.*

6.174 Long distance views from the upland areas are characteristic of the National Park, with views from hill summits including Ben Lomond, Ben Venue, Ben Ledi and Ben Vorlich, and other smaller surrounding summits to the surrounding settled straths forming a key characteristic of the National Park. Existing operational wind farms are visible in panoramic views from hill summits and elevated slopes within the National Park, including Earlsburn and Craigengelt to the south, south-east, Braes of Doune and Burnfoot Hill to the east, and single wind turbines within the Forth Valley to the south-east. Other wind farms are visible in views west, north and north-east from the National Park, beyond those which are considered here.

6.175 The proposed wind farm Development will be visible from limited upland summits located within the Loch Lomond and The Trossachs National Park, however the Development will be introduced close to Earlsburn and Craigengelt Wind Farms on the Fintry, Gargunnock and Touch Hills which lie at a distance across the Carse of Forth. The Development will be seen as a small number of turbines, in front of Earlsburn Wind Farm in views from Ben Lomond, but as a separate group in views from Ben Vorlich due to the direction of view. The Development will introduce additional turbines to an area of hills where there are existing turbines, at a distance from the National Park boundary. While some views from the National Park will have the development as a feature of the wider landscape, the introduction of the development will not affect the reasons for which this area was given National Park status. The scale of change in landscape character of the National Park is judged to be imperceptible.

6.176 Landscape effects on the National Park have not been assessed in this chapter (assessment of landscape effects on LCTs), as the nearest LCTs of the National Park lie at approximately 15 km from the proposed Development Site.

6.177 Other areas within the National Park were identified as having limited visibility at long distances, and were unlikely to have significant landscape effects (see **Table 6.8: Landscape Character Types considered as Landscape Receptors**). There will therefore be no significant effects on the landscape character of areas of the National Park. Significant landscape effects were identified for an area within 8 km of the proposed wind farm Development Site, of Flat Valley Floor LCT, which forms a small part of the wider setting of the National Park.

6.178 In the visual assessment, the ZTV (**Figure 6.5a**) indicates there will be limited visibility of the proposed wind farm development from within the National Park, however judgements regarding visual effects include:

- Port of Menteith – minor (on the National Park boundary);
- Aberfoyle – negligible;
- Callander – negligible;
- A84 – negligible;
- A81 – minor;
- A821 – negligible (theoretical visibility limited to a short section over the Dukes Pass);
- Rob Roy Way – minor locally, negligible for the route as a whole;
- NCN 7 – negligible;
- Viewpoint 9: Roby Roy Way – minor;
- Viewpoint 10: Ben Ledi – minor;
- Viewpoint 13: Ben Vorlich – minor;
- Viewpoint 14: Ben Lomond – negligible; and
- Viewpoint 15: Meall an-t Seallaidh –minor.

6.179 The presence of an additional group of turbines in views from the National Park will not introduce visibility of wind farm development from substantial new areas of the National Park, with the Development appearing in the context of the existing Earlsburn and Craigengelt Wind Farms, and consistent with the existing pattern of operational and consented wind farm development within the lowland hills visible from the National Park. It is judged that the introduction of the proposed wind farm Development will not significantly affect the Special Qualities of the National Park. In addition, it is judged that although there will be no significant effects on the landscape and views in the vicinity of the Development Site; this will not amount to a significant effect on the setting of the National Park.

6.180 In a cumulative situation in which the consented and application stage wind farms listed in **Table 6.52: Wind Farms considered in the Cumulative Assessment** are also present in the landscape, there will be views from the hill summits at the southern edge and interior of the National Park, of a series of wind farms within the Fintry, Gargunnock and Touch Hills to the south. The Development will be seen as one of this series of wind farms to the west of Earlsburn, Earlsburn North and Craigengelt Wind Farms. It is judged that the cumulative effects will not affect the reasons for which the area is designated.

Trossachs NSA

6.181 This National Scenic Area is located within the Loch Lomond and The Trossachs National Park, approximately 15km north-west of the site at its nearest point. The Special Qualities of the Trossachs NSA are outlined within the SNH Commissioned Report, No. 376 (Scottish Natural Heritage and Loch Lomond and The Trossachs National Park Authority, 2010) and include:

- *A traditional 'Gateway to the Highlands';*
- *A harmonious concentration of lochs, woods and hills;*
- *Rugged Ben Venue, the centrepiece of the Trossachs;*
- *Loch Katrine, the 'Queen of the Trossachs';*
- *A landscape of beautiful lochs;*
- *The romance of the Trossachs;*
- *The resort of Aberfoyle and the Duke's Pass;*
- *The curious wooded hillocks of Aberfoyle;*

[33] GIS Data for the Southern Hills LLA not available, but AGLV area correlates with the proposed LLA
[34] GIS Data for the Western Ochils LLA not available, but AGLV area correlates with the proposed LLA
[35] The Trossachs and Breadalbane AGLV (Stirling) lies almost solely within the National Park boundary, therefore implications for this locally designated landscape have not be considered separately.

- *The gateway town of Callander;* and
- *The tranquil Lake of Menteith.*

6.182 Landscape effects on the National Scenic Area have not been assessed in this chapter (assessment of landscape effects on LCTs), as the nearest LCTs which cover the NSA lie at approximately 15km from the site. There will therefore be no significant effects on the landscape character of areas of the NSA.

6.183 In the visual assessment, the ZTV (**Figure 6.5a**) indicates there will be limited visibility of the proposed wind farm development from within the NSA, however judgements regarding visual effects include:

- A821 – negligible (theoretical visibility limited to a short section over the Dukes Pass);
- Rob Roy Way – minor locally, negligible for the route as a whole;
- NCN 7 – negligible; and
- Viewpoint 9: Roby Roy Way – minor (located just outside the NSA).

6.184 Long distance views from hill summits, including Ben Venue (727 m AOD), within the NSA are characteristic, however views are limited from lower summits and slopes due to the presence of coniferous forestry. Existing operational wind farms are visible in panoramic views from hill summits and elevated slopes within the NSA, including Earlsburn and Craigengelt to the south, south-east, Braes of Doune and Burnfoot Hill to the east, and single wind turbines within the Forth Valley to the south-east. Other wind farms are visible in long distance views from the NSA, beyond those which are considered here.

6.185 The Development will be seen as an additional small group of turbines on the distant horizon of the Fintry, Gargunnock and Touch Hills, from limited high slopes and hill tops within the NSA. The NSA is approximately 15 km away at its closest point. Given the distance to the Development, which will be seen in the context of Earlsburn and Craigengelt Wind Farms, the scale of change is judged to be imperceptible.

6.186 In a cumulative situation in which the consented and application stage wind farms listed in **Table 6.52: Wind Farms considered in the Cumulative Assessment** are also present in the landscape, there will be views from hill summits located within the NSA, included Ben Venue of a series of wind farms within the Fintry, Gargunnock and Touch Hills to the south. The Development will be seen as one of this series of wind farms to the west of Earlsburn, Earlsburn North and Craigengelt Wind Farms, and will be indistinguishable from the turbines of Earlsburn and Earlsburn North in views from the NSA. It is judged that the cumulative effects will not affect the reasons for which the area is designated.

Fintry, Gargunnock and Touch Hills AGLV (Stirling)

6.187 The Fintry, Gargunnock and Touch Hills AGLV is a designated local landscape, which covers the lowland hills area surrounding the Carron Valley, including the site. The AGLV extends westwards to the highest point of the Fintry Hills and south-west to incorporate the northern slopes of the Campsie Fells. To the east the AGLV extends to the edge of the Touch Hills, south-west of Stirling and south-east to the Kilsyth Hills north of Greater Glasgow. The existing AGLV designation is currently under review as part of the pending Stirling Local Development Plan. It is proposed the Fintry, Gargunnock and Touch Hills AGLV will be replaced by the Southern Hills Local Landscape Area (LLA) when adopted. The key characteristics of the Southern Hills LLA (LLA5) are outlined in the Proposed Supplementary Guidance SG27: Protecting Special Landscapes (Stirling Council, 2012) and include:

6.188 ***"Key landscape and visual characteristics - Hills Generally:***

- *"Dramatic western and northern hill edges play an important role in the overall landscape composition of Strath Blane and the Forth Valley west of Stirling. With an extensive visual envelope and large viewing populations these edges and skylines have a high level of visual sensitivity;*
- *Lacking exposed rock cliffs the eastern profile of the hill mass is less dramatic, topped by a long ridge and the gentle roll of land around Craigengelt. Wind turbines are now a prominent feature on parts of the skyline. The hill land then rolls down into transitional farmed and wooded slopes. This skyline and landscape is important in views from Stirling (including principal apartments and viewpoints in the Castle and the Bannockburn Monument) and makes an important contribution to the setting of Stirling in views from the north and east of the city;*
- *There are pockets throughout the upland parts of the LLA where lack of maintenance of landscape features or discordant developments have resulted in localised areas of landscape degradation or erosion of character – for example stone walls falling into disrepair, over mature shelterbelts not being replanted and small areas of derelict or brownfield land etc. The scale of these problems is somewhat greater than in any other LLA in the plan area, even allowing for the fact that this is also the single largest LLA."*

"Key landscape and visual characteristics - Fintry, Gargunnock and Touch Hills:

- *"Distinctive horizontally banded lava flows, eroded into stepped cliffs, top the western and northern hill faces shelving gently downwards towards the east. Beneath the rock banding the hill slopes fall away precipitously and are largely open, except at Scout Head where the shallower gradients are well wooded.*
- *Wind energy developments have had an effect on the skyline of the northern hill edge in some longer-distance views - although not, as yet, from most of the carse or to an overwhelming extent.*
- *Wind turbines have had more impact on the interior hill-plateau, introducing new, large-scale and dynamic man made features in to the landscape and increasing complexity. Wind turbines appear on the eastern skyline of the hills and are particularly visible at Craigengelt. The presence of the turbines adds another dimension to the landscape - although distinctions between the existing developments and between development and the remaining open landscape are delicately balanced.*
- *Away from the turbines, the interior of the hills is still largely open with little subdivision by roads or fences. Small reservoirs, scattered forestry blocks and occasional shelterbelts offer local visual foci and scale reference points.*
- *Outward views predominate, although in some areas the eye is now drawn rather to moving turbine blades.*
- *The Fintry Hills form a key and dramatic element in the setting of Fintry village".*

6.189 Special Qualities for the Southern Hills LLA (LLA5) are outlined within the emerging *Proposed Supplementary Guidance SG27: Protecting Special Landscapes* (Stirling Council, 2012) and include:

*"**Diversity of landscape experience:***

- *"Contrast between large scale, simple open hill land and smaller scale, diverse, farmed, wooded and settled hill fringes – with areas such as Kippen Muir and the Carron Valley being transitional between the two.*
- *Contrast between expansive views from hill summits and edges with enclosure and introspection within the valleys and parts of the hill fringes.*
- *Large-scale forestry management and wind energy developments have created localised areas of marked change in landscape character and experience."*

"Striking views:

- *Panoramic outward views from the hill edges and summits and Kippen Muir.*
- *Locally important and dramatic views descending into the Endrick Valley from Kippen Muir and the Campsie Fells; to and from Lewis Hill/Sauchie Craigs and passing close to the Earlsburn and Craigengelt Wind Farms.*
- *Views towards the LLA are equally important - from surrounding lowland and settlements, key viewpoints in and around Stirling and the edges of the national park. The skylines and outer faces of the hills help to define Strath Blane, the Carse of Stirling and contribute to the setting of Stirling itself."*

6.190 Existing operational wind farms are present within the landscape of the AGLV/LLA, including Earlsburn and Craigengelt in the Gargunnock and Touch Hills to the east of the site, and the consented wind farm of Earlsburn North to the north-east of the site. The wind farms of Braes of Doune and Burnfoot Hill are visible in views to the north-east, and single wind turbines are visible within the Forth Valley to the north. Other wind farms are visible in views west, south and south-east from elevated areas and hill summits on the southern edge of the AGLV/LLA, beyond those which are considered here.

6.191 Effects on the landscape of the AGLV/LLA have been assessed in this chapter (assessment of landscape effects on LCTs), and includes major, therefore significant landscape effects on the Lowland Hills LCT for the local area of the site and moderate, therefore significant landscape effects, identified for the Fintry, Gargunnock and Touch Hills area of the Lowland Hills LCT that extends across lowland hills to the east

and west of the site and the Flat Valley Floor LCT which lies to the north of the lowland hills within the Forth Valley. Minor and therefore not significant landscape effects are identified for the Lowland River Valley LCT within the Carron Valley to the south of the site, where visibility of existing wind farm development is already a key feature of the LCT in this locality.

6.192 The Development will introduce a small group of turbines near to, but distinct from the Earlsburn Wind Farm. It is judged that direct effects on the site itself will be significant (as outlined above). Indirect effects relate to the introduction of the Development as a third group of turbines within this AGLV/LLA, although it will not be visible from all areas of the AGLV/LLA. The visibility of the Development will be restricted to within the Backside Burn valley, and hill tops. Given the presence of wind farms in this AGLV/LLA, the scale of change resulting from the Development is judged to be large for the area of the AGLV/LLA immediately around the site and the Backside Burn valley, but small for the AGLV/LLA as a whole, it is not considered that the Development will affect the Special Qualities for its designation.

6.193 The Development will add to the existing pattern of wind farm development within the AGLV/LLA and extend development west across the Fintry Hills. Visibility of the Development in isolation will be limited to small areas of the AGLV/LLA in the Gargunnock Hills to the north-east and the west facing slopes of Cairnoch Hills in the Carron Valley to the south-east. In the visual assessment, the ZTV (**Figure 6.5a**) indicates there will be limited visibility of the Development from within the AGLV/LLA, however judgements regarding visual effects include:

- B818 Denny to Killearn – negligible;
- B822 Callander to Lennoxtown – minor locally, negligible for the route as a whole;
- Minor road Todholes to Borestone – minor locally, negligible for the route as a whole;
- Viewpoint 1: Minor Road nr. Easter Cringate – moderate, therefore significant visual effect;
- Viewpoint 2: Sir John de Graham's Castle – negligible;
- Viewpoint 3: Carleatheran – moderate, therefore significant visual effect;
- Viewpoint 4: Meikle Bin – minor;
- Viewpoint 5: Kippen Muir - moderate, therefore significant visual effect;
- Viewpoint 15: Meall an-t Seallaidh – minor.

6.194 In a cumulative situation in which the consented and application stage wind farms listed in **Table 6.52: Wind Farms considered in the Cumulative Assessment** are also present in the landscape, there will be views of the Development from across the AGLV/LLA, however this visibility will almost always be in the context of the existing wind farm developments present in the landscape, where the turbines of the Development will appear as an extension to the Earlsburn and Earlsburn North Wind Farms located within the AGLV/LLA to the east, north-east. The Development will introduce turbines to the western side of the Backside Burn valley, but the presence of turbines of Earlsburn North Wind Farm on the eastern side of the valley will mean that turbines are not new features to this valley. Although the additional turbines of the Development will further dominate the Backside Burn valley, the rest of the designated area, which stretches from Strathblane to Stirling, will not be greatly affected, given the proximity of these schemes to each other and the limited visibility of the development.

6.195 In views towards the AGLV/LLA from the surrounding area, the Development will be seen as one of this series of wind farms located within the Fintry, Gargunnock and Touch Hills, and will be indistinguishable from the turbines of Earlsburn and Earlsburn North. Visibility of the Development in this cumulative situation is not likely to introduce visibility of turbines to new areas of the AGLV/LLA. Overall, the scale of cumulative change is judged to be medium for the area of the AGLV/LLA immediately around the site and the Backside Burn valley, but small for the AGLV/LLA as a whole. It is judged that the cumulative effects will not affect the special qualities for which the area is designated.

Western Ochils AGLV (Stirling)

6.196 The existing AGLV designation is currently under review as part of the pending Stirling Local Development Plan. It is proposed the Fintry, Gargunnock and Touch Hills AGLV will be replaced by the Western Ochils Local Landscape Area (LLA) when adopted. The key characteristics of the LLA relevant to this review are outlined in the *Proposed Supplementary Guidance SG27: Protecting Special Landscapes* (Stirling Council, 2012) and have been considered as part of this review.

6.197 No wind farms are located within this AGLV, but Burnfoot and Greenknowes Wind Farms are located nearby to the east, and view outwards to the west include Braes of Doune Wind Farm, West Cambushinnie and Balafark Farm turbines and Earlsburn and Craigengelt Wind Farms on the Gargunnock Hills.

6.198 The Development will be visible from the high tops within this AGLV only, and will be seen as turbine blades and a limited number of hubs, visible on the distant Gargunnock Hills beyond Earlsburn Wind Farm. The introduction of the Development will not affect the character or reasons for which this area is valued. The scale of change is judged to be imperceptible.

6.199 In a cumulative situation in which the consented and application stage wind farms listed in **Table 6.52: Wind Farms considered in the Cumulative Assessment** are also present in the landscape, there will be views of the Development from across the AGLV, however this visibility will almost always be in the context of the existing wind farm developments present in the landscape, where the turbines of the Development will appear as an extension to the Earlsburn and Earlsburn North Wind Farms. Additional groups of turbines near Burnfoot Hill will also be visible from this RSA, extended with the presence Rhodders and Frandy Hill Wind Farms in this cumulative scenario. It is judged that the cumulative effects will not affect the reasons for which the area is designated, as the scale of cumulative change is judged to be imperceptible. It is judged that the cumulative effects will not affect the reasons for which the area is designated.

Campsie Fells RSA (Glasgow and Clyde Valley Joint Structure Plan)

6.200 No wind farms are located within this AGLV, but Earlsburn and Craigengelt Wind Farms are located nearby to the north, on the Gargunnock Hills and Touch Hills. Visibility of wind farm developments is possible in views south from this RSA, including the Cathkin Braes turbine on the southern edge of Greater Glasgow and other wind farm developments out with those considered within the 35 km study area for this Development.

6.201 Effects on the landscape of the AGLV have been assessed in this chapter (assessment of landscape effects on LCTs), and includes negligible, therefore not significant landscape effects on the Rugged Hills LCT for the local area of the study area south-west of the Carron Valley Reservoir, where dense coniferous forestry covers the north facing flanks of the hills and existing wind farm developments are a key feature of views north from this locality of the LCT.

6.202 The Development will be visible from limited areas of this RSA, such as north facing slopes and hill summits, including Meikle Hill, Lecket Hill and Holehead on the south-western edge of the Carron Valley. In the visual assessment, the ZTV (**Figure 6.5a**) indicates there will be limited visibility of the proposed wind farm development from within the RSA, however judgements regarding visual effects include:

- B822 Callander to Lennoxtown – minor locally, negligible for the route as a whole; and
- Viewpoint 4: Meikle Bin – minor (viewpoint located just outside the RSA).

6.203 In a cumulative situation in which the consented and application stage wind farms listed in **Table 6.52: Wind Farms considered in the Cumulative Assessment** are also present in the landscape, there will be views of the Development from across the AGLV, however this visibility will almost always be in the context of the existing wind farm developments present in the landscape, where the turbines of the Development will appear as an extension to the Earlsburn and Earlsburn North Wind Farms. The scale of cumulative change to the RSA is judged to be imperceptible. It is judged that the cumulative effects will not affect the reasons for which the area is designated.

Kilsyth Hills RSA (Kilsyth Local Plan)

6.204 No wind farms lie within this RSA, but Craigengelt Wind Farm is close to the boundary to the north, and Earlsburn is further north-west. Views from the high tops also include more distant schemes.

6.205 Effects on the landscape of the AGLV have been assessed in this chapter (assessment of landscape effects on LCTs), and includes negligible, therefore not significant landscape effects on the Rugged Hills LCT for the local area of the study area south of the Carron Valley Reservoir, where dense coniferous forestry covers the north facing flanks of the hills and existing wind farm developments are a key feature of views north from this locality of the LCT.

6.206 The Development will be visible from limited areas of this RSA, such as north facing slopes and hill summits, including Tomtain and Garrel Hill on the southern edge of the Carron Valley. In the visual

assessment, the ZTV (**Figure 6.5a**) indicates there will be limited visibility of the proposed wind farm development from within the RSA, however judgements regarding visual effects include:

- B818 Denny to Killearn – negligible; and
- Viewpoint 6: Tomtain – moderate, therefore significant visual effect.

6.207 The Development will increase the presence of turbines on the hills to the north of the RSA, and may be noticeably on lower ground than the existing turbines, but will not affect the reasons for which this area is valued. The scale of change to this RSA is judged to be small.

6.208 In a cumulative situation in which the consented and application stage wind farms listed in **Table 6.52: Wind Farms considered in the Cumulative Assessment** are also present in the landscape, there will be views of the Development from across the AGLV, however this visibility will almost always be in the context of the existing wind farm developments present in the landscape, where the turbines of the Development will appear as an extension to the Earlsburn and Earlsburn North Wind Farms. The scale of cumulative change to the RSA is judged to be imperceptible. It is judged that the cumulative effects will not affect the reasons for which the area is designated.

Summary of Significant Effects

6.209 Significant effects are anticipated on the site during construction (**major**), though these will be temporary and will cease following completion of the restoration works.

6.210 The LVIA considered the operational effects of the Development against the existing baseline which includes wind farms which are currently operational and under construction as listed in **Table 6.7: Wind Farms Operational and Under Construction**. The CLVIA considered the operational effects of the Development against the LVIA baseline of wind farms included in **Table 6.7: Wind Farms Operational and Under Construction**, plus the addition of all proposed developments included within **Table 6.52: Wind Farms considered in the Cumulative Assessment**.

6.211 A number of significant effects have been identified for landscape and visual receptors close to the site. These arise from the introduction of the Development into the Lowland Hills LCT and the visual relationship it will have with other wind farms located within the Fintry, Gargunnock and Touch Hills. In addition, some of the views close to the site include valued views from locally designated landscapes, including Viewpoint 1: Minor Road nr Easter Cringate, Viewpoint 2: Sir John de Graham's Castle, Viewpoint 3: Carleatheran, Viewpoint 4: Meikle Hill and Viewpoint 5: B822 at Kippen Muir located within the Fintry Gargunnock and Touch Hills AGLV[36] and Viewpoint 6: Tomtain located within the Kilsyth Hills RSA.

6.212 Significant landscape effects are predicted to the landscape resource of the site itself (**major**), and to the landscape character of the Lowland Hills LCT (**moderate**), specifically the Fintry, Gargunnock and Touch Hills area, which is also covered by the Fintry, Gargunnock and Touch Hills AGLV local designated landscape. The Carse West of Stirling area of the Flat Valley Floor LCT will also experience a significant (**moderate**) landscape effect. No significant effects on other LCTs are anticipated.

6.213 Significant visual effects on views are predicted at 5 of the 15 representative viewpoints, all of which are located within approximately 10km of the Development, and all of which represent high or medium sensitivity receptors. Significant (**moderate**) visual effects are predicted on views experienced from each of these viewpoints.

6.214 Significant visual effects are not predicted on views from settlements, users of local roads around the site and on walkers and cyclists using the Rob Roy Way and NCN 7.

6.215 In the cumulative assessment, the closest wind farms to the Development are Earlsburn and Earlsburn North Wind Farms. The Development will follow the same development trend as is seen across the study area, with wind farms located in Lowland Hills and Igneous Hills LCTs. Significant (**moderate**) cumulative effects are identified for the Fintry, Gargunnock and Touch Hills Landscape Character Area of the Lowland Hills LCT in the assessment.

6.216 There will be cumulative landscape and visual effects arising from the Development should all of the wind farms which are considered in the cumulative assessment be present. There are varying degrees of certainty associated with likelihood of these other projects being present in the landscape, depending upon the status of each. These effects will be largely the same as for the LVIA, and limited additional significant cumulative effects are identified. The main focus of the cumulative assessment is on describing the potential visual relationships between the closest wind farms to the Development, and how the designs of each relate to one another, as seen from the various viewpoints and routes which are assessed.

Summary of Implications for Designated Landscapes

Nationally Designated Landscapes

6.217 The assessment does not identify any significant effects for landscape or visual receptors that may affect the special qualities of nationally designated areas, including the Loch Lomond and the Trossachs National Park and the Trossachs National Scenic Area.

Locally Designated Landscapes

6.218 Notwithstanding the significant (**moderate**) landscape identified for the Fintry, Gargunnock and Touch Hills area of the Lowland Hills LCT, and the significant (**moderate**) visual effects identified from Viewpoint 1: Minor Road nr Easter Cringate, Viewpoint 2: Sir John de Graham's Castle, Viewpoint 3: Carleatheran, Viewpoint 4: Meikle Hill and Viewpoint 5: B822 at Kippen Muir within the Fintry, Gargunnock and Touch Hills AGLV, it is not considered that reasons for designation and special qualities of this locally designated landscape (emerging Southern Hills LLA[37]) will be affected as a result of the Development.

6.219 Despite the significant (**moderate**) visual effect identified at Viewpoint 6: Tomtain, located within the Kilsyth RSA, it is not judged that the reasons for designation and the special qualities of this locally designated landscape will be affected.

Statement of Significance

6.220 For most commercial wind farms in the UK, having some residual significant landscape and visual effects is unavoidable. A number of significant effects have been identified in relation to landscape and visual receptors, generally in close proximity to the site. Based on the assessed locations and receptors, significant effects will be contained within 15km of the Development, of which significant landscape effects are judged to be contained within 10km and significant visual effects within 15km of the Development. Mitigation measures for landscape and visual effects are those embedded into the design of the scheme, and those relating to the restoration of the site during and after construction. The effects identified are therefore residual effects.

6.221 No monitoring is proposed for landscape and visual effects.

Summary of Effects

6.222 **Table 6.58: Summary of Residual Effects** below summarises sets out the residual landscape and visual effects predicted for the Development, after mitigation is complete (mitigation is largely through design as outlined in **Chapter 3: Site Selection and Design Strategy**).

Table 6.58: Summary of Residual Effects

Resource	Residual Effects LVIA	Residual Effects CLVIA
Construction		
Landscape and Visual effects of Construction on the site	**Major** during construction, Negligible post construction	-

[36] It is proposed the Fintry, Gargunnock and Touch Hills AGLV will be replaced by the Southern Hills Local Landscape Area (LLA) when adopted.

[37] Special Qualities for the Southern Hills LLA (LLA5) are outlined within the emerging Proposed Supplementary Guidance SG27: Protecting Special Landscapes (Stirling Council, 2012).

Resource	Residual Effects LVIA	Residual Effects CLVIA
Landscape and Visual effects of Decommissioning on the site	Minor during decommissioning, Negligible post decommissioning	-
Operation – Landscape Character		
Effects - Landscape of the Site		
Landscape and Visual effects of Operation on the site	**Major**	**Major**
Effects - Landscape Character Types		
Lowland Hills (Central Region LCA: 10 Fintry, Gargunnock and Touch Hills)	**Moderate**	**Moderate**
Lowland Hills (Central Region LCA: 11, Campsie Fells)	Minor	Negligible
Lowland Plateaux (Central Region LCA: 18 Kippen Muir)	Minor	Negligible
Lowland River Valleys (Central Region LCA: 28, Upper Carron)	Minor	Negligible
20 Rugged Moorland Hills (Glasgow and the Clyde Valley LCA)	Negligible	Negligible
Flat Valley Floor (Stirling SPG: L2, Carse West of Stirling)	**Moderate**	Minor
Flat Valley Floor (Stirling SPG: L3 Flanders Moss West)	Minor	Negligible
L6, Rolling Valley Farmland – Dyke Head	Negligible	Negligible
L14, Farmed Valley or Hill Fringe – Forth/Teith Valley Fringe	Negligible	Negligible
Operation – Visual Receptors		
Visual Effects - Settlements		
Port of Menteith	Minor	Negligible
Aberfoyle	Negligible	-
Callander	Negligible	-
Falkirk	Negligible	-
Visual Effects - Routes		
A84 Stirling to Lochearnhead	Negligible	Negligible
A81 Glasgow to Callander	Minor	Negligible
A821 Aberfoyle to Callander	Negligible	-

Resource		Residual Effects LVIA	Residual Effects CLVIA
A873 Braeval to Blair Drummond		Minor locally, Negligible for the route as a whole	Negligible
B818 Denny to Killearn		Negligible	Negligible
B822 Callander to Lennoxtown		Minor locally, Negligible for the route as a whole	Negligible
B8034 Port of Menteith to Arnprior		Minor locally, Negligible for the route as a whole	Negligible
Minor road Todholes to Borestone		Minor locally, Negligible for the route as a whole	Negligible
Minor road Craigend to Mains of Boquihan		Minor locally, Negligible for the route as a whole	Minor locally, Negligible for the route as a whole
Rob Roy Way		Minor locally, Negligible for the route as a whole	-
NCN 7 Inverness to Glasgow via Pitlochry		Negligible	-
Visual Effects - Viewpoints			
VP1	Minor Road nr. Easter Cringate	**Moderate**	Minor
VP2	Sir John de Graham's Castle	Negligible	Negligible
VP3	Carleatheran	**Moderate**	Negligible
VP4	Meikle Bin	Minor	Negligible
VP5	B822 at Kippen Muir	**Moderate**	Minor
VP6	Tomtain	**Moderate**	Minor
VP7	B8034 nr. Arndale Park and Gardens	**Moderate**	Minor
VP8	A873 nr. Ruskie	Minor	Negligible
VP9	Rob Roy Way	Minor	Negligible
VP10	Ben Ledi	Minor	Negligible
VP11	Shieldhill	Negligible	-
VP12	Ben Cleuch	Minor	Negligible
VP13	Ben Vorlich	Minor	-

Resource		Residual Effects LVIA	Residual Effects CLVIA
VP14	Ben Lomond	Negligible	-
VP15	Meall an-t Seallaidh	Minor	-

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7 Noise

Introduction

7.1 This chapter considers the potential noise effects of the proposed Craigton and Spittalhill Wind Farm on the surrounding area, and in particular nearby residential properties. The noise assessment was undertaken by Hayes McKenzie Partnership Ltd.

7.2 The assessment has been carried out according to the recommendations of ETSU-R-97, *The Assessment and Rating of Noise from Wind Farms*, as referred to within web based guidance provided by the Scottish Government, and the best practice guidance contained with the Institute of Acoustics (IoA) document published in May 2013, *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*.

7.3 Predicted turbine noise levels, based on the use of a candidate turbine with an 80m hub height, have been compared with the noise limits set out within ETSU-R-97.

7.4 Due to the location of the Craigton and Spittalhill Wind Farm, and the consequent low levels of predicted turbine noise at the nearest residential properties, it is considered that, in accordance with ETSU-R-97, baseline noise measurements are not required for the purposes of this assessment. As such, predicted noise levels associated with the operation of the wind farm have been compared with the simplified noise limit proposed within ETSU-R-97.

7.5 A cumulative noise assessment has also been carried out that includes the consented Earlsburn North development, the operational Fintry Community and Earlsburn wind farms, and the Balafark Farm Wind Turbine.

7.6 An assessment has also been made of noise arising from the operation of plant and machinery in connection with the construction of the wind farm. The assessment has been carried out following the principles described in BS 5228: *Code of Practice for Noise and Vibration Control on Construction and Open Sites*.

Construction and Decommissioning Noise

7.7 Noise during the construction period would arise from the construction of the wind turbine bases, the erection of the turbines, the excavation of trenches for cables, the construction of associated hard standings, access tracks, the construction compound and switch gear building. Noise from vehicles on local roads and access tracks would also arise from the delivery of the turbine components, construction materials and staff commuting.

7.8 During decommissioning, noise would occur from plant used in the removal of the turbines; demolition of the switch gear building; breaking and crushing of the exposed part of the concrete turbine bases; and removal of the access tracks as required.

Operational Noise Sources

7.9 Noise is generated by wind turbines as they rotate to generate power. This generally occurs above the 'cut-in' wind speed and below the 'cut-out' wind speed. Below the cut-in wind speed there is insufficient strength in the wind to generate efficiently and above the cut-out wind speed the turbine is automatically shut down to prevent any malfunctions from occurring. The cut-in wind speed at turbine hub height is normally between 2.5 and 5 metres per second (m/s) and the cut-out wind speed is normally around 25 m/s.

7.10 The principal sources of noise are from the blades rotating in the air (aerodynamic noise) and from internal machinery, normally the gearbox and, to a lesser extent, the generator (mechanical noise). The blades are carefully designed to minimize noise whilst optimising power transfer from the wind.

Noise in the Environment

7.11 Although operational noise levels at nearby properties are fairly low, wind farms are often situated in rural environments where there are few other sources of noise. At higher wind speeds, turbine noise is more likely to be masked by wind induced noise effects, particularly that of wind in trees and foliage. At lower wind speeds or in particularly sheltered locations, the wind induced background noise may not be sufficient to mask any noise from the turbines. However, under these conditions, potential turbine noise levels may be so low as to generate very little impact.

7.12 Noise levels are normally expressed in decibels (dB). Noise in the environment is measured using the dB(A) scale which includes a correction for the response of the human ear to noises with different frequency content. It is generally accepted that, for noise of a similar character, a change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving and doubling the loudness of a sound. **Table 7.1** shows the general context of noise in the environment.

Table 7.1: Examples of Indicative Noise Levels[1]

Source/Activity	Indicative noise level dB (A)
Unsilenced pneumatic drill (at 7m distance)	95
Heavy diesel lorry (40km/h at 7m distance)	83
Modern twin-engine jet (at take-off at 152m distance)	81
Passenger car (60 km/h at 7m distance)	70
Office environment	60
Ordinary conversation	50
Quiet bedroom	35

Planning and Technical Guidance

The Control of Noise (Codes of Practice for Construction and Open Sites) (Scotland) Order 2002

7.13 Although The Control of Noise (*Codes of Practice for Construction and Open Sites* (Scotland) Order 2002 still refers to BS 5228 in the 1997 version, the *Technical Advice Note Assessment of Noise* states that '*under Environmental Impact Assessment and for planning purposes, i.e. not in regard to the Control of Pollution Act 1974, the 2009 version of BS 5228 is applicable'*.

BS 5228: Code of Practice for Noise and Vibration Control on Construction and Open Sites

7.14 The 1997 version of BS5228 was updated in early 2009. This provides example criteria for the assessment of the significance of construction noise effects and a method for the prediction of noise levels from construction activities. Two example methods are provided for assessing significance.

7.15 The first is based on the use of criteria defined in Department of the Environment Advisory Leaflet (AL) 72, *Noise Control On Building Sites* (DoE 1969) which sets a fixed limit of 70 dB(A) in rural suburban and urban areas away from main roads and traffic. Noise levels are generally taken as façade L_{Aeq} values with free-field levels taken to be 3 dB lower giving an equivalent noise criterion of 67 dB L_{Aeq}.

7.16 The second is based on noise change, with a 5 dB increase in overall noise considered to be significant. However, when existing noise levels are low, such as at this site, and continue for more than one month, minimum criteria are applicable. These are 45, 55 and 65 dB L_{Aeq}, for night-time (2300-0700), evening and weekends, and daytime (0700-1900) including Saturdays (0700-1300) respectively.

7.17 It is proposed that construction noise will be assessed against this daytime noise limit of 65 dB L_{Aeq}, as this is when construction noise will be generated.

[1] Planning and Noise, Planning Advice Note 1/2011, Scottish Government, 2011

Planning Advice Note PAN1/2011, Planning and Noise

7.18 PAN1/2011 identifies two sources of noise from wind turbines; mechanical noise and aerodynamic noise. It states that 'good acoustical design and siting of turbines is essential to minimise the potential to generate noise'. It refers to the '*web based planning advice'* on renewables technologies for onshore wind turbines.

Web Based Planning Advice, Onshore Wind Turbines

7.19 The web based planning advice on onshore wind turbines[i] re-iterates the sources of noise as "*the mechanical noise produced by the gearbox, generator and other parts of the drive train; and the aerodynamic noise produced by the passage of the blades through the air*" and that "*there has been significant reduction in the mechanical noise generated by wind turbines through improved turbine design". It states that "the Report,* 'The Assessment and Rating of Noise from Wind Farms' *(Final Report, Sept 1996, DTI), (ETSU-R-97), describes a framework for the measurement of wind farm noise, which should be followed by applicants and consultees, and used by planning authorities to asses and rate noise from wind energy developments, until such time as an update is available*". It notes that "*this gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable burdens on wind farm developers, and suggests appropriate noise conditions*".

ETSU-R-97, The Assessment and Rating of Noise from Wind Farms

7.20 ETSU-R-97, *The Assessment and Rating of Noise from Wind Farms*[ii], presents the recommendations of the Working Group on Noise from Wind Turbines, set up in 1993 by the Department of Trade and Industry as a result of difficulties experienced in applying the noise guidelines existing at the time to wind farm noise assessments. The group comprised independent experts on wind turbine noise, wind farm developers, DTI personnel and local authority Environmental Health Officers. In September 1996 the Working Group published its findings by way of report ETSU-R-97. This document describes a framework for the measurement of wind farm noise and contains suggested noise limits, which were derived with reference to existing standards and guidance relating to noise emission from various sources.

7.21 ETSU-R-97 recommends that, although noise limits should be set relative to existing background, and should reflect the variation of both turbine and background noise with wind speed, this can imply very low noise limits in particularly quiet areas, in which case "*it is not necessary to use a margin above background in such low-noise environments. This would be unduly restrictive on developments which are recognised as having wider global benefits. Such low limits are, in any event, not necessary in order to offer a reasonable degree of protection to the wind farm neighbour*".

7.22 For day-time periods, the noise limit is 35-40 dB(A) or 5 dB(A) above the '*quiet day-time hours*' prevailing background noise, whichever is the greater. The actual value within the 35-40 dB(A) range depends on the number of dwellings in the vicinity; the effect of the limit on the number of kWh generated; and the duration of the level of exposure.

7.23 For night-time periods the noise limit is 43 dB(A) or 5 dB(A) above the prevailing night-time hours background noise, whichever is the greater. The 43 dB(A) lower limit is based on a sleep disturbance criteria of 35 dB(A) with an allowance of 10 dB(A) for attenuation through an open window and 2 dB(A) subtracted to account for the use of L_{A90} rather the L_{Aeq}.

7.24 Where the occupier of a property has some financial involvement with the wind farm, the day and night-time lower noise limits are increased to 45 dB(A) and consideration can be given to increasing the permissible margin above background. These limits are applicable up to a wind speed of 12 m/s measured at 10 m height on the site.

7.25 Quiet day-time periods are defined as evenings from 1800-2300 plus Saturday afternoons from 1300-1800 and Sundays from 0700-1800. Night-time is defined as 2300-0700. The prevailing background noise level is set by calculation of a best fit curve through values of background noise plotted against wind speed as measured during the appropriate time period with background noise measured in terms of $L_{A90,t}$. The $L_{A90,t}$ is the noise level which is exceeded for 90% of the measurement period 't'. It is recommended that at least 1 week of measurements are required.

7.26 A simplified approach may also be applied whereby wind turbine noise can be limited to 35 dB L_{A90} at wind speeds of up to a standardised 10 metre height wind speed of 10 m/s. This removes the need for extensive background noise measurements for smaller or more remote schemes.

7.27 It is stated that the $L_{A90,10min}$ noise descriptor should be adopted for both background and wind farm noise levels and that, for the wind farm noise, this is likely to be between 1.5 and 2.5 dB less than the LAeq measured over the same period. The $L_{Aeq,t}$ is the equivalent continuous 'A' weighted sound pressure level occurring over the measurement period t. It is often used as a description of the average noise level. Use of the L_{A90} descriptor for wind farm noise allows reliable measurements to be made without corruption from relatively loud, transitory noise events from other sources.

7.28 ETSU-R-97 also specifies that a penalty should be added to the predicted noise levels, where any tonal component is present. The level of this penalty is described and is related to the level by which any tonal components exceed audibility.

7.29 With regard to multiple windfarms in a given area ETSU-R-97 specifies that the absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area contributing to the noise received at the properties in question. Existing wind farms should therefore be included in cumulative predictions of noise level for proposed wind turbines and not considered as part of the prevailing background noise.

Institute of Acoustics Good Practice Guide (IoA GPG)

7.30 In May 2013, the Institute of Acoustics published *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*[2] (IoA GPG). The publication of the IoA GPG followed a review of current practice[3] carried out for the Department of Energy and Climate Change (DECC) and an IoA discussion document[4] which preceded the IoA GPG.

7.31 The GPG includes sections on Context; Background Data Collection; Data Analysis and Noise Limit Derivation; Noise Predictions; Cumulative Issues; Reporting and other matters including Planning Conditions, Amplitude Modulation, Post Completion Measurements and Supplementary Guidance Notes. The Context section states that the guide '*presents current good practice in the application of the ETSU-R-97 assessment methodology for all wind turbine development above 50 kW, reflecting the original principles within ETSU-R-97, and the results of research carried out and experience gained since ETSU-R-97 was published'*. It adds that '*the noise limits in ETSU-R-97 have not been examined as these are a matter for Government'*.

7.32 As well as expanding on and, in some areas, clarifying issues which are already referred to in ETSU-R-97 additional guidance is provided on noise prediction and a preferred methodology for dealing with wind shear. These are referred to in the relevant sections below.

7.33 This good practice guide was subsequently endorsed by the Scottish Government on 29th May 2013[5].

Further Technical Considerations

Blade Swish (Amplitude Modulation of Aerodynamic Noise)

7.34 The noise limits prescribed in ETSU-R-97 take into account the fact that all wind turbines exhibit the character of noise described as blade swish, to a certain extent. DTI Report W/45/00656/00/00*, The Measurement of Low Frequency Noise at Three UK Windfarms*[iii], concluded that "*the common cause of complaints associated with noise at all three wind farms is not associated with low frequency noise, but is the audible modulation of the aerodynamic noise, especially at night".* It suggests that "*it may be appropriate to re-visit the issue of aerodynamic modulation (AM) and the means by which it should be assessed*".

7.35 As a result, Salford University carried out a study in 2007, jointly commissioned by Defra, BERR (formerly the DTI) and the CLG, to investigate AM of wind turbine noise. The results were published by way of report NANR233, *Research into Aerodynamic Modulation of Wind Turbine Noise*[iv], which concluded that AM was only considered to be a factor at 4, and at a possible further 8, of the 133 sites (all the sites in the UK operational at the time of the study) considered. At these 4 sites, it was considered that

[2] Institute of Acoustics, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, May 2013
[3] Report on DECC Research Contract 01.08.09.01/492A (Analysis), Analysis of How Noise Impacts are Considered in the Determination of Wind Farm Planning Applications, Department of Energy and Climate Change, 2011
[4] Discussion Document on "A Good Practice Guide to the Application of ETSU-R-97 for Wind Turbine Noise Assessment, Institute of Acoustics, July 2012
[5] http://www.ioa.org.uk/pdf/scottish-government-endorsement-of-ioa-gpg.pdf

conditions associated with AM might occur between about 7 and 15% of the time. In a statement[v] accompanying the published report, the Government states that it "*continues to support the approach set out in Planning Policy Statement (PPS) 22 – Renewable Energy. This approach for local planning authorities to ensure that renewable energy developments have been located and designed in such a way to minimise increases in ambient noise levels, through the use of the 1997 report by ETSU to assess and rate noise from wind energy developments"*.

7.36 The IoA GPG states that current practice is to not assign planning conditions to cover AM as the ETSU-R-97 noise limits include a provision for a certain amount of blade swish and levels higher that those envisaged by ETSU-R-97 remain unlikely. Additionally there is no agreed method for assessing AM or rating its level in terms of a dose response relationship.

Infra-sound

7.37 Infra-sound is noise occurring at frequencies below that at which sound is normally audible, i.e. at less than about 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. In this frequency range, for sound to be perceptible, it has to be at a very high amplitude and it is generally considered that when such sounds are perceptible then they can cause considerable annoyance.

7.38 Wind turbines have been cited by some as producers of infra-sound. This has, however, been due to the high levels of such noise, as well as audible low frequency thumping noise, occurring on older 'downwind' turbines of which many were installed in the USA prior to the large scale take up of wind power production in the UK. Downwind turbines are configured with the blades downwind of the tower such that the blades pass through the wake left in the wind stream by the tower resulting in a regular audible thump, with infra-sonic components, each time a blade passes the tower. Virtually all modern larger turbines are of the upwind design; that is with the blades upwind of the tower, such that this effect is eliminated.

7.39 The DTI Low Frequency Noise Study referred to in Paragraph 7.34 concluded that "*infrasound noise emissions from wind turbines are significantly below the recognised threshold of perception for acoustic energy within this frequency range. Even assuming that the most sensitive members of the population have a hearing threshold which is 12 dB lower than the median hearing threshold, measured infrasound levels are well below this criterion*". It goes on to state that, based on information from the World Health Organisation, "*there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects*" and that "*it may therefore be concluded that infrasound associated with modern wind turbines is not a source which may be injurious to the health of a wind farm neighbour*".

Low Frequency Noise

7.40 Noise from modern wind turbines is essentially broad band in nature in that it contains similar amounts of noise energy in all frequency bands from low to high frequency. As distance from a wind farm site increases the noise level decreases as a result of the spreading out of the sound energy and also due to air absorption which increases with increasing frequency. This means that, although the energy across the whole frequency range is reduced, higher frequencies are reduced more than lower frequencies with the effect that as distance from the site increases the ratio of low to high frequencies also increases. This effect may be observed with road traffic noise or natural sources, such as the sea, where higher frequency components are diminished relative to lower frequency components at long distances. At such distances, however, the overall noise level is so low, such that any bias in the frequency spectrum is insignificant.

Wind Shear

7.41 Wind shear, or more specifically vertical wind shear, is the rate at which wind speed increases with height above ground level. This has particular significance to wind turbine noise assessment where background noise measurements are referenced to measurements of wind speed at 10 metres height, which is suggested as appropriate by ETSU-R-97, but which is not representative of wind at hub-height which is what affects the noise generated by the turbines.

7.42 The preferred method for taking wind shear into account in noise assessments is by referencing background noise measurements to hub height wind speed. Hub height wind speed may be determined by using a tall mast or remote sensing technology (e.g. LiDAR or SoDAR) which takes wind speed measurements at either hub height, or a number of heights below hub height, in order to calculate the hub height wind speed during the background noise survey period, as described in the IoA GPG referred to in Paragraphs 7.30 to 7.33 (above). The hub height wind speeds are then converted to '*standardised 10m wind speed*' assuming standardised conditions as used by turbine manufacturers when specifying turbine sound power levels. It should be noted, however, that background noise measurements are not required and have not been carried out due to the low predicted noise levels of the Craigton and Spittalhill Wind Farm.

Assessment Methodology

Consultation

7.43 The noise assessment methodology was agreed with the Environmental Health department of Stirling Council. A table of consultation responses is included below:

Table 7.2: Consultation Responses

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Stirling Council	Formal Scoping Consultation The Council were advised of the noise assessment methodology, including the provision for carrying out a cumulative noise impact assessment.	The Council stated that the latest version of the Scottish Government's web based planning guidance should be used. The Council re-iterated that the noise assessment should ensure that cumulative noise levels are below the relevant ETSU-R-97 noise limits. Where there is existing background noise data for receptor locations which have been used in previous Environmental Statements for existing or proposed windfarms it is preferable that this is used, rather than carrying out repeat background noise measurements.	The latest web based planning guidance has been used in this assessment. Cumulative operational noise levels have been predicted, and compared with the noise limits contained within ETSU-R-97. Cumulative operational noise levels have been compared with noise limits derived for the neighbouring Carron Valley submitted scheme (which was refused planning permission).
Stirling Council	Email correspondence describing proposed noise assessment methodology: It will be ensured that predicted noise levels from the Craigton and Spittalhill site are below the ETSU-R-97 simplified noise limit of 35dB LA90 (for wind speeds up to 10 m/s)	The EHO stated that it is preferable not to re-measure background noise data at Todholes as the data has been accepted from the Carron Valley ES. The EHO wanted more information as to the nearby residential properties that would be included in the noise	Noise limits derived from background noise measurements at Todholes from the Carron Valley ES have been used in the cumulative noise assessment. Details, including the grid coordinates, of the nearest residential properties to be included

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
	at all nearby residential properties, such that measurement of background levels at nearby properties is not required. It will be ensured that cumulative noise levels at the nearest residential properties to the Craigton and Spittalhill Wind Farm are either below 38 dB LA90, for standardised 10m-height wind speeds up to 12 m/s, or that Craigton and Spittalhill Wind Farm adds less than 1dB to the cumulative total from the other consented sites.	assessment. The EHO specifically requested that the 2 properties known as Easter Cringate were included in the predictions[6].	in the noise assessment were sent to the EHO. Two additional properties known as Easter Cringate were included in the prediction results.

Field Survey

7.44 Due to the location of the scheme, with the resultant operational noise levels from the wind farm expected to be below the ETSU-R-97 simplified noise limit of 35dB L_{A90}, background noise measurements were not undertaken.

7.45 In addition, discussions with the Environmental Health Department of Stirling Council (detailed at **Table 7.2**), showed that it was preferable not to re-measure background noise levels at location where measurements have already be undertaken and the results accepted for other submitted ESs.

Wind Farm Layout Design Considerations

7.46 There was no requirement to alter the scheme layout in respect to noise effects due to the distance to the nearest properties.

Effects Assessment

Construction Effects

Predicted Effects

7.47 At this site, due to the distance of residential properties to the construction site (construction activities will take place at distances greater than 1 km from any residential property) an indicative assessment of noise has been carried out for the works closest to a noise receptor i.e. the main site access track. To provide a 'worst case' scenario, predictions have been carried out for the noise effect of the track construction nearest to Todholes (approximately 1110 m from the nearest point of track construction) using the methods prescribed in BS5228:2009. It is assumed that all construction works will occur during daytime hours (0700-1900) including Saturdays (0700-1300).

[6] These properties are labelled Easter Clingate, and Easter Cringate Cottage on the 1:25k Ordinance Survey map

7.48 The plant assumed for track construction is shown at **Table 7.3** with assumed octave band sound power levels for each item provided at **Table 7.4**. For the calculations, 50% soft ground attenuation has been used throughout with no topographical barrier attenuation. In practice, it is likely that at least some of the plant will be screened from view, but the calculation represents a worst case.

Table 7.3: Assumed Plant Location and Number

Location / Activity	Plant List	No. of Items
Quasi-Static Track Construction	Dozer	1
	Wheeled Backhoe Loader	1
	Dump Truck	2
	Tracked Excavator	2

Table 7.4: Assumed Plant Noise Levels

Plant List	Table Ref	Ref No.	Octave Band Sound Pressure Levels at 10 m, Hz								A-weighted sound pressure level, dB L_{Aeq}, at 10m
			63	125	250	500	1k	2k	4k	8k	
Dozer	C.5	12	80	78	71	70	74	68	65	61	77
Wheeled Backhoe	C.2	8	74	66	64	64	63	60	59	50	68
Dump Truck	C.9	16	86	89	88	88	86	83	76	70	91
Tracked Excavator	C.5	35	82	72	71	69	69	70	61	54	74

7.49 This results in a worst-case predicted sound pressure level resulting from track construction at Todholes of 45 dB L_{Aeq} assuming that all plant are 1100m from the property and operating for 100% for the working day. It should be noted that average noise levels over the construction period will be significantly lower. All other works on the site would have a significantly lower noise effect due to the separation distances involved, and therefore would be well below the 65 dB L_{Aeq} criteria**.**

7.50 Numbers of HGVs, aggregate lorries and general construction related traffic expected per day have been predicted and are discussed at **Chapter 12: Access, Traffic and Transport**. The factored 2012 traffic flows have been used to forecast percentage increases in traffic flow during the construction phase. Although staff traffic will substantially increase the traffic flow (on small local roads) at peak hours, it is only the increase in HGVs that will be likely to increase the road traffic noise over the entire daytime period. The most significant increase in HGV traffic will be on the B818 where the percentage of HGVs is predicted to increase from 10% to 11% during the most intensive month of construction (note that this increase of 1% relates only to the proportion of HGVs on the B818; a different calculation is used in **Chapter 12: Access, Traffic and Transport**, where total percentage increase is calculated for all vehicles, including HGVs. The predicted increases to traffic movement would cause a negligible increase to existing traffic noise.

7.51 Access to the site takes construction traffic on the existing access track past the residential property of Todholes. There will be road traffic noise at this property generated by passing construction vehicles (including site vehicles and HGV deliveries). Assuming that 4 HGVs and 15 cars pass Todholes per hour at a distance of 20m during the most intensive phase of construction, the resultant noise level is 58 dB L_{Aeq}[7], which is below the adopted 65 dB criterion.

[7] Based on equation F.6 from BS5228-1:2009, assuming a speed of 30 km/h, and that the sound power level for an HGV of 109.5 dB and a sound power level for a car of 104.5 dB

7.52 In addition to construction noise from traffic and access road construction, there will also be blasting associated with the proposed borrow pit in order to obtain materials for the construction of turbine bases and the onsite access road. This type of noise does not typically fall within the assessment of normal construction noise because of the extremely high amplitude and impulsive nature of the waveform. It is very likely that blasting noise could be heard at nearby residential locations but a construction noise assessment would average noise levels across the day and is therefore not applicable to use for the assessment of blasting noise effects. The frequency, duration and noise levels from blasting all depend very much on the type of rock, depth of charge and surrounding ground conditions onsite, together with the number of turbines and length of access track to be built.

Proposed Mitigation

7.53 Contractors would be required to assess noise effects during the construction phase and prepare a noise control plan as part of the Environmental Management Plan and Construction Method Statements associated with such activities. A similar document would also be produced for decommissioning. As a minimum, the noise control plan during construction would include:

- procedures for ensuring compliance with statutory or other identified noise control limits;
- procedures for minimising noise from construction related traffic on the existing road network;
- procedures for ensuring that all works are carried out in accordance with the principle of 'Best Practicable Means' as defined in the Control of Pollution Act 1974;
- general induction training for site operatives, and specific training for staff having responsibility for particular aspects of controlling noise from the site;
- a noise monitoring/auditing programme; and
- liaison with the local authority and the community.

7.54 The construction and decommissioning works on site would be carried out in accordance with:

- relevant EU Directives and UK Statutory Instruments that limit noise emissions from a variety of construction plant;
- the guidance set out in BS5228: 2009; and
- Section 61 of the Control of Pollution Act 1974 and Section 80 of the Environmental Protection Act.

Operational Effects

Predicted Effects

7.55 Noise predictions were carried out using International Standard ISO 9613, *Acoustics – Attenuation of Sound During Propagation Outdoors* (ISO 9613-2). The propagation model described in Part 2 of this standard provides for the prediction of sound pressure levels based on either short-term downwind (i.e. worst case) conditions or long-term overall averages. Only the downwind condition has been considered in this assessment; that is, for wind blowing from the proposed turbines towards the nearby houses. When the wind is blowing in the opposite direction noise levels will be significantly lower, especially if there is any shielding between the site and the houses. The details of the noise predictions are described in **Appendix 7.1**.

7.56 Predictions have been based on the candidate Vestas V90 3MW turbine, with the warranted sound power levels shown at **Table 7.5** below, and a ground factor of G=0.5. The IoA GPG states that where warranted noise data is used it must be ensured that there is a suitable margin between the results of test measurements and the warranted sound power level. It is likely that warranted noise levels will be in the region of 1-2 dB higher than the results of test measurements, but as a worst case 2 dB has been added to the warranted noise levels to allow for uncertainty in the source data. The is in line with Hayes McKenzie's recommendations presented at **Appendix 7.2** whereby 2 dB is added to the warranted noise level to ensure that suitable uncertainty is accounted for in the turbine source data.

7.57 Where source noise levels include an allowance for uncertainty the results based on these levels and a ground factor of G=0.5 the resultant noise levels can be considered absolute worst case, and that in practice operational noise levels are likely to be lower than presented here.

Table 7.5: V90 Turbine Warranted Sound Power Levels

Standardised 10 metre height Wind Speed (m/s)	Sound Power Level (dB L_{Wd})
4	99.9
5	102.9
6	106.2
7	108.1
8	109.0
9	108.9
10	107.6
11	107.2
12	107.3

7.58 The results are plotted in the form of noise contours shown on **Figure 7.1**, for a standardised 10 metre height wind speeds of 8 m/s. This is the wind speed for which the highest sound power level occurs up to 12 m/s as can be seen at **Table 7.5**.

7.59 The predicted turbine noise L_{Aeq} has been adjusted by subtracting 2 dB to give the equivalent L_{A90} as discussed at paragraph 7.27.

7.60 The results of the noise predictions for Craigton and Spittalhill Wind Farm are also shown in **Table 7.6** below for the nearest residential properties to the site, for a standardised 10m-height wind speed of 8m/s. There are two properties referred to as Easter Cringate raised by the EHO that are also included in the table below.

Table 7.6: Results of Operational Noise Predictions (for standardised 10m-height wind speed of 8 m/s)

ID	Prediction Location	Grid Reference	Predicted Noise Level (dB L_{A90})
1	Todholes	NS 67288 86095	32.0
2	Property adjacent to Gartcarron Holiday Cottage	NS 67020 85949	31.7
3	Gartcarron Holiday Cottage	NS 66974 85992	31.9
4	Gartcarron WTW Cottage	NS 66799 86045	32.2
5	Spittalhill Cottage	NS 66615 86430	34.1
6	Spittalhill	NS 64701 86192	30.7
7	Mains of Glinn	NS 63419 90972	28.5
8	Easter Glinns	NS 64969 91483	30.5
9	Ballochleam	NS 65662 92351	28.5

ID	Prediction Location	Grid Reference	Predicted Noise Level (dB L_{A90})
10	Easter Cringate[8]	NS 70493 86893	26.5
11	Easter Cringate[9]	NS 71743 87544	24.2

7.61 The results of the operational noise predictions shown at **Figure 7.1** and **Table 7.6** show that the predicted noise levels at all residential properties are below the ETSU-R-97 simplified noise limit of 35dB L_{A90} as discussed at **Table 7.2**. There are 7 properties where predicted noise levels are greater than 30 dB L_{A90} where cumulative noise predictions are required according to the assessment methodology agreed with Stirling Council.

Proposed Mitigation

7.62 No mitigation is proposed as the ETSU-R-97 simplified noise limits are met at all residential properties surrounding the Craigton and Spittalhill Wind Farm for all wind speed and direction conditions.

Cumulative Effects

7.63 This section considers the cumulative effect of the Craigton and Spittalhill Wind Farm operating simultaneously with the following nearby consented and operational schemes as shown on **Figure 7.2**:

- Earlsburn North (consented);
- Fintry Community Wind Farm (operational) ;
- Earlsburn Wind Farm (operational);
- Balafark Farm (operational);
- Craigengelt (operational).

Predicted Cumulative Effects

7.64 Cumulative noise predictions have been carried out as for Craigton and Spittalhill Wind Farm in isolation, using the methodology presented at **Appendix 7.1**. It is not possible to obtain the warranted noise data for the nearby operational and consented sites due to commercial confidentiality reasons; therefore the declared apparent sound power level has been calculated in line with Hayes McKenzie's recommendations presented at **Appendix 7.2**. The sound power levels used for the neighbouring schemes are shown at

7.65 **Table** 7.7 with the octave band data presented at **Appendix 7.1**. Where noise data was not available at high or low wind speeds, as a worst case, the sound power level reached has been extended to the lower or higher wind speeds and marked with an asterisk (*), to enable an assessment over the full range of wind speeds from 3 – 12 m/s.

Table 7.7: Turbine Source Sound Power Level

Standardised 10 metre height Wind Speed (m/s)	Sound Power Level (dB L_{Wd})			
	Earlsburn, Fintry Community Turbine	Earlsburn North, Craigengelt	Balafark Farm	Craigton and Spittalhill
	Nordex N80	Nordex N90 NS	Endurance E-3120	Vestas V90 3MW
3	95.6	106.2*	90.2	99.9*
4	99.6	106.2*	90.4	99.9
5	102.1	106.2*	90.7	102.9
6	104.1	106.2*	91.2	106.2
7	104.8	106.2	92.1	108.1
8	105.3	108.0	93.7	109.0
9	105.8	108.8	95.5	108.9
10	106.1	109.0	97.4	107.6
11	106.1	108.8	98.5	107.2
12	106.1	108.8*	98.0	107.3

7.66 A contour plot has been produced that show the worst case predicted cumulative noise levels, for a standardised 10 m height wind speed of 8 m/s (highest noise level up to 10 m/s for Craigton and Spittalhill Wind Farm) for Craigton and Spittalhill Wind Farm acting together with all nearby operational and consented wind farm sites (**Figure 7.2**).

7.67 The results of the cumulative noise predictions for Craigton and Spittalhill Wind Farm and the surrounding sites are shown at **Table 7.8** below for the nearest residential properties to the site. It should be noted that although it was agreed that a cumulative noise assessment was only required for properties where predicted noise levels for Craigton and Spittalhill alone are above 30 dB L_{A90}, results have been provided for all 11 nearby residential properties detailed in **Table 7.6** above. The results show the predicted noise levels for standardised 10m-height wind speeds of 8 and 10 m/s, and are presented for these two wind speeds because the Vestas V90 reaches its highest sound power level at 8 m/s whereas the Nordex N80 and N90 HS turbines reach their highest sound power level at 10 m/s. It should be noted that these results represent downwind noise propagation from all turbines to each property simultaneously, which clearly cannot occur in practice, and that in practice cumulative noise levels are expected to be lower.

Table 7.8: Results of Operational Noise Predictions for Cumulative sites including Consented and Operational Wind Farms

ID	Prediction Location	Wind Speed	Total Cumulative Predicted Noise Level (dB L_{A90})	Cumulative Predicted Noise Level excluding Craigton and Spittalhill (dB L_{A90})	Craigton and Spittalhill; additional[10] (dB)
1	Todholes	8	35.6	33.1	2.5
		10	35.6	34.0	1.6
2	Property adjacent to Gartcarron Holiday Cottage	8	35.0	32.3	2.7
		10	35.0	33.2	1.8

[8] Labelled Easter Clingate on the 1:25k OS map
[9] Labelled Easter Cringate Cottage on the 1:25k OS map
[10] It should be noted that the difference is calculated prior to rounding to 1 significant figure.

ID	Prediction Location	Wind Speed	Total Cumulative Predicted Noise Level (dB L_{A90})	Cumulative Predicted Noise Level excluding Craigton and Spittalhill (dB L_{A90})	Craigton and Spittalhill; additional[10] (dB)
3	Gartcarron Holiday Cottage	8	35.1	32.3	2.8
		10	35.1	33.2	1.9
4	Gartcarron WTW Cottage	8	35.2	32.2	3.0
		10	35.1	33.0	2.0
5	Spittalhill Cottage	8	36.5	32.8	3.7
		10	36.2	33.6	2.6
6	Spittalhill	8	32.8	28.7	4.1
		10	32.4	29.6	2.9
7	Mains of Glinn	8	31.3	28.1	3.2
		10	31.2	29.1	2.2
8	Easter Glinns	8	34.1	31.6	2.5
		10	34.2	32.5	1.6
9	Ballochleam	8	33.0	31.2	1.9
		10	33.3	32.1	1.2
10	Easter Cringate	8	39.5	39.2	0.2
		10	40.3	40.1	0.1
11	Easter Cringate	8	41.2	41.1	0.1
		10	42.1	42.1	0.1

7.68 The results of the cumulative noise predictions presented at **Table 7.8** show that either cumulative noise levels are below 38 dB L_{A90} or that Craigton and Spittalhill Wind Farm adds less than 1 dB to the overall cumulative noise levels. **Table 7.8** shows that there are two residential locations where predicted cumulative noise levels are above 38 dB L_{A90} (the adopted cumulative noise limit discussed at detailed at **Table 7.2)**, but that, at these properties it can be seen that Craigton and Spittalhill Wind Farm does not add materially (i.e. adds less than 1 dB) to the total cumulative noise level.

7.69 As noted at paragraph 7.67 the results represent downwind noise propagation from all turbines to each property simultaneously, which clearly cannot occur in practice, and that in practice cumulative noise levels are expected to be lower. Additionally, it should be noted that where predicted noise levels are based on declared apparent sound power levels (or warranted noise data plus 2 dB) the results include uncertainty within the source noise data that ensures that the predicted noise levels are unlikely to be exceeded in practice under any noise propagation conditions.

Proposed Mitigation

7.70 No mitigation is proposed as cumulative noise levels that include Craigton and Spittalhill Wind Farm are below the relevant noise limits detailed in **Table 7.2**.

Further Survey Requirements and Monitoring

7.71 No further survey requirements or monitoring are proposed.

Summary of Effects

7.72 Operational noise levels from Craigton and Spittalhill Wind Farm are predicted to meet the ETSU-R-97 simplified noise limit of 35 dB L_{A90} for all operational conditions.

7.73 On site construction noise is predicted to meet the BS5228 65 dB L_{Aeq} day-time hours noise criterion. The increase in traffic noise on local roads due to construction is predicted to be negligible except at the property of Todholes where it meets the 65 dB L_{Aeq} criterion.

7.74 The effects of Craigton and Spittalhill Wind Farm, when added to other existing and consented wind farms in the area, are either negligible, adding less than 1 dB to the predicted noise from other sites or meet the cumulative noise limits agreed with the Planning Authority.

[i] Onshore Wind Turbines, http://www.scotland.gov.uk/Resource/0040/00400442.pdf [August 28, 2012], Scottish Government, 2012
[ii] ETSU-R-97, The Assessment and Rating of Noise from Wind Farms, ETSU for the Department of Trade and Industry, 1996
[iii] W/45/00656/00/00, The Measurement of Low Frequency Noise at Three UK Windfarms, Department of Trade and Industry, 2006
[iv] DEFRA NANR233, Research into amplitude modulation of wind turbine noise, Moorhouse et al., University of Salford, July 2007
[v] Department for Business, Enterprise & Regulatory Reform, www.bis.gov.uk/files/file40571.pdf

8 Geology, Hydrology and Hydrogeology

Introduction

8.1 This chapter considers the potential effects of the proposed Craigton and Spittalhill Wind Farm on geology, hydrology, hydrogeology, soils and peat. It details each of these items in turn, including a baseline description, followed by the identification of specific effects on particular receptors. The assessment was undertaken by the Land & Water Team at Mouchel, based in Glasgow.

8.2 There are links between this chapter and **Chapter 9: Ecology**, specifically on issues such as aquatic ecology and groundwater dependent terrestrial ecosystems. Please note that the Habitats Regulations Appraisal (HRA) for this project is considered in **Chapter 9: Ecology**.

8.3 Peat studies have contributed to this report, the findings having been used to inform the constraint-led design, applying a precautionary approach. Study Area Description

8.4 The study area focussed on the area within the red line site boundary where fieldwork was undertaken and the immediate surrounding area of the Fintry Hills and Ling Hill. From a hydrological perspective, downstream locations to the mouth of the Endrick Water to Loch Lomond have been considered using a catchment-based study approach, as per good practice.

Effects Assessed in Full

The following effects have been assessed in full:

- pollution incidents;
- erosion and sedimentation;
- modification of surface water drainage patterns;
- modification of groundwater levels and flows;
- compaction of soils;
- peat instability.

Effects Scoped Out

8.5 No potential effects were scoped out of the assessment.

Assessment Methodology

Assessment Structure

8.6 The assessment is structured around the consideration of potential effects on the following:

- Geology – changes to geological structures or effects on designated sites.
- Hydrology – changes to drainage regime and associated alteration to surface water runoff rates and volumes, erosion/sedimentation and water quality characteristics across the local area and the catchment as a whole, including designated sites. Also changes to water resources such as water supplies.
- Hydrogeology – changes to groundwater infiltration and groundwater levels, water quality and wetland characteristics.
- Peat – changes to soil and peat characteristics related to erosion, compaction and soil quality, changes to peat stability within and immediately adjacent to the site.

Data Sources and Guidance

8.7 The following data sources have been used during this assessment:

- Ordnance Survey digital mapping, 1:50,000 and 1:10,000 scale (OS Open Data);
- Ordnance Survey Landform Profile 10m Digital Terrain Model (DTM) data (OS Open Data);
- British Geological Survey Geoindex Onshore Bedrock 1:50,000(interactive web map);
- British Geological Survey Geoindex Onshore Superficial Deposits 1:50,000 (interactive web map);
- British Geological Survey Hydrogeological Map of Scotland, 1:625,000 scale;
- SNIFFER (2004) Map of Vulnerability of Groundwater in the Uppermost Aquifer, Scotland;
- Soil Survey of Scotland 1:250,000 Sheet 6, mapping of soil types and land capability for agriculture;
- Centre for Ecology & Hydrology (CEH) Flood Estimation Handbook (FEH) CD-ROM v3;
- ISIS hydrological software;
- Wallingford HydroSolutions LowFlows 2000 software;
- SEPA Flood Risk Map of Scotland (interactive web map);
- SEPA River Basin Management Planning Map (interactive web map);
- National Vegetation Classification survey of site, undertaken by MacArthur Green (2012).

8.8 The following legislation, policies and guidance have been taken into consideration during this assessment:

- Environmental Impact Assessment (Scotland) Regulations 2011;
- Water Environment and Water Services (Scotland) Act 2003;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011;
- Private Water Supplies (Scotland) Regulations 2006;
- CIRIA Report C532, Control of water pollution from construction sites: Guidance for consultants and contractors;
- CIRIA Report C648, Control of water pollution from linear construction projects: Technical guidance;
- CIRIA Report C649, Control of water pollution from linear construction sites: Site guide;
- CIRIA Report C697, The SUDS Manual;
- Forestry Commission (2011) Forests & water guidelines, 5th Edition;
- Scottish Executive (2000) River crossings & migratory fish: Design guidance;
- Scottish Executive (2006) Peat landslide hazard and risk assessments: Best practice guide for proposed electricity generation developments;
- Scottish Natural Heritage (2009) A handbook on environmental impact assessment;
- Scottish Natural Heritage (2002) Guidelines on the environmental impacts of windfarms and small scale hydroelectric schemes;
- Scottish Environment Protection Agency Policy No. 19, Groundwater protection policy for Scotland;
- Scottish Environment Protection Agency Policy No. 26, Policy on the culverting of watercourses;
- Scottish Environment Protection Agency Position Statement WAT-PS-06-02, Culverting of watercourses;
- Scottish Environment Protection Agency WAT-SG-25, Good practice guide - river crossings;
- Scottish Environment Protection Agency WAT-SG-31, Special requirements for civil engineering contracts for the prevention of pollution;
- Scottish Environment Protection Agency/CIRIA (2006) Small environmental guide for construction workers;
- Scottish Natural Heritage and Forestry Commission (2010) Floating roads on peat;
- Scottish Renewables Good Practice During Windfarm Construction (co-authored by Scottish Natural Heritage, Scottish Environment Protection Agency and Forestry Commission Scotland);
- SEPA (2010)Regulatory Position Statement – Developments on Peat.

8.9 The following Scottish Environment Protection Agency (jointly with the Environment Agency and the Northern Ireland Environment Agency) Pollution Prevention Guidelines have also been considered:

- PPG1 General guide to the prevention of pollution;
- PPG2 Above ground oil storage;
- PPG3 The use and design of oil separators in surface water drainage systems;
- PPG4 Treatment and disposal of sewage where no foul sewer is available;
- PPG5 Works and maintenance in or near water;
- PPG6 Working at construction and demolition sites;
- PPG7 Safe operation of refuelling facilities;
- PPG8 Storage and disposal of used oils;
- PPG13 Vehicle washing and cleaning;
- PPG18 Managing fire water and major spillages;
- PPG21 Pollution incident response planning;
- PPG22 Incident response - dealing with spills;
- PPG26 Safe Storage – Drum and intermediate bulk containers.

Field Survey

8.10 Field surveys were undertaken by a two-person team with experience of assessing geology, hydrology, soil and peat issues on onshore wind farms in upland environments. These visits were undertaken on the 2nd October 2012 (weather conditions were dry and mild), 4th October 2012 (intermittent rain, mild), 24th October 2012 (dry and mild) and 7th December 2012 (dry and cold, snowmelt evident). These combined visits equate to approximately 48 person hours on site.

8.11 The visits focused on gaining a good overall understanding of the hydrological regime of the area, evaluating outcrops of bedrock and undertaking initial peat probing to feed into the layout constraints for both peat depth and stability. The field techniques used for the peat probing were in line with the Scottish Government's Peat Landslide Hazard and Risk Assessment Best Practice Guide[i] and Floating Road on Peat guidance[ii].

Consultation

8.12 **Table 8.1** details the consultation responses to the Scoping Report and information requested from Stirling Council.

Table 8.1 Consultation Responses

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Scottish Environment Protection Agency	Scoping	Disruption to wetlands including peatlands Disturbance and re-use of excavated peat	Included in assessment of effects, with good practice measures specified Peat survey undertaken to locate infrastructure away from disturbing deeper peat. Peat Stability Report included at Appendix 8.2, Carbon Balance at Appendix 14.1 and Outline Soil and Peat Management
		Engineering activities in the water environment Pollution prevention and environmental management Impact on existing groundwater abstractions Water abstraction Borrow pits Flood risk	Plan at Appendix 4.2. Included in assessment of effects, with stream crossing details specified Included in assessment of effects, with good practice measures specified No groundwater abstractions identified on or adjacent to site No onsite water abstraction identified Included in assessment of effects, Included in assessment of effects
Scottish Water	Scoping	None	
Stirling Council	Private Water Supply Data Request	Data provided	Supplies reviewed against provided location and source information to identify any key issues.

Assessing Significance

8.13 The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, taking into account three key factors:

- sensitivity of the receiving environment;
- potential magnitude of the effect;
- probability of that effect occurring.

8.14 This approach is based on guidance given in the Scottish Natural Heritage (SNH) publication 'A Handbook on Environmental Impact Assessment'[iii].

8.15 The receptor sensitivity represents its ability to absorb the anticipated effect without perceptible change resulting. Three levels of sensitivity have been used, as shown in **Table 8.2**. Evaluation of sensitivity of soils and water can be difficult to quantify. A considerable degree of judgement, based on defined characteristics and values and calling on professional experience, is accordingly applied during evaluation.

Table 8.2: Sensitivity

Sensitivity	Definition
High	The receptor has little ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national or international importance, for example waterbodies of at least good status under the Water Framework Directive (WFD) and/or with designated status such as SAC or SSSI.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional importance, for example waterbodies with moderate status under the WFD.
Low	The receptor is tolerant of change without detriment to its present character, is of low environmental value, or of local importance, for example waterbodies with poor or bad status under the WFD.

8.16 The magnitude of the effect takes into account the timing, scale, size and duration of the potential effect. Four levels of magnitude have been adopted, as shown in **Table 8.3**, using hydrology as an example.

Table 8.3: Magnitude of Effect

Magnitude	Definition
Major	There would be fundamental changes to the hydrology, for example a pollution event resulting in downgrading of a watercourse WFD status, or leading to an acute ecological issue such as a fish kill.
Moderate	There would be material but non-fundamental changes to the hydrology, such as a pollution incident with defined short term effect on a watercourse, returning to previous condition within a number of months without an acute effect upon aquatic ecology.
Minor	There would be detectable but non-material changes to the hydrology, such as a small scale pollution incident with very short term effect on a watercourse, returning to previous condition within a number of weeks.
Negligible	There would be no perceptible changes to the hydrology.

8.17 The probability of occurrence of an effect has been evaluated as being low, medium or high.

8.18 The findings of the three criteria considered in the evaluation of the effects have been used via a matrix for each potential effect (see **Table 8.4**) to form a judgement on the significance of the effect.

8.19 Potential effects are concluded to be of major, moderate, minor or negligible significance (before and after proposed mitigation measures have been taken into account).The assessment concludes with a review to determine if the anticipated effects would be significant in terms of the EIA regulations.

8.20 Major and moderate effects are considered to be significant in the context of the EIA Regulations.

Table 8.4: Significance Matrix

Sensitivity	Magnitude	Probability	Significance of Effect
High	Major	High	Major
		Medium	Major
		Low	Moderate
	Moderate	High	Moderate
		Medium	Moderate
		Low	Minor
	Minor	High	Minor
		Medium	Minor
		Low	Minor
	Negligible	High	Minor
		Medium	Negligible
		Low	Negligible
Medium	Major	High	Major
		Medium	Moderate
		Low	Minor
	Moderate	High	Moderate
		Medium	Minor
		Low	Minor
	Minor	High	Minor
		Medium	Minor
		Low	Negligible
	Negligible	High	Negligible
		Medium	Negligible
		Low	Negligible
Low	Major	High	Moderate
		Medium	Minor
		Low	Negligible
	Moderate	High	Minor
		Medium	Minor
		Low	Minor
	Minor	High	Minor
		Medium	Negligible
		Low	Negligible
	Negligible	High	Negligible
		Medium	Negligible
		Low	Negligible

Planning Policy

8.21 Planning policies of relevance to this assessment are provided in **Chapter 5: Planning Policy Context**.

Existing Conditions

8.22 The Craigton and Spittalhill site is located in the Fintry Hills, 4km north-east of Fintry, 15km south-west of Stirling. This is an upland moorland site with blanket peat evident and the current land use is rough grazing. The site is located on a north facing hillside, which is drained by the Backside Burn, one of the headwaters of the Endrick Water which flows into Loch Lomond.

Designations

8.23 This section details the designations relating to hydrology, geology or soils which are of regional, national or international importance.

8.24 Although there are no sites designated for nature conservation within the Craigton and Spittalhill Wind Farm site boundary, there are several sites present in the surrounding region. There are two sites of European importance within a 5km radius of the site centre, Endrick Water SSSI and SAC, and Double Craigs SSSI.

8.25 Endrick Water SSSI and SAC both cover the same area and extend for 36km west from Loup of Fintry to 1.5km east of Loch Lomond, where the designation meets the Endrick Mouth and Islands SSSI[iv]. These are located 5.1km downstream of the site, 1.2km south-west of the site at its nearest point. These sites are primarily designated for their fish populations and presence of nationally rare plant species.

8.26 Double Craigs SSSI is located 1.7km south-west of site. This is a series of cliffs on the south side of the Fintry Hills, designated for both volcanic geology and relatively undisturbed upland plant species which are not common in the Stirling area[v].

8.27 **Table 8.5** summarises the citations for all designated sites within 5km of the site boundary, for issues relating to hydrology, geology or soils. The locations of the SSSI designated sites are shown on **Figures 8.1 and 8.2**.

Table 8.5: Table showing designations within a 5km radius of the site (note all distances are given at their nearest point)

Designation Name	Designation	Category	Distance and Direction Relevant to Site	Linkage to site
Endrick Water	SAC	SAC qualifying features are Atlantic salmon, brook lamprey and river lamprey,	1.2km south-west of site	Downstream of site
Endrick Water	SSSI	Fluvial geomorphology Biological- Populations of Atlantic salmon, river lamprey and brook lamprey. Presence of nationally rare plant species	1.2km south-west of site	Downstream of site
Double Craigs	SSSI	Geological- Igneous strata exposures Carboniferous to Permian Biological- Upland Plant communities	1.7km south-west of site	No linkage

Climate

8.28 This section details:

- the climate characteristics for Craigton and Spittalhill Wind Farm and the surrounding region;
- the historic rainfall data for the surrounding region.

8.29 The Fintry Hills are recognised by the Met office as within the Western Scotland climatic region. Much of Western Scotland's climate is influence by Westerly winds from the Atlantic Ocean and the Gulf Stream[vi]. Coastal areas of the region are milder than the east of Scotland with temperatures falling inland and with altitude.

8.30 The Fintry Hills are likely to experience a higher level of precipitation compared with lower areas nearby, with air cooling at altitude causing more cloud and precipitation.

8.31 The standard average annual rainfall (SAAR) has been estimated from the Flood Estimation Handbook CD-ROM[vii] as varying between 1591mm and 1644mm across the site. To put this in perspective, annual average rainfall across Scotland varies from over 4000mm in the north west Highlands, to less than 700mm along the Fife coast.

8.32 The long term average monthly rainfall is shown on **Diagram 8.1** in **Appendix 8.1** using details from the Paisley Met Office station[viii](32mAOD and located approximately 30km south-west of the site). Further local data has been provided from stations based at Stirling[ix] (altitude 28mAOD, 15km north east) and Callander[x](altitude 91mAOD, 20km north). The upper area of the site is at approximately 400mAOD and the lower site area on the banks of the Backside Burn at around 290mAOD.

8.33 It is noted that the short-term period of the Callander station data has led to an apparently skewed dataset, with very high values of precipitation for November and December data which may be the result of abnormally high rainfall in 2011 (which are the only available data for these months during this station's operation). The additional data provided for Paisley and Stirling provide a longer term trend.

8.34 This precipitation data provides an understanding of seasonal variations that would be anticipated in the region area, but the higher altitude of the site would lead to an expectation of greater rainfall than these station records.

8.35 Climate change projections for 2050 suggest that a medium emissions scenario would yield an increase in temperatures within Western Scotland of approximately 2°C[xi]. Furthermore projections suggest an increase of between 6-8% in autumn and winter precipitation, potentially increasing flood risk and frequency.

Geology

8.36 This section details the:

- solid geology;
- superficial geology;
- other geological features - found within the site and surrounding area.

8.37 The Fintry Hills are largely formed from volcanic rocks of the Clyde Plateau Volcanic Formation, which is comprised of lavas, tuffs and volcaniclastic sediments of varying compositions. The upper slopes of the Fintry Hills, including the bedrock underlying the main part of the site, consists of basalt lavas of varying microstructure (due to varying mineral composition and cooling rates) i.e. plagioclase-macrophyric basaltic rock, microporphyritic basalt plagioclase-microphyric basaltic rock and trachybasalt.

8.38 The proposed site access track crosses an area of volcaniclastic sandstone and conglomerate located in the valley below the confluence of the Backside and Burnfoot Burns.

8.39 A number of Mafite dykes of the Midland Valley Carboniferous to Early Permian Alkaline Basic Dyke Suite are present in the upper Endrick Water valley, below the confluence Backside and Burnfoot Burn. Another of these dykes is located downhill of the proposed Turbine 5. **Photograph 8.1** presented in **Appendix 8.1**, displays exposed bedrock geology.

8.40 In the wider region, the Clyde Plateau Volcanic Formation is heavily faulted, however in the immediate vicinity of the site this faulting is limited to two short faultlines trending approximately north east to south west, close to the proposed Turbine 6. Such faults are widespread and common in this area of Scotland.

8.41 The superficial geology of the summits of the Fintry Hills is dominated by peat deposits. However on the sides of the valley of the Backside Burn, where the turbines are to be located, the superficial geology is a patchwork of peat and glacial till interspersed with areas of exposed bedrock. Hummocky Glacial Deposits comprising glacial till, sand and gravel are found on gentler lower slopes of the upper Endrick valley, where the access track is proposed. Alluvial deposits are also found close to the larger watercourses, in particular the Backside Burn and Endrick Water.

8.42 Solid Geology and Superficial Geology are presented in **Figure 8.3** and **Figure 8.4**, respectively.

Geomorphology

8.43 This section details:

- the geomorphological characteristics of the site;
- topographic cross-sections of the site.

8.44 The site lies within a wide u-shaped valley, likely to have been created by a combination of historically greater erosive forces including glaciation and a larger watercourse than the present Backside Burn. The local landscape has been smoothed in consequence.

8.45 **Photographs 8.2 and 8.3** show the site from two viewpoints, giving a good impression of current site conditions.

8.46 There is a ridge along the crest of the Fintry Hills where the ground is relatively level, with highest point being around 460m above ordnance datum. The altitude at the Backside Burn is around 290mAOD, representing a 170m height differential from ridge to valley base over a distance of approximately 1,500m.

8.47 Topographic cross-sections of the site taken from south-west to north-east and north-east to south-west are provided in **Diagram 8.2** and **Diagram 8.3** of **Appendix 8.1**, respectively. They were generated using digital terrain model data[xii]. Site elevation data, including cross-section positions are shown on **Figure 8.5**.

8.48 From the Fintry Hills ridge the ground falls away relatively steeply to both north and south, with the northern slopes from this ridge to the Backside Burn shown on **Diagram 8.2** in **Appendix 8.1**. **Diagram 8.3** in **Appendix 8.1** displays the gently undulating features of a 1300m cross-section of the southern side of the Backside Burn valley, this cross section is positioned approximately 200m south of the Backside Burn slightly above the base of the valley.

8.49 The slope angles exhibited on the Fintry Hills are very steep in localised places, with slope angles of 16° found on the northern slopes above the Backside Burn within the site boundary. Nearby but outwith the site boundary, slopes in excess of 30° have been identified on the craggy southern slopes above Loch Walton.

8.50 The local watercourse pathways on the site are determined by topography and these tend to flow directly downhill from south-west to north-east. The upper slopes exhibit evidence of surface water flows, in flush zones characterised by wetland vegetation, prior to forming into more defined channels at lower altitude, before meeting the Backside Burn.

8.51 Where steeper slopes and watercourse channels are coincident, some accelerated bankside erosion was noted on both sides of the Fintry Hills. These locations are likely to be unstable and subject to on-going slope failure, particularly on the southern slopes above Spittalhill Farm.

Soil and Peat

8.52 This section details:

- the soils present at the site and their characteristics, including peat;
- peat stability.

Soils

8.53 The distribution of soils within the study area is dependent on the geology, topography and drainage regime of the area.

8.54 The site soils consist of blanket peat, units of the Darvel association and a small amount of units of the Darleith / Kirktonmoor Association, associated with drifts derived from basaltic rocks[xiii]. The soil units present are detailed in **Table 8.6**.

Table 8.6: Soil units with associated landforms, in order of dominance onsite

Soil Unit	Soil Association	Parent Materials	Component Soils	Landforms
4	Organic Soils	Organic Deposits	Blanket peat	Uplands and northern lowlands with gentle and strong slopes
163	Darvel	Fluvioglacial sand and gravels derived mainly from carboniferous rocks	Brown forest soils; some humus-iron podzols and gleys	Mounds and terraces with gentle and strong slopes
149	Darleith / Kirktonmoor	Drifts derived from basaltic rocks	Noncalcareousgleys, humicgleys; some brown forest soils and peaty gleys	Undulating lowlands with gentle and strong slopes; non-rocky

8.55 The site is underlain by soil unit 4 to the south of the Backside Burn. Adjacent and to the north of the Backside Burn, the soil is recorded as soil unit 149 which extends east of the site, approaching the south of Ling Hill. Soil unit 163 is present to the south-east, adjacent to the valley of the Endrick Water (downstream of the confluence of the Backside Burn and the Burnfoot Burn) following the valley toward Fintry[xiv].

8.56 Soil types characteristic of the site location and of the soil associations derived from Macaulay Land Use Research Institute (MLURI)[xv] are summarised below:

- **Blanket peat**: Undecomposed organic material that has remained wet to the surface. Peat forms under cool, wet climatic conditions, which, in combination with high acidity and nutrient deficiency, depress microbiological activity.
- **Brown forest soils**: Fertile, often deep soils, rich in nutrients and organic matter. Soil is free draining and often not very distinctive visually, although usually lightens in colour with depth as organic content decreases. Texture and level of fertility depend on parent material and degree of alteration that the soil has undergone.
- **Podzols**: these typically form in acid, coarse textured, well drained materials. Surface vegetation is usually coniferous woodland or heather moorland. Podzols are generally nutrient deficient and heavily leached in the upper horizons resulting in a bleached appearance, with an accumulation of thin layers of iron/aluminium oxides ('ironpan') or organic material at lower levels within the soil profile, with an orange-brown or black colour respectively. **Humus-iron podzols** have a surface horizon of humified (or decomposed) organic material. In areas with low slope angles, waterlogging may occur above the ironpan; this can produce a soil intermediate between a podzol and a gley.
- **NoncalcareousGleys**: naturally poor drained soils that develop under conditions of intermittent or permanent waterlogging. Soils are typically greyish or blue-grey with orange mottling. **Humicgleys** are loamy or clayey with a surface horizon of decomposed organic material, while **Peaty gleys** have a peat-rich surface horizon.

8.57 **Photograph 8.4** in **Appendix 8.1** illustrates a characteristic soil profile attributed to the soil associations identified at the site. It is located at an area where blanket peat is eroded at a stream bank exposing underlying horizons. A dark humus peat layer can be seen above a bleached horizon indicative of leached iron. Below this humus layer, there is a rusty horizon developed through deposition of leachates. This soil profile is best described as a humus-iron podzol.

Peat

8.58 Blanket peat (Soil Unit 4) is mainly located at the valley base, adjacent to the Backside Burn. On the steeper slopes of the Fintry Hills, on the southern part of the site. There is typically a shallow peat layer above other soil units. Evidence of this is provided at locations where soil horizons are exposed such as at eroded stream banks, as shown in **Photograph 8.4** in **Appendix 8.1**.

8.59 Peat is a soft to very soft, highly compressible, highly porous organic material which can consist of up to 90% water by volume. Unmodified peat typically has two layers, a surface layer or acrotelm which is usually 0.1 to 0.3 m thick, highly permeable and receptive to rainfall. The acrotelm layer generally has a high proportion of fibrous material and often forms a crust under dry conditions. The second layer, or catotelm, lies beneath the acrotelm and forms a stable colloidal substance which is generally impermeable. As a result, the catotelm usually remains saturated with little groundwater flow. Peat is thixotropic, meaning that its viscosity decreases under applied stress. This property may be considered less important where the peat has been modified through artificial drainage and is drier, but will be significant when the peat body is saturated.

8.60 Given the prevalence of peat, Mouchel was requested to undertake further peat-specific work, including peat probing for use in a site-specific peat stability assessment (see Appendix 8.2 Peat Stability Assessment)and in evaluating carbon emissions (see Appendix 14.1 Carbon Report). Soil and peat depths were sampled at representative locations across the site.

8.61 **Table 8.7** shows the range of results gathered during peat depth surveys. A total of 620 soil and peat depth records were gathered at the site and the surrounding areas, with measured depths averaging 0.57m. 82.1% of recordings were less than 1.0m and 92.9% less than 1.5m. Deeper deposits were concentrated on the lower altitude, shallow gradient ground close to the Backside Burn. A single depth record greater than 2.5m was identified, at 2.56m.

Table 8.7: Peat/Soil Depths

Peat/Soil Depth Range (m)	Number of locations surveyed	Percentage of locations surveyed	Average depth in range (m)
0.0 to <0.5	358	57.7%	0.27
0.5 to <1.0	151	24.4%	0.65
1.0 to <1.5	67	10.8%	1.21
1.5 to <2.5	43	6.9%	1.79
2.5 to <4.0	1	0.2%	2.56
4.0 and deeper	0	-	-
Total / Aggregate	**395**	**100%**	**0.57**

8.62 The results of the peat/soil depth survey were extrapolated to produce an indicative peat depth map as a 50m x 50m grid for the site. This map and the results of the peat depth survey are shown on **Figure 8.6**.

8.63 It is recognised that the equipment employed by Mouchel to determine peat depth will also pass through other soil types before 'refusal depth', thus peat depth results incorporate all soil through which 10mm steel rods pass. This is a conservative approach to ensure soil depths are accurately gauged, but is anticipated to provide an overestimate of peat depths, given the site conditions and the fact that the mapping indicates peat overlying other soil types.

8.64 On one particular date of fieldwork (7th December 2012) winter conditions led to some frozen ground being evident, at these locations peat depth results and the local frozen conditions were noted but these results have not been included in the dataset.

Hydrogeology

8.65 This section details:

- hydrogeological features present at the site and their characteristics;
- groundwater vulnerability;
- groundwater Body characterisation and water quality;
- groundwater dependent terrestrial ecosystems (GWDTEs).

Hydrogeological features

8.66 The basaltic lavas of the Clyde Plateau Volcanic Formation, which underlie the majority of the site, are generally impermeable and form an aquifer of low productivity. Groundwater flow is restricted to the near surface weathered zone and secondary fractures, with flow rates of up to 2l/s possible from the rare springs.

8.67 The volcaniclastic sandstone and conglomerate present in the south east of the site forms a moderately productive multi-layered aquifer, with fracture flow yielding up to 10l/s in localised areas. This formation may support small private water supplies.

Groundwater vulnerability

8.68 Groundwater vulnerability to pollution for the site is class 4c and 4d (in western and eastern parts of the site, respectively). The ridge of the Fintry Hills, to the south of the site, is classified as 4b. These are all sub-classifications of class 4, which is defined as "areas where groundwater is vulnerable to those pollutants not readily adsorbed or transformed"[xvi]. The groundwater vulnerability increases as altitude increases from the base of the valley to the ridge. This increasing vulnerability is likely to be due to the generally decreasing depth of drift material protecting the underlying bedrock towards the top of the hill.

Groundwater Body Characterisation and Water Quality

8.69 The Water Framework Directive (WFD) (EU, 2000) came into force in December 2003 and is implemented in Scotland through the Water Environment and Water Services (Scotland) Act 2003 (Scottish Executive, 2003). A key objective of this Directive is the achievement of 'good ecological status' (as a minimum) of all natural waterbodies by 2015. This involves a move towards a risk based classification system (SEPA, 2005). This risk based system highlights such issues as over abstraction, in addition to chemical water quality.

8.70 Under the terms of the WFD, all river basin districts are required to be characterised. The characterisation process required SEPA to produce an initial assessment of the impact of all significant pressures acting on the water environment. Groundwater bodies have been identified to reflect the main aquifer types. For areas above low productivity aquifers, groundwater bodies have been defined using surface water sub-catchments as a surrogate. Areas above high productivity aquifers have been defined using geological and major catchment boundaries. The main purpose of identifying waterbodies is so that their status can be described accurately and compared with environmental objectives.

8.71 The entire site falls within one WFD groundwater body the Campsie bedrock and localised sand and gravel aquifers waterbody, and is immediately adjacent to a second located north of the site boundary (the East Campsie bedrock and localised sand and gravel aquifers waterbody). The classification results of these waterbodies, and SEPA's confidence in the classification result, are summarised in **Table 8.8**. SEPA provide a confidence rating for each classification result which gives an indication of the robustness of the monitoring data upon which the classification status is based.

Table 8.8: Water Framework Directive Groundwater Classification

	Groundwater water body SEPA ID (area)	Overall Classification (2008)	Anticipated Classification (2015)	Relevant Associated Waterbody	Summary of Pressures
Campsie bedrock and localised sand and gravel aquifers	150216 187.12km²	Chemistry: Good High Confidence Quantitative: Good High Confidence	Chemistry: Good Quantitative: Good	Allander Water Blane Water/ Ballagan Burn Duntocher Burn Garrel Burn Kirk Burn	No pressures identified
East Campsie bedrock and localised sand and gravel aquifers	150395 144.7km²	Chemistry: Good High Confidence Quantitative Good High Confidence	Chemistry: Good Quantitative: Good	Auchenbowie Burn Bannock Burn Carron Valley Reservoir Earl's Burn Loch Coulter Reservoir River Carron	No pressures identified

Groundwater Dependent Terrestrial Ecosystems

8.72 During preparation of **Chapter 9: Ecology**, MacArthur Green surveyed the site against the National Vegetation Classification (NVC) system and produced an associated map. This map was reviewed for groundwater dependent terrestrial ecosystems (GWDTE), using SEPA guidance[xvii]. This was used to determine which NVC areas could potentially be GWDTE-applicable.

8.73 The vegetation within the site boundary is a matrix of species including those which are identified as GWDTE, including NVC M6, M23, M25, MG9 and MG10. These particular types of vegetation are considered by the UK Technical Advisory Group on the Water Framework Directive as having low to moderate potential groundwater dependency[xviii]. However, based on local site conditions it is judged that the vegetation present is dependent on wet conditions but groundwater is not considered as the primary source of water. The primary source of water is more likely to be from rainfall and the associated surface runoff down the northern slopes of the Fintry Hills, forming wet flush zones on the hillside. These become more defined channels nearer the base of slope.

Hydrology

8.74 This section details:

- hydrological description of the characteristics of the site and downstream area;
- surface water flows and flooding;
- water quality;
- water supplies;
- fisheries.

8.75 By evaluating the hydrology of the site using a catchment based system, judgements can be made regarding potential influences that onsite activities may have downstream and on other water bodies within the catchment. Maps displaying the hydrological overview and more detailed site-specific hydrology are provided in **Figures 8.1 and 8.2**, respectively.

Hydrology Description

8.76 The site lies in the upper catchment of the Endrick Water, with the Backside Burn and its tributaries draining the northern site area. The southern area of the site (representing the site access track) is drained by small tributaries which flow off the Fintry Hills directly into the Endrick Water, downstream of the confluence of the Backside Burn and the Burnfoot Burn (NS 666881). The Endrick Water flows south and then west past Fintry and continues generally west to Loch Lomond.

8.77 The Backside Burn, shown in **Photograph 8.5** in **Appendix 8.1**, defines the northern boundary of the Craigton and Spittalhill Wind Farm site, draining the site directly as well as via two of its tributaries which collect surface drainage from the northern slopes of the Fintry Hills. Shelloch Burn is the northern-most tributary within the site, with a second main (unnamed) tributary in the centre of the site, both flow north-east to merge into the Backside Burn at NS 659894 and NS 665889, respectively. Where site streams flow over steep slopes, these stretches are characterised by series of waterfalls, shown in **Photograph 8.6** in **Appendix 8.1.**

8.78 Numerous smaller unmapped watercourses and flush zones are also present within the site, shown in **Photograph 8.7** in **Appendix 8.1**. These form up into more distinct channels on the lower slopes closer to the Backside Burn (and in the southern site area, the Endrick Water). During fieldwork it was noted that areas of the site were wet underfoot, particularly on the lower slopes and in flush zones.

8.79 No standing water bodies are present within the site boundary. There is a small unnamed pond (surface area of 0.2hectares or 0.002km^2) located 100m north east of the site entry track (NS 6776 8749), which collects drainage from the hillside to the west and then flows east down to the Endrick Water. Loch Walton is a small fishery located 1km south of the site, with a surface area of 0.18km² (when combining the two adjacent lochans). The main inflow stream to Loch Walton is a modified lade channel which supplies the Loch from the east. This channel collects drainage from numerous small tributaries on the southern slopes of the Fintry Hills, with a watershed divide approximately at the location of the existing access to Earlsburn Wind Farm. These lochans discharge to the south into the Endrick Water.

8.80 The catchment sizes for the Backside Burn's unnamed tributary, the Shelloch Burn tributary and the Backside Burn itself to the confluence with the Burnfoot Burn are 1.12km², 1.29km² and 8.37km², respectively. The Burnfoot Burn has a catchment area of similar size to the Backside Burn.

8.81 From this upper reach of the Endrick Water, the river braids slightly before flowing south-east to Todholes, bypassing Carron Valley Reservoir. A small channel from Carron Valley Reservoir may flow intermittently into the Endrick Water during reservoir maintenance or for operational reasons. Approximately 5km downstream of the site, the Endrick Water flows over the Loup of Fintry waterfall. The Loup of Fintry is a series of waterfalls at NS 662 862 during which the Endrick Water falls approximately 30m.

8.82 The watercourse then flows generally west for approximately 49km, meandering in its lower reaches before discharging into Loch Lomond, 1km south of Balmaha.

8.83 The Endrick Water catchment upstream of Loch Lomond covers 268km^2, with the entire River Leven catchment to its mouth on the Clyde Estuary covering an extensive 795km^2, which includes all freshwater inputs into Loch Lomond[xix].

Surface Water Flows and Flooding

8.84 Theoretical runoff rates have been estimated for the full extent of each defined stretch of catchment, i.e. flow of the Shelloch Burn upstream of meeting Backside Burn, plus for the stretch of the Endrick Water downstream of the confluence of the Backside and Burnfoot Burns (identified as being upstream of Todholes property). Peak flows have been estimated using the Flood Estimation Handbook[xx]catchment characteristics with the 'FEH Rainfall-Runoff' method used to derive a range of peak flow return periods[xxi]. Low flow measurements have been determined by the 'Low Flow' method[xxii] and are quoted as Q_{95}(i.e. the flow exceeded 95% of the time). These data are shown in **Table 8.9**.

Table 8.9: Estimated Surface Water Flow Characteristics

Catchment	Area (km^2)	Mean Annual Flow (m^3/s)	Low Flow Q_{95} (m^3/s)	Estimated Peak Runoff (m^3/s) for each return period (years)					
				5	10	25	50	100	200
Unnamed tributary of Backside Burn	1.12	0.05	0.008	2.3	2.7	3.3	4.0	4.6	5.3
Shelloch Burn, tributary of Backside Burn	1.29	0.05	0.009	2.3	2.8	3.4	4.1	4.7	5.4
Backside Burn	8.37	0.35	0.048	12	15	18	21	24	28
Endrick Water (upstream of Todholes)	19.5	0.81	0.098	25	30	36	44	50	57
Endrick Water (upstream of Loch Lomond)	268	8.82	0.836	150	178	212	253	286	326

8.85 The Hydrology of Soil Types (HOST) is a hydrologically-based classification of soils on the basis of their physical properties and their effects on the storage and transmission of water[xxiii]. It makes use of the fact that the physical properties of soils have a major influence on the hydrological response of a catchment. Other parameters can then be derived from the HOST classification. For the purposes of hydrological assessment the Baseflow Index (BFI) and Standard Percentage Runoff (SPR) are the most useful parameters.

8.86 BFI is the long-term ratio of baseflow to total stream flow, where baseflow represents the contribution to total flow from groundwater[xxiv]. BFI values range from 0.1 in relatively impermeable clay catchments to 0.99 in highly permeable chalk catchments. A very low BFI of 0.15 represents a flashy catchment with minimal storage, low BFI values (e.g. 0.3) indicate a catchment with little storage and active runoff, a BFI of 0.7 (or greater) indicates a significant contribution to flow from a major aquifer.

8.87 SPR is the average percentage of rainfall that causes the short-term increase in flow seen at a catchment outflow following a storm event[xxv].

8.88 Upstream of the confluence with the Burnfoot Burn, which is considered as the site catchment area, the Backside Burn has a BFI-HOST value of 0.28 (with the two site tributaries having values between 0.23-0.25), indicating a low contribution from stored water sources. These values would be expected given the underlying geological conditions with little groundwater infiltration leading to low aquifer productivity. This has led to the upland moorland landform formation exhibited on the site. Local watercourses will quickly respond to rainfall events, with a short lag time between rainfall occurring and increased stream flow values. The SPR value for the Backside Burn is 56% (with the 2 site tributaries having values between 59%-60%), indicating a moderately flashy response to rainfall, with little attenuation. In comparison, the Backside Burn tributaries are more flashy than the Backside Burn itself where it meets the Burnfoot Burn.

8.89 To put the site data into perspective, the catchment of the Endrick Water, upstream of Loch Lomond, has a BFI-HOST value of 0.46 and SPR value of 42%. These values suggest that the larger overall catchment has greater influence from aquifer flow and that short-term rainfall run-off is not as dominant as found at the site.

8.90 Flood risk data provided by SEPA[xxvi] shows flooding risk limited to the immediate area adjacent to the Backside Burn channel and its confluence with Burnfoot Burn. Downstream of the site, there is a wider area noted at Todholes (NS 672 861) approximately 0.5km upstream of Gartcarron Bridge. A more substantial area of flood risk has been identified in the Fintry area, where a number of tributaries converge with the Endrick Water, such as the Hall Burn and Cooper's Burn. Downstream of Fintry, the flood risk zone associated with the Endrick Water increases in extent as the watercourses passes through Balfron, at the confluence with the Blane Water (west of Killearn) and also exhibits an extensive flood-prone area south of Drymen.

Water Quality

8.91 As discussed in the groundwater water quality section, the Water Framework Directive (WFD) is a risk based classification system. This highlights such issues as stream morphology and existing artificial structures in addition to chemical water quality and ecological diversity. Heavily modified waterbodies, which can no longer be considered to be natural, are classified on the basis of 'ecological potential'.

8.92 Under the terms of the WFD, all river basin districts are required to be characterised and SEPA has produced an assessment of significant pressures acting on the water environment. Surface waterbodies are defined as being whole or parts of rivers, canals, lochs, estuaries or coastal waters. The main purpose of identifying waterbodies is so that their status can be described accurately and compared with environmental objectives.

8.93 The WFD applies to all surface waters, but for practical purposes, SEPA has defined a size threshold above which a river or loch qualifies automatically for characterisation. For lochs, the threshold is a surface area of $0.5km^2$ and rivers must have a catchment area of $10km^2$ or more. In addition to these larger waterbodies, smaller waters have been characterised where there is justification by conservation interests and to meet the requirements of regulatory legislation such as for drinking water supplies. **Table 8.10** summarises the Water Framework Directive classification for the Endrick Water[xxvii].

Table 8.10: Water Framework Directive Surface Water Classification

Catchment	Waterbody Name	Waterbody SEPA ID	Overall classification Data for 2008	Anticipated classification for 2015	Summary of Pressures
River Leven (Loch Lomond)	Endrick Water (upstream of Blane Water)	10153	Moderate	Good	Point source pollution as a result of sewage disposal Flow regulation Abstraction

8.94 For waterbodies that have not been classified, such as the Backside Burn, the normal convention is to assume a classification based on downstream or adjacent waterbodies unless there are specific indications to the contrary. Given the location of the site and the status of nearby watercourses, all waterbodies within the wind farm site should be assumed to have 'good status', as it is considered that downstream pressures that do not apply to the site watercourses, have downgraded the Endrick Water catchment to 'moderate'.

8.95 In relation to this EIA it is considered that the higher the WFD status, the higher the sensitivity of the waterbody. To prevent any deviation from 'good status' for receiving watercourses, the objective is to keep construction phase and post development runoff to pre-development conditions, in terms of both quality and quantity, whilst recognising that natural variability in flow values and water quality do occur. Measures to ensure this are discussed in the assessment sections below.

Water Supplies

8.96 The site area is not a source zone for public water supply, with the water supply in this area being sourced from the Carron Valley Reservoir, which does not collect runoff from the site and therefore is not hydrologically linked to the site. Loch Lomond is used for public water supply, however the distance and dilution factor between the site and Loch Lomond have led to public water supplies not being considered further.

8.97 Private water supply information was sought from Stirling Council who provided a list of identified supplies within the entire Council area. Regional private water supplies are shown on **Figure 8.1**.The information provided included premises details (including addresses and often grid references) and from these details a reduced list of supplies located in the local area was created. These were then considered in more detail, taking account of source type and location, distance from site and intervening topography and water features to determine if there were potential pollutant source-pathway-receptor relationships. Following review of the Stirling Council data it was judged that there are no supplies hydrologically connected to the site area as they collect water from local streams or springs rather than from the Endrick Water itself. Private water supplies have therefore not been considered further.

Fisheries

8.98 The River Leven (Loch Lomond) is categorised by SEPA as a salmonid watercourse (catchment ID 116)[xxviii]. The Endrick Water is a recognised as one of the main salmon spawning and nursery areas in the Leven catchment, with the tributaries of the Endrick Water also considered important for trout and sea trout. River lamprey and brook lamprey are found in the River Leven on a seasonal basis. Sea lamprey is native to the River Leven catchment, but not considered common and it has not been reported in the Endrick Water. Further details and species information are available in the Loch Lomond Fisheries Trust Fisheries Management Plan 2009-2013[xxix]. The presence of salmon, river and brook lamprey species are qualifying features of the Endrick Water SAC designation.

8.99 Migratory fish stock in the Endrick Water is restricted to the stretch downstream of the Loup of Fintry waterfall, found at NS 662 861. This feature acts as a natural barrier and therefore it is unlikely that migratory fish will be present upstream of this feature[xxx].

8.100 Loch Walton is used as a commercial fishery for leisure use.

Wind Farm Layout Design Considerations

Constraint Identification

8.101 Mouchel provided detailed constraints advice during the iterative layout design process for both the turbine and associated infrastructure features. At various stages during the iterative design process, fieldwork was undertaken in order to provide feedback to the development design team. This approach minimised a number of potential effects (such as minimising development infrastructure close to or crossing water features and undertaking initial peat depth and stability studies to avoid deeper peat areas). A combined soil and water constraints drawing has been provided on **Figure 8.7.**

8.102 The hydrology and ground condition constraints that were taken into account in the design of the wind farm are listed below:

- 50m buffer around water features shown on OS 1:10,000 mapping (other than where access tracks required incursion) – to protect from physical damage, pollution or flood inundation;
- additionally a 20m buffer has been placed around very small water features which were identified onsite or via aerial photography (once again, other than where access required incursion)– to protect from physical damage or pollution or flood inundation. These watercourses are not mapped by Ordnance Survey at 10,000 scale and have very small flows and catchment areas in comparison with any mapped watercourses;
- avoidance of areas where peat depths anticipated to be 1.5m or deeper – to protect from physical damage and minimise excavation and transportation of peat;
- avoidance of slope angles greater than 8°- to minimise soil loss and potential instability;
- avoidance of areas where initial peat stability concern was identified (factor of safety values less than 1.4) – to avoid areas with possible instability issues and associated indirect effects on surface water;
- minimisation of watercourse crossing structures and identification of best locations for necessary crossings – to protect from physical damage or pollution;
- identification of best local location for final turbine positions to take account of peat depth, peat stability and water features – to minimise impact from turbine base.

8.103 As part of the layout design strategy, watercourse crossings were minimised. Where access necessitates stream crossings, construction features have been limited in these buffers as far as possible, for example minimising tracks running parallel to streams and trying to avoid track junctions being constructed in these zones. This approach has resulted in a single new crossing (NS 6638 8882) that is mapped on OS 1:50,000 scale map. This is planned as a bridge structure, spanning the channel with supports set well back from channel edge. During the detailed design and construction phases, sections of track will be surveyed and microsited to optimise the distances from the waterbodies, taking into account local micro-topography.

8.104 A number of additional, smaller watercourse crossings were also been identified during fieldwork, these watercourses are not mapped on OS 1:10,000 scale mapping. These comprise crossings of flush zones, drainage ditches and small headwater channels. These crossings will have structures installed appropriate to local conditions and are likely to be designed as over-sized culverts or layers of pipes for flush zones.

8.105 Aggregate material will be won onsite by a combination of specific defined borrow pit excavations and the gathering of suitable surface outcrop at planned infrastructure locations.

8.106 Land, flooding and drainage related items within Scottish Planning Policy (2010) were considered, including avoidance of better quality agricultural land, risk-based assessment of individual catchments with regard to SEPA Flood Mapping, use of sustainable drainage techniques and appropriate design of stream crossing structures.

8.107 The infrastructure proposed is shown on **Table 8.11**.

Table 8.11: Infrastructure Proposed

Catchment	Watercourse Name	Proposed Development Features
Endrick Water (upstream of Loch Lomond, River Leven system)	Backside Burn (upstream of Burnfoot Burn confluence)	7 turbines and associated crane hardstandings 3.8km of new access track 1 CAR-applicable watercourse crossing, shown on OS 1:50,000 mapping. For this crossing a bridge span without channel support is suggested. Approximately 30 small watercourses and flush zones which are not shown on OS 1:50,000 or OS 1:10,000 mapping, that will require crossings. These would be suggested as a location-specific selection of small culvert or drainage blanket for wide flush zones (consisting of porous aggregate and multiple small diameter pipes). Underground cables Site compound Substation Anemometer Borrow pits

Good Practice Measures

8.108 Good practice measures will be employed as standard techniques during the construction and operation of Craigton and Spittalhill Wind Farm. Therefore, these are not considered to be mitigation as such, but an integral part of the design, construction and operation of the wind farm. This is considered a realistic scenario given the current regulatory context and accepted good practice across the industry.

8.109 All good practice measures are clearly stated below and any further specific mitigation measures are identified in the assessment of likely construction and operational effects.

8.110 Good practice measures to minimise the effects of the development on geology, hydrology, hydrogeology and soil have been provided below. A list of good practice documents were provided in the Assessment Methodology section of this chapter, many of the items proposed are taken from these publications.

8.111 During construction, there will be a suitably qualified environmental manager appointed with responsibilities including training, liaison with SEPA and ensuring applicable licences held. This role will have authority for halting works if necessary. Emergency procedures to be detailed and subsequently agreed with SEPA, including contact lists and the personnel responsible.

8.112 The proposed development will be constructed in accordance with a site Environmental Management Plan (EMP) and relevant Construction Method Statements (CMS), the content of which will be agreed with Stirling Council and relevant statutory bodies in advance of work commencing on site. The EMP will include measures to prevent, reduce and, where appropriate, offset environmental effects, this will include measures which seek to mitigate against the risk of pollution or environmental damage. Measures will be implemented to ensure that activities are carried out in such a manner as to minimise waste generation. Where waste is generated, appropriate disposal practices will be identified. Systems employed will conform to all appropriate waste management regulatory controls and adhere to the SEPA 'Waste Hierarchy'.

8.113 An outline Peat Management Plan (PMP) has been produced (see Appendix 4.2) examining peat excavation during construction and opportunities for reuse of this material. It also identifies measures for the management of peat during the construction process.

Pollution Incidents

8.114 Pollution prevention planning prioritises prevention at source, followed by mitigation measures local to source. Pollution incident management will operate on two main principles:

- reducing the likelihood of an incident occurring;
- minimising the magnitude (or severity) of an incident that does occur.

8.115 In tandem, these measures will limit the potential for contamination of surface and groundwater, soil and associated habitats. To achieve this, the following measures will be implemented:

- The construction compound will be located at NS 6645 8872, which is over 125m from any Ordnance Survey 1:10,000 mapping watercourses (and over 50m from smaller unmapped watercourses identified on site), on an impermeable surface and out with SEPA's 1:200 year flood risk zone. This will be the default storage location for all chemical, fuel and oil requirements. Borrow pits will also be sited at least 50m from all surface watercourses. Construction activities in sensitive locations (including those within 50m of hydrological features) will be carefully considered and also supervised by suitably qualified environmental specialists).
- Oil and chemical storage will meet the minimum requirements of SEPA's PPG2 and PPG26, i.e. good practice secondary containment (bund) volumes. This will apply to all temporary storage locations. All chemical, fuel and oil stores will be sited on impermeable bases within an appropriately-sized secure bund, suitable to contain at least 110% of the contents (for a single tank) or 110% of the contents of the largest container (for multiple tank storage), with default location within the construction compound. Materials will be stored in accordance with applicable COSHH (Control of Substances Hazardous to Health Regulations) requirements. Empty chemical/fuel containers will be retained within the construction compound (bunded area) until collected from site. No underground storage devices will be employed.
- Site compounds will be secure environments, with locked storage containers to prevent unauthorised releases (including via theft or vandalism).
- Storage of chemicals and/or fuel will be limited to the minimum required to serve immediate need, in order to minimise the volumes of chemicals and fuels stored on site. Biodegradable oils will be used as a substitute for standard oil/grease, wherever practical.
- Substations and other areas of hardstanding planned to store hazardous materials or to have equipment installed containing such materials, (for example transformers), will have appropriate pollution prevention measures incorporated in their design.
- Delivery and refuelling of vehicles and machinery will be carried out in specific designated impermeable and bunded areas such as construction compounds or other suitably equipped sites and will be carried out under supervision. Associated equipment such as refuelling hoses, vent pipes, delivery pipes and sight gauges will be contained within bunded areas.
- Contingency measures will contain items identified in PPG21 and will include emergency plans for different pollution incidents, fire procedures, emergency contact telephone lists, spill kits located at appropriate locations on site and staff trained and equipped to deal with incidents effectively.
- Standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Vehicle maintenance and repairs will be undertaken in the construction compound. Exceptionally, vehicles or other equipment that has broken down will require maintenance at the point of breakdown. Special precautions will be taken in this eventuality, including the use of drip trays and spill kits to prevent pollution.
- Runoff from the construction compound areas carries a higher risk of being contaminated and will be treated appropriately, such as by oil interception and/or neutralisation of high alkalinity.
- No pesticides, detergents or rock salt will be applied to access tracks or any other site infrastructure during any phase of the project. Should exceptional circumstances occur which may necessitate the use of such materials, advice will be sought from SEPA regarding good practice and required volumes.
- There will be no onsite water abstraction, with ready-mix cement brought to the rather than using a concrete batching plant. This reduces the potential for pollution but will require clear procedures for offloading cement. Pre-cast concrete structures will be considered for all appropriate locations. Use of wet concrete in the vicinity of watercourses will be minimised and carefully controlled. Competent personnel will confirm that details such as rainwater removal and good quality shuttering are *in situ* prior to pour. Particular care will be taken to develop robust procedures where concrete will be used between cables and stream beds (to protect the cable from scour) at excavated cable stream crossing locations. Geochemical testing will be undertaken to establish the likelihood of sulphate attack on concrete. If necessary, sulphate resistant concrete will be used.
- The washing out of concrete mixing plant, if deemed necessary to be carried out on site, will be carried out in a contained area and a settlement and re-circulation system for water reuse will be discussed with SEPA. Wash water will be adequately treated to deal with suspended solids and high alkalinity before discharge. Wash out activities for the plant and vehicles will be carried out in accordance with a clear procedure developed in consultation with SEPA, with a key element being clarity of process for operators. A lined settlement pond will be provided to prevent infiltration of alkaline runoff into soils, groundwater and adjacent watercourses. If a discharge licence is required under the CAR Regulations, consultations will be carried out with SEPA at the earliest practical stage in the detailed design process.
- A ground investigation will be undertaken for any location where directional drilling is deemed necessary, such as should cables require to be drilled below stream beds, to ensure ground conditions are suitable. If grout or any drilling lubricants are to be used, these will have appropriate protocols developed and communicated for storage, use and collection.
- Should any contaminated groundwater or surface water be identified, work will cease, enabling investigation of the source of contamination and development of measures to contain and/or remove pollutant (this will include any water within cable trench).
- All sewage and waste water will be collected on site in an appropriately designed and located tank and will be tankered from site at an appropriate frequency or, with Scottish Water agreement, removed via direct connection to Scottish Water sewer systems. Disposal of sewage from the site will be carried out by methods recommended in PPG04. In all cases, final disposal will be into the local sewer system at a location agreed with Scottish Water.

Erosion and Sedimentation

8.116 Erosion control is recognised as being more effective than sediment control in preventing water pollution, i.e. minimising generation of sediment and control 'at source'. This 'prevention-led' philosophy will be applied to this project. Careful construction project programming will take account of interactions between construction, erosion and sedimentation, thus reducing the potential for adverse effects.

8.117 All construction work will be undertaken to meet current good practice standards, including recommendations in CIRIA guidance documents such as Control of water from linear construction projects[xxxi] and Handbook for construction of SUDS[xxxii]. Specific measures that will be employed include:

- Where practicable, vehicles will use existing tracks or prepared surfaces rather than disturbing unprepared ground. Where plant movement is necessary off track, low ground pressure vehicles will be utilised, particularly at locations where ground conditions are considered sensitive.
- Areas recently disturbed and cleared of vegetation are prone to sediment wash-off, even in low intensity rainfall. In consequence, vegetation clearance will be scheduled only as needed ('just in time' principle). Specific erosion control precautions will be taken at stream crossing locations and other areas where construction work is required within 50m of watercourses. In areas identified as at increased risk of sediment contamination, a double line of sediment containment measures will be considered.
- Buffer strips will be retained as vegetated features between development features and watercourses, acting as filters, minimising sediment transport, attenuating flows and maximising infiltration. These will preferentially be placed on flat ground. Location and distance of buffer strips from watercourses will be determined taking into account geology, topography and vegetation characteristics. A vegetated buffer of at least 20m will be retained around all water features in order to protect these features from sediment contamination, with the exception of stream crossing locations where specific controls will be put in place.
- Sediment-laden water can reduce the efficiency of SuDS features through clogging and reduction in channel capacity. All discharges with heavy sediment load will be routed through balancing tanks and one or more suitable filters or silt busters, in series as necessary, to reduce the sediment load. The resulting supernatant water will be discharged onto vegetated surfaces and directed away from burns and ditches to avoid direct entry into watercourses. Sediment slurry will be stored appropriately prior to being tankered offsite for appropriate further treatment and disposal.
- Silt traps and sediment settlement tanks will be inspected and cleared regularly to ensure they remain fully operational and effective. Removed sediment will be collected for offsite disposal. All silt traps and settlement tanks will be designed and constructed to accommodate 1-in-200 year rainfall events, to minimise the potential for sediment-laden water overflowing into local watercourses. 'Splashboards' will be fitted on any temporary bridging structures, prior to their use as crossings, in order to reduce the splash/wash of sediment-laden surface water directly into watercourse channels below.
- Site tracks will be designed and constructed to good practice standards. The tracks will be constructed with sufficient camber or crossfall to minimise the ponding of surface water on the track surface, to minimise track erosion and reduce the risk of downstream sediment deposition.
- Temporary interception bunds, sheet piles and/or drainage ditches will be constructed upslope of excavations such as borrow pits to minimise surface runoff ingress and in advance of excavation activities. These cut-off ditches will be of the minimum required length, depth and gradient. The same approach will be applied to interception of surface water around soil stockpiles.
- Soil removed during excavation activities will be stored nearby and battered or otherwise protected such that it will not dry out or be liable to erosion, and can be used subsequently to reinstate the excavated area. Protective coverings (such as jute, coir or geotextiles) will be considered as temporary measures to protect the stockpiles from rainfall and wind erosion. Where bare ground exhibits rough external characteristics these are less prone to erosion than smooth slopes and will revegetate faster. This approach is likely to be most applicable to areas adjacent to track construction (CIRIA, 2006) whereas individual stockpiles adjacent to turbines or borrow pits may be more suitable for covering.
- Excavated material or other forms of loading will not be placed on or close to breaks in slope or other potentially unstable slopes.
- Re-vegetation will be encouraged to minimise sediment loss. Techniques such as replacement of turves, protection of in situ seed bank, reseeding with native vegetation can be used, all with an aim to encourage viable vegetation cover within 12 months (with particular focus on riparian vegetation regeneration at locations adjacent to watercourses where fluvial erosion may be expected).
- Care will be taken to remove turves of vegetation with minimal damage using suitable equipment. In order to retain good quality turves storage time will be minimised, with an aim of no longer than 6 weeks from lift to replacement at track side. Longer timescales are anticipated at turbine and hardstanding areas due to areas involved and construction programme requirements. The aim is a maximum of 12 weeks from lift to replacement at such sites. Watering of stored and recently replaced turves will occur during prolonged weather conditions that could lead to desiccation (dry windy conditions for example), to encourage successful re-establishment.
- Cable trenches will be laid in the disturbed material adjacent to tracks. Where conditions are suitable, that is on deeper subsoil, cable can be laid using a plough 'lift and turn' process which lifts and turns the required depth of material over, exposing the trench. The cable is immediately laid and the overlying material turned back to its original position, burying the cable. This method is effective and swift and produces very little damage to the surface.
- Where cable watercourse crossing requirements are not adjacent to track crossings suitable conduits will be placed below drain channels to minimise disturbance and erosion potential. The laying of such conduits will be undertaken using construction industry good practice techniques, with reference to SEPA CAR Guidance on engineering activities near watercourses.
- Wheelwash plants will be set up at agreed locations for vehicles coming offsite, consideration will be given to the application of dry wheel cleaning systems. A road sweeping vehicle will be employed on site to maintain the site access area in order to minimise accumulation and transport of dust, mud and other loose debris.
- Borrow pits will have appropriate and specific drainage treatment, likely to involve a series of settlement lagoons during borrow pit operation to remove particulates, with monitoring to ensure that the quality of final output is suitable for discharge to the local environment (with no direct connection to natural watercourses). Specification of treatment will be confirmed at the detailed design stage. These lagoons would be removed on restoration of the borrow pit following confirmation of runoff being of suitable quality for direct discharge.
- All excavation and earthworks will be suspended during and immediately following periods of heavy rainfall in order to minimise sediment generation and soil damage. Rainfall forecasts will be used as an early warning system.

Modification of Surface Water Drainage Patterns

8.118 The principles on which the surface water management strategy will be devised are:

- minimised locations and extents where engineering works are planned in the riparian zone;
- runoff from the developed area will not be significantly different from runoff prior to development;
- runoff from the developed area will not result in any downgrading in the status or quality of downstream watercourses or habitat.

8.119 To achieve this, the following measures will be implemented:

- Artificial drainage will be installed only where necessary. The individual lengths, depths and gradients of these drains will be minimised to avoid intercepting large volumes of diffuse overland flow and generating high velocity flows during storm events.
- Drainage features will, wherever practical, be installed in advance of ground being cleared of vegetation, with sustainable drainage techniques specifically targeted at the substation location to mitigate any increases in flows due to the impermeable surface area of the substation.
- Cross-drains will be constructed at appropriate intervals to conduct surface flow across the track to discharge it from the drainage system. Frequent discharge points will limit the concentration of surface runoff and diversion of flows between sub-catchments.
- In-channel works will be minimised and carefully managed where necessary will reduce the potential for impediments to flows.
- SEPA will be fully consulted regarding the requirements for registration or licensing of elements of the drainage system such as discharges and stream crossings under the *Water Environment (Controlled Activities) (Scotland) Regulations 2011* (known as CAR).
- All watercourse crossing structures will be designed and constructed using good practice techniques and will be of sufficient capacity to receive 1:200 year storm flows, with an allowance for increased flows due to climate change.
- Watercourse crossings will not restrict water flow, hinder the passage of mammals along the banks, where mammals are present, or form a barrier to suspected fish migration. They will be designed and constructed following guidance published by the Scottish Executive, River Crossings and

Migratory Fish: Design Guidance[xxxiii] and will be engineered in accordance with CIRIA[xxxiv] and SEPA[xxxv] river crossing guidance.

- Increased data has been provided for the single CAR-applicable stream crossing, which is of the unnamed tributary to the Backside Burn shown on the OS 1:50,000 mapping. This data includes channel characteristics, watercourse photographs, theoretical flow values, catchment area and suggested crossing types. This is provided in **Figure 8.8**.
- The crossing of all smaller watercourses will follow the SEPA General Binding Rules under CAR, **Figure 8.9**provideslocation details of typical smaller watercourse crossing locations (not shown on OS 1:50,000 mapping and hence non-CAR) and representative site photographs of flush zones, small natural channels and drainage/modified channels.

Modification of Groundwater Levels and Flows

8.120 The key concerns for good groundwater management involve careful decisions involving locations of drainage and dewatering activity and ensuring such activities are undertaken sympathetically and minimised in terms of extent and time to avoid excessive influence on groundwater levels and flows. To achieve this, the following measures will be employed:

- where necessary, a permanent drainage system, typically consisting of french drains (using a gravel layer as water conduit, rather than pipework, running downhill to a soakaway zone designed to enable water to percolate back into soil), will be installed at hardstanding locations;
- any necessary dewatering activity will be limited to the minimum necessary duration, with removed water returned locally to minimise hydrological regime alteration, such discharges will be discussed with SEPA to establish appropriate level of licence;
- clay bunds will be installed to divert groundwater flow from cable laying trenches on cross-slope sections, where this is appropriate.

8.121 The above measures will also minimise any effect upon groundwater dependent terrestrial ecosystems.

Compaction of Soils

8.122 This issue is closely aligned to erosion and sedimentation mitigation, discussed above.

- prior to the availability of tracks for heavy vehicles, limiting movements to specific corridors avoiding sensitive receptors such as deep peat will reduce any effect considerably;
- low pressure vehicles will also be employed where vehicles are required to cross sensitive locations;
- where possible topsoil will be stripped in reasonably dry conditions and stored in a mound no more than 2m high;
- stored topsoil will be kept from the passage of vehicles and will be prevented from intermixing with other materials;
- where distinct soil layers are identified, excavated sub-soils will be stored separately from topsoil to enable successful restoration of the soil profile;
- soil reinstatement will be undertaken under reasonably dry conditions to limit compaction. Soil loosening may be required in areas where heavy load traffic has occurred.

Peat Stability

8.123 Early identification of areas of deep peat and/or peat stability concern were an integral part of the design stage. These areas have been avoided but further studies will be necessary pre-construction and will be submitted as Supplementary Environmental Information.

Effects Assessment

8.124 The assessment of effects is based upon the project description outlined in **Chapter 4: Development Description** and is structured as follows:

- construction effects;
- operational effects;
- cumulative effects.

8.125 There are a number of effects which are specific to the construction phase assessment, with a reduced number of effects in the operational and cumulative assessments. The assessment assumes good practice measures outlined above have been incorporated into the scheme design and these do not form mitigation measures.

Receptor Sensitivity

8.126 All watercourses and groundwater receptors have been rated as of **high** sensitivity, given water quality and groundwater vulnerability classifications. This high sensitivity grading also includes surface drainage patterns, given downstream flooding concerns on the Endrick Water.

8.127 There are a number of groundwater dependent terrestrial ecosystems known as GWDTE[xxxvi] on the site, these habitats can be particularly sensitive to changes in groundwater regime and include some areas judged as of moderate groundwater sensitivity[xxxvii]. Taking a conservative approach, the entire site has been considered as being of **high** hydrological sensitivity regarding groundwater levels and flows.

8.128 Soils, where infrastructure is planned, have been rated as of **medium** sensitivity, based on soil characteristics. Higher value areas of deeper peat (deeper than 1.5m) have been avoided following the constraint mapping exercise. Soils are also considered of moderate sensitivity for peat stability, given no evidence of previous failures on the site.

Construction Effects

8.129 The potential for effects to occur is greatest during the construction phase due to the high levels of activity onsite and when there is the greatest rate of change to the existing environment.

Predicted Effects

Pollution Incidents

8.130 During the construction phase a number of potential pollutants will be present onsite, including oil, fuels, chemicals, unset cement and concrete and waste and wastewater from construction activities. With chemicals and oil being stored and used on site, there will remain the potential for an incident, however the adoption of the good practice measures outlined above will reduce the probability of an incident occurring and also reduce the magnitude of any incident due to a combination of good site environmental management including minimised storage volumes, staff training, contingency equipment and emergency plans. Any pollution incident occurring on the site may have a detrimental effect on the water quality of the nearby surface waters, groundwater and/or soil, thereby also indirectly effecting ecology.

8.131 With the implementation of the good practice measures described above, the magnitude of pollution effect on surface water is considered **moderate** and of **low** probability to occur, giving an overall significance of **minor**.

8.132 With the implementation of the good practice measures described above, the magnitude of pollution effect on groundwater is considered **moderate** and of **low** probability to occur, giving an overall significance of **minor**.

8.133 With the implementation of the good practice measures described above, the magnitude of pollution effect on soil is considered **moderate** and of **low** probability to occur, giving an overall significance of **minor**.

Erosion and Sedimentation

8.134 Soil erosion and sediment generation may occur in areas where the ground has been disturbed, particularly at watercourse crossings or where surface water flows have been concentrated. Drainage ditches are particularly prone to this problem, due to the high velocities of surface water passing through the drainage network. Greater sediment generation is to be expected where the ground has been excavated for turbine bases.

8.135 Sediment transport in watercourses can result in high turbidity levels which effect the ecology, particularly fish stocks, by reducing the light and oxygen levels in the water. Sediment deposition can further effect watercourses by potentially smothering plant life and spawning grounds and can reduce the flood storage capacity of channels and block culverts, resulting in an increased flood risk.

8.136 Requirements for soil excavation, transport and storage may lead to additional sedimentation issues at locations where new track, crane hardstandings or foundation construction activities are necessary. Borrow pits have the potential to release sediment-laden runoff if measures are not taken to minimise surface water input into such areas and to adequately treat flows from the borrow pit.

8.137 With the implementation of the good practice measures described above, the magnitude of an erosion effect on soil is considered **moderate** and of **high** probability to occur, giving an overall significance of **moderate** (**significant**).

8.138 With the implementation of the good practice measures described above, the magnitude of sedimentation effect on surface water is considered **moderate** and of **high** probability to occur, giving an overall significance of **moderate** (**significant**).

Modification of Surface Water Drainage Patterns

8.139 The local watercourses on the site have been identified as having a flashy response to rainfall events, as demonstrated by rapid response times and high peak flows. In addition, very low flows may be recorded in site watercourses during dry periods, such as in summer months. It is recognised that changes in river siltation, land drainage, water quality, the presence of river obstructions and river flow reductions can have a detrimental effect on the populations of fish, freshwater invertebrates and species dependent on the water environment.

8.140 Turbine bases and other constructed impermeable surfaces will restrict the infiltration of rainfall into the soil and underlying superficial deposits, resulting in localised increased volumes of surface runoff. The area of impermeable surface created will be very small in comparison with the Backside Burn catchment, as only the turbine, substation and compound bases will be designed as impermeable, with the unbound tracks likely to act as semi-permeable features with limited infiltration potential.

8.141 The interception of diffuse overland flow by new tracks and their drains may disrupt the natural drainage regime of the site by concentrating flows and influencing drainage in soils. This effect will be incremental during the construction phase and the main effect may only become apparent during the operational phase of the wind farm.

8.142 Surface flows can be impeded by construction activity in or adjacent to stream channels, poor choice of crossing locations and inadequately designed crossing structures. Blockages can be caused by inadequate control of earthmoving plant, sedimentation and poor waste management, all of which could lead to flooding upstream. Downstream in the lower reaches of the Endrick Water there are a number of flood-sensitive locations, such as at Fintry.

8.143 With the implementation of the good practice measures described above, the magnitude of effect on surface water drainage patterns is considered **minor** and of **medium** probability to occur, giving an overall significance of **minor**.

Modification of Groundwater Levels and Flows

8.144 Deep excavations, such as those required for the turbine foundations, can disrupt shallow groundwater systems. Groundwater controls, such as physical cut-offs or dewatering, will be utilised to prevent the excavations filling with water. This is likely to result in the lowering of groundwater levels in the immediate vicinity of the excavations and alterations to flow paths during dewatering activities.

8.145 Access tracks may interrupt shallow groundwater flow. There may be some infiltration of water through the access tracks, but the majority of the water will enter the surface water drainage system and will be discharged downslope of the access track at discrete points.

8.146 Cable trenches, particularly if backfilled with more permeable material than surrounding soil, can create preferential pathways for groundwater flow, resulting in local lowering of groundwater level.

8.147 The effects of dewatering are likely to be local and temporary with groundwater expected to return to former levels quickly following cessation of such activities. It is possible that there will be local lowering of the water table close to track corridors. The result of lowering of the water table may be a localised corridor of altered vegetation and ecology. Turbine foundations and borrow pit excavations will permanently alter groundwater flows at the coincident locations, however it would be expected that natural conditions of groundwater level and flow will recur close to these locations.

8.148 Groundwater dependent terrestrial ecosystems may be adversely effected by local changes in the groundwater regime, potentially resulting in altered vegetation in corridors close to infrastructure.

8.149 With the implementation of the good practice measures described above, the magnitude of effect on groundwater levels and flows is considered **minor** and of **medium** probability to occur, giving an overall significance of **minor**.

Compaction of Soils

8.150 Compaction may damage the vegetation and result in a reduction in soil permeability and rainfall infiltration, particularly on peat, thereby increasing the potential for longer-term erosion from surface water runoff. Stockpiled and exposed areas of soils could be at risk of desiccation and erosion.

8.151 As the majority of vehicle movements will be restricted to site tracks or hardstanding areas, any effect will be very localised and temporary in nature, restricted to the earliest phases of construction. Site monitoring will identify any areas where effects are noted and enable a fast response to minimise effect.

8.152 With the implementation of the good practice measures described above, the magnitude of effect of compaction of soil is considered **minor** and of **low** probability to occur, giving an overall significance of **negligible**.

Peat Stability

8.153 Peat slides are a natural occurrence that can occur without human interference, but issues such as removal of slope support or increased loading upon slopes can either increase the likelihood of an event occurring or can increase the scale of the failure. No evidence of peat slides within the study area were identified during the desk study or site surveys, however, there are steep slopes and peat recorded on these provides potential for their occurrence.

8.154 Peat slides affect soil (and associated habitats) and potentially downstream water systems where soil inundation can lead to sedimentation reducing water quality and modification in drainage patterns. The various receptors of a peat stability failure have been separated for this evaluation.

8.155 With the implementation of the good practice measures described above, the magnitude of effect of a peat stability failure on soil loss is considered **moderate** and of **medium** probability to occur, giving an overall significance of **minor**.

8.156 With the implementation of the good practice measures described above, but prior to mitigation, the magnitude of effect of a peat stability failure on surface water sedimentation is considered **moderate** and of **medium** probability to occur, giving an overall significance of **moderate** (**significant**).

8.157 With the implementation of the good practice measures described above, once again prior to mitigation, the magnitude of effect of a peat stability failure on surface water drainage is considered **moderate** and of **medium** probability to occur, giving an overall significance of **moderate** (**significant**).

Proposed Mitigation

Erosion and Sedimentation

8.158 Due to the large number of watercourses draining the slopes of the site, including a large number of watercourse crossings anticipated on the access track, it will be very important to ensure that, in addition to the good practices measures identified above, a number of further mitigation measures are employed to adequately manage erosion and sedimentation in the riparian zone (adjacent to watercourses), these will include:

- gathering detailed characteristics of watercourse crossing locations, to ensure optimum final crossing locations are identified;
- ensuring appropriate site-specific crossing structures will be employed;
- suitably qualified environmental staff will observe watercourse crossing construction, taking account of flow conditions, erosion and sedimentation processes and use of sediment management measures;
- channel conditions will be restored to former state, with photographic evidence of pre-construction and post-construction condition;
- all excavated areas (including turbine bases and borrow pits) and soil storage zones will be carefully managed, with sediment management techniques monitored for efficacy;
- environmental personnel will monitor watercourses downstream of construction activity and have the authority to postpone or halt activities, as appropriate.

Peat Stability

8.159 The combination of deep peat and steep slopes on this site led to the instruction to undertake a Peat Stability Assessment as a Technical Appendix (see Appendix 8.2 Peat Stability Assessment), this involved a large initial peat depth survey across the general site area, followed by more detailed probing at planned infrastructure locations as the design evolved, providing feedback to the client at regular intervals.

8.160 The Peat Stability Assessment highlighted 7 small areas of initial stability concern (2 high risk, 5 moderate risk), with detailed assessment undertaken at these areas involving additional peat depth probing, peat coring (providing decomposition and bulk density data), surface shear vane tests, photographs and interpretation to gain more understanding of ground characteristics to inform appropriate mitigation suggestions.

8.161 Where activities are close to areas of concern, a number of mitigation measures will be employed, these include:

- avoidance of removal of slope support;
- avoidance of heavy loading on slopes, particularly avoiding breaks of slope;
- good drainage practice to ensure flows not concentrated onto slopes or into excavations;
- earthmoving activities will be restricted during and immediately after intense and prolonged rainfall events;
- re-establishing vegetation cover on exposed ground to anchor soil;
- on-going monitoring of key areas of concern to for signs of slope instability;
- creation and management of geotechnical risk register or similar management system throughout the detailed design and construction phases.

8.162 Following the detailed assessment and suggested mitigation measures, the risk at all 7 areas of concern was reduced to low.

Residual Effects

Pollution Incidents

8.163 The magnitude of pollution effect on surface water is considered to remain **moderate** and of **low** probability to occur, giving an overall significance of **minor**.

8.164 The magnitude of pollution effect on groundwater is considered to remain **moderate** and of **low** probability to occur, giving an overall significance of **minor**.

8.165 The magnitude of pollution effect on soil is considered to remain **moderate** and of **low** probability to occur, giving an overall significance of **minor**.

Erosion and Sedimentation

8.166 There remains the potential for increased erosion and associated sedimentation where earthworks are necessary, such as turbine foundations, borrow pits and track routes. Areas close to watercourses are particularly susceptible to these issues, where any alteration of stream banks and bed are still likely to cause increased levels of erosion and downstream sedimentation. The outline mitigation measures include interceptor drainage to divert surface flows from soil stockpiles, filter strips and good practice at stream crossings. On-going monitoring of watercourses for erosion and sedimentation will also enable a fast response to observed issues and therefore reduce the overall effect. These measures will reduce both the probability of an incident occurring and the volume of material involved in an incident if it does occur.

8.167 With the implementation of the additional mitigation measures described above, the magnitude of an erosion effect on soil is considered to be reduced to **minor**, remaining at **high** probability to occur, giving an overall significance of **minor**.

8.168 With the implementation of the additional mitigation measures described above, the magnitude of sedimentation effect on surface water is considered to be reduced to **minor**, remaining at **high** probability to occur, giving an overall significance of **minor**.

Modifications of Surface Water Drainage Patterns

8.169 The magnitude of effect on surface water drainage patterns is considered to remain **minor** and of **medium** probability to occur, giving an overall significance of **minor**.

Modification of Groundwater Levels and Flows

8.170 The magnitude of effect on surface water drainage patterns is considered to remain **minor** and of **medium** probability to occur, giving an overall significance of **minor**.

Compaction of Soils

8.171 The magnitude of effect of compaction of soil is considered to remain **minor** and of **low** probability to occur, giving an overall significance of **negligible**.

Peat Stability

8.172 The additional information gained during the Peat Stability Assessment process, plus ongoing monitoring of areas of more risk, gives confidence that the probability of a peat slide event effecting local receptors is reduced.

8.173 With the implementation of the additional mitigation measures described above, the magnitude of effect of a peat stability failure on soil loss is considered to remain **moderate**, with the probability reduced to **low**, giving an overall significance of **minor**.

8.174 With the implementation of the additional mitigation measures described above, the magnitude of effect of a peat stability failure on surface water sedimentation is considered to remain **moderate**, with the probability reduced to **low**, giving an overall significance of **minor**.

8.175 With the implementation of the additional mitigation measures described above, the magnitude of effect of a peat stability failure on surface water drainage patterns is considered to remain **moderate**, with the probability reduced to **low**, giving an overall significance of **minor**.

Operational Effects

8.176 Operational activities would be expected to involve routine maintenance and testing. There may however be a very infrequent requirement for larger scale activity in certain circumstances, such as turbine replacement.

Predicted Effects

Pollution Incidents

8.177 The risk of pollution is substantially lower during operation than during construction because of the decreased levels of activity on the site. The majority of the potential pollutants will have been removed when construction is complete. The turbines and other necessary ancillary equipment which will be installed onsite will require routine maintenance plus there will be vehicular traffic operating, therefore the potential for spillage will remain.

8.178 With the implementation of the good practice measures described above, the magnitude of pollution effect on surface water is considered **minor** and of **low** probability to occur, giving an overall significance of **minor**.

8.179 With the implementation of the good practice measures described above, the magnitude of pollution effect on groundwater is considered **minor** and of **low** probability to occur, giving an overall significance of **minor**.

8.180 With the implementation of the good practice measures described above, the magnitude of pollution effect on soil is considered **minor** and of **low** probability to occur, giving an overall significance of **negligible**.

Modification of Surface Water Drainage Patterns

8.181 As the man-made impermeable areas are small in comparison with the catchment area no appreciable increase in runoff volumes is expected, even at Backside Burn catchment level.

8.182 The interception of diffuse overland flow by the tracks and their drains may disrupt the natural drainage regime of the site, with extensive flush zones noted on the site, concentrating flows. New track has been limited to the minimum required length but there remains the potential for drainage alteration.

8.183 Surface flows would be most likely to be impeded during operation due to lack of maintenance of stream crossing structures (e.g. blockages caused by aggregation of small particulates or individual large items) although sedimentation may also be possible as a result of alteration to hydrological regime.

8.184 Following the good practice measures outlined will reduce the magnitude of the potential effect, via a good practice crossing structure design and sustainable drainage design features including soakaways and french drains which will encourage infiltration into soil and increasing the lag time in peak flows following rainfall events. These features will mitigate against any onsite flooding and avoid increasing peak surface water flows from the site which could exacerbate existing flood risk issues on the downstream Endrick Water.

8.185 With the implementation of the good practice measures described above, the magnitude of effect on surface water drainage patterns is considered **minor** and of **medium** probability to occur, giving an overall significance of **minor**.

Modification of Groundwater Levels and Flows

8.186 Groundwater levels may be influenced by the drainage features installed at the construction phase, they may also be influenced by local alterations in groundwater regime such as where foundations or track construction leads to changes in level or flow. Such issues are more likely to become apparent in the operation phase than during construction, where corridors of altered vegetation may occur adjacent to tracks and other locations where the natural regime has changed.

8.187 With the implementation of the good practice measures described above, the magnitude of effect on groundwater levels and flows is considered **minor** and of **low** probability to occur, giving an overall significance of **minor**.

Proposed Mitigation

8.188 No mitigation measures, beyond the good practice measures outlined above, including site environmental monitoring, are proposed during the operational phase of the project.

Residual Effects

Pollution Incidents

8.189 The magnitude of pollution effect on surface water is considered to remain **minor** and of **low** probability to occur, giving an overall significance of **minor**.

8.190 The magnitude of pollution effect on groundwater is considered to remain **minor** and of **low** probability to occur, giving an overall significance of **minor**.

8.191 The magnitude of pollution effect on soil is considered to remain **minor** and of **low** probability to occur, giving an overall significance of **negligible**.

Modification of Surface Water Drainage Patterns

8.192 The magnitude of effect on surface water drainage patterns is considered to remain **minor** and of **medium** probability to occur, giving an overall significance of **minor**.

Modification of Groundwater Levels and Flows

8.193 The magnitude of effect on groundwater levels and flows is considered to remain **minor** and of **low** probability to occur, giving an overall significance of **minor**.

Cumulative Effect Assessment

8.194 Cumulative effects relating to this chapter have been considered using a catchment-based approach, as discussed in the hydrology description. Geology and soil cumulative effects are considered limited to the site area, however surface water and groundwater pathways have the potential to cause cumulative effect.

8.195 Specific to wind farm developments, there are a number of developments in this area, those of most interest are those within the same catchments as the site. With reference to SEPA's catchment mapping and SNH's windfarm map dated August 2012[xxxviii], Earlsburn, Earlsburn North and Craigengelt are already approved/installed, with Kingsburn and Loaninghead at scoping stage. There is also a foreseeable potential for some of these projects to request an extension.

Predicted Cumulative Effects

8.196 Due to the specific locations of each of these projects, runoff from the watercourses draining the Craigton and Spittalhill site will not pass through the other sites, however all of these contribute to overall water quality and flow within the Endrick Water catchment. There is the potential for flow levels, sediment or other contaminant levels to be heightened downstream due to site activities at all these sites, particularly if there were coincident construction phases.

8.197 The issues of most concern would be pollution of surface water and groundwater, plus modifications to surface water drainage during the construction phase. During the operational phase, on-going modification to surface water flows would be the main concern.

8.198 Given the design philosophy inherent in this development, with application of the good practice and mitigation measures recommended including all structures close to watercourses designed for 1:200 year flood events, pollution prevention procedures (including sediment management), sustainable drainage principles throughout and environmental monitoring, it is judged that this development will not cause an adverse cumulative influence on existing developments or those that may be planned downstream within the same hydrological catchments.

8.199 The differing construction programming that would be anticipated to occur across other developments mean it is considered unlikely that water quality and flow issues would be coincident across a number of sites in a manner that would lead to an adverse cumulative effect downstream.

8.200 With the site location in the headwaters of the Endrick Water catchment, it is unlikely there will be other developments upstream that may contribute to the site effect.

8.201 With the implementation of the good practice measures described above, the magnitude of the cumulative pollution effect on surface water during construction is considered **minor** and of **low** probability to occur, giving an overall significance of **minor**.

8.202 With the implementation of the good practice measures described above, the magnitude of the cumulative pollution effect on groundwater during construction is considered **minor** and of **low** probability to occur, giving an overall significance of **minor**.

8.203 With the implementation of the good practice measures described above, the magnitude of the cumulative effect on surface water drainage patterns during construction is considered **minor** and of **low** probability to occur, giving an overall significance of **minor**.

8.204 With the implementation of the good practice measures described above, the magnitude of the cumulative effect on surface water drainage patterns during operation is considered **minor** and of **low** probability to occur, giving an overall significance of **minor**.

Proposed Mitigation

8.205 No mitigation measures, beyond the good practice measures outlined above, including site environmental monitoring, are proposed for cumulative effects. It would be anticipated that other sites would similarly follow similar good practice methodology.

Residual Cumulative Effects

8.206 These effects will remain as per the above section, as there are no proposed mitigation measures.

Further Survey Requirements and Monitoring

8.207 Surface water quality will be monitored prior to and during construction, primarily reviewing pH and turbidity to establish pre-construction natural seasonal levels and then during construction activities.

8.208 Slope stability monitoring will occur during pre-construction and construction phases of work. These would focus on locations highlighted as being of concern, as per the Peat Stability Assessment Technical Appendix (Appendix 8.2).

8.209 All monitoring activities will be discussed with SEPA and other stakeholders to ensure frequency, determinants and monitoring locations are appropriate.

Summary of Effects

8.210 The effects detailed in the tables below (**Tables 8.12, 8.13 and 8.14**) are with reference to the criteria identified in **Tables 8.2**, **8.3** and **8.4** and the mitigation measures from the applicable sections of text above. Following the implementation of good practice measures and specific mitigation measures outlined, no significant effects are predicted.

Table 8.12: Summary of Effects (Construction)

Predicted Effect	Pre-Mitigation Significance of Effect	Mitigation	Significance of Residual Effect
Pollution of surface waters	High sensitivity Moderate magnitude Low probability Resulting in minor effect **Not significant**		High sensitivity Moderate magnitude Low probability Resulting in minor effect **Not significant**
Pollution of groundwater	High sensitivity Moderate magnitude Low probability Resulting in minor effect **Not significant**		High sensitivity Moderate magnitude Low probability Resulting in minor effect **Not significant**
Pollution of soil	Medium sensitivity Moderate magnitude Low probability Resulting in minor effect **Not Significant**		Medium sensitivity Moderate magnitude Low probability Resulting in minor effect **Not Significant**
Erosion or loss of soil	Medium sensitivity Moderate magnitude High probability Resulting in moderate effect **Significant**	Carefully managed and monitored riparian zone construction activities to reduce likelihood of erosion and to minimise soil loss, should it occur Reducing magnitude to minor	Medium sensitivity Minor magnitude High probability Resulting in minor effect **Not Significant**
Sedimentation of surface waters	High sensitivity Moderate magnitude High probability Resulting in moderate effect **Significant**	Carefully managed and monitored riparian zone construction activities to reduce likelihood of erosion and to minimise soil loss, should it occur, as this will be the primary cause for sedimentation Reducing magnitude to minor	High sensitivity Minor magnitude High probability Resulting in minor effect **Not Significant**
Modifications to surface water drainage patterns	High sensitivity Minor magnitude Medium probability Resulting in minor effect **Not Significant**		High sensitivity Minor magnitude Medium probability Resulting in minor effect **Not Significant**
Modification to groundwater levels or flows	High sensitivity Minor magnitude Medium probability Resulting in minor effect **Not Significant**		High sensitivity Minor magnitude Medium probability Resulting in minor effect **Not Significant**
Compaction of soil	Medium sensitivity Minor magnitude Low probability Resulting in negligible effect **Not Significant**		Medium sensitivity Minor magnitude Low probability Resulting in negligible effect **Not Significant**
Peat stability failure; soil loss	Medium sensitivity Moderate magnitude Medium probability Resulting in minor effect **Not Significant**	Good practice geotechnical techniques in areas of concern, including routine monitoring for early evidence of slope failure and remedial action Reducing probability to low	Medium sensitivity Moderate magnitude Low probability Resulting in minor effect **Not Significant**

Predicted Effect	Pre-Mitigation Significance of Effect	Mitigation	Significance of Residual Effect
Peat stability failure; sedimentation of surface waters	High sensitivity Moderate magnitude Medium probability Resulting in moderate effect **Significant**	Good practice geotechnical techniques in areas of concern, including routine monitoring for early evidence of slope failure and remedial action Reducing probability to low	High sensitivity Moderate magnitude Low probability Resulting in minor effect **Not Significant**
Peat stability failure; modification to surface water drainage	High sensitivity Moderate magnitude Medium probability Resulting in moderate effect **Significant**	Good practice geotechnical techniques in areas of concern, including routine monitoring for early evidence of slope failure and remedial action Reducing probability to low	High sensitivity Moderate magnitude Low probability Resulting in minor effect **Not Significant**

Table 8.13: Summary of Effects (Operational)

Predicted Effect	Pre-Mitigation Significance of Effect	Mitigation	Significance of Residual Effect
Pollution of surface waters	High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**		High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**
Pollution of groundwater	High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**		High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**
Pollution of soil	Medium sensitivity Minor magnitude Low probability Resulting in negligible effect **Not significant**		Medium sensitivity Minor magnitude Low probability Resulting in negligible effect **Not significant**
Modifications to surface water drainage patterns	High sensitivity Minor magnitude Medium probability Resulting in minor effect **Not significant**		High sensitivity Minor magnitude Medium probability Resulting in minor effect **Not significant**
Modification to groundwater levels or flows	High sensitivity Minor magnitude Low probability Resulting in minor effect **Not Significant**		High sensitivity Minor magnitude Low probability Resulting in minor effect **Not Significant**

Table 8.14: Summary of Effects (Cumulative)

Predicted Effect	Pre-Mitigation Significance of Effect	Mitigation	Significance of Residual Effect
Construction Phase Pollution of surface waters	High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**		High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**
Construction Phase Pollution of groundwater	High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**		High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**
Construction Phase Modifications to surface water drainage patterns	High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**		High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**
Operational Phase Modifications to surface water drainage patterns	High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**		High sensitivity Minor magnitude Low probability Resulting in minor effect **Not significant**

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9 Ecology

Introduction

9.1 This chapter of the ES has been completed by MacArthur Green Ltd. It evaluates the effects of the Craigton and Spittalhill Wind Farm (the 'Development') on those ecological resources present. Effects on birds are addressed separately in **Chapter 10: Ornithology** of this ES.

9.2 The Development is described in full within **Chapter 4: Development Description** and illustrated within **Figures 4.1 to 4.7**.

9.3 This chapter is supported by the following Appendices:

- 9.1 Phase 1 habitat survey report;
- 9.2 National Vegetation Classification (NVC) survey report;
- 9.3 Protected Species survey report;
- 9.4 Bat survey report; and
- 9.5 Fisheries survey report.

Study Area Description

9.4 For the purposes of this summary and the subsequent baseline descriptions, the Development Area (hereafter referred to as the site) is defined as the area within which all wind farm infrastructure shall be contained and includes the proposed access track route (see **Chapter 4**, **Figure 4.1**).

9.5 The field surveys extended across a larger area than defined by the site; for the purposes of this report, the area covered by these surveys is referred to as 'the study area' and is detailed separately within the field survey methodologies section (and within the individual appendices).

9.6 The site is dominated by heavily degraded bog habitats, especially on the plateau sections in the west. Marshy grassland is also extensive, especially across the central slopes and within the vicinity of the main watercourse, the Backside Burn, which forms the eastern site boundary in places. Grazing occurs across much of the site, and this along with extensive historic drainage has resulted in the degraded nature of the vast majority of habitats present.

Effects Assessed in Full

9.7 The assessment concentrates on the effects of construction and operation of the Development upon those ecological receptors identified during survey work; in general, effects upon the following will be assessed:

- Designated area: effects include direct (i.e. derived from land-take) and indirect (i.e. changes caused by effects to supporting systems such as groundwater);
- Terrestrial habitats: effects include direct (i.e. derived from land-take) and indirect (i.e. changes caused by effects to supporting systems such as groundwater);
- Aquatic habitats: effects are limited to changes in water conditions through potential pollution effects; and
- Protected species: effects include direct (i.e. loss of life as a result of the Development; loss of key habitat; displacement from key habitat; barrier effects preventing movement to/from key habitats; and general disturbance) and indirect (i.e. loss/changes of/to food resources; population fragmentation; degradation of key habitat e.g. as a result of pollution).

Effects Scoped Out

9.8 Following SNH review of the findings from bat surveys undertaken during 2011 (results are provided at **Appendix 9.4** and there is also brief discussion under 'Existing Conditions', below), no further consideration is given to this receptor within this assessment. Furthermore, effects upon both invertebrates and reptiles have been scoped out due to the perceived limited effects upon both groups.

Assessment Methodology

Assessment Structure

9.9 The assessment method follows the process set out in the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 ('the EIA Regulations') and guidance on the implementation of the EU Birds and Habitats Directives[i].

9.10 The method for assessing the likely significance of effects upon on the integrity of a Special Area of Conservation (SAC) is different from that employed for wider ecological interests. This method is detailed separately in paragraphs 9.30 onwards (Habitats Regulations Appraisal).

9.11 The information provided by these assessment methods will provide sufficient information to allow the competent authority to undertake an appropriate assessment should this be required. This would involve establishing whether the proposal (either alone or in combination with other plans or projects) is likely to have a significant effect on the integrity of the relevant designated site. The relevant designated site with regard to Craigton and Spittalhill Wind Farm is:

- Endrick Water SAC.

9.12 The evaluation for wider ecological interests (i.e. unrelated to the Endrick Water SAC) involves the following process:

- identification of the potential effects of Craigton and Spittalhill Wind Farm;
- consideration of the likelihood of occurrence of potential effects where appropriate;
- defining the Nature Conservation Value of the ecological receptors present;
- establishing the receptor's Conservation Status where appropriate;
- establishing the Magnitude of the likely effect (both spatial and temporal);
- based on the above information, a professional judgement as to whether or not the identified effect is significant with respect to the EIA Regulations;
- if a potential effect is determined to be significant, measures to mitigate or compensate for the effect are suggested where required;
- opportunities for enhancement are considered; and
- residual effects after mitigation, compensation or enhancement are considered.

Data Sources and Guidance

9.13 The following legislation and guidance are considered as part of the assessment:

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna ('Habitats Directive');
- 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');
- Environmental Impact Assessment Directive 85/337/EEC (as amended);
- Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations (2011);
- The Water Environment and Water Services (Scotland) Act 2003 (WEWS);
- The Wildlife and Countryside Act 1981 (as amended);
- Nature Conservation (Scotland) Act 2004 (as amended);
- The Wildlife and Natural Environment (Scotland) Act 2011;
- The Protection of Badgers Act 1992;
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (the Habitats Regulations);

- SERAD (Scottish Executive Rural Affairs Department) 2000. Habitats and Birds Directives, Nature Conservation: Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and 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;
- Policy Advice Note PAN 1/2013 - Environmental Impact Assessment (Scottish Government 2013);
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- Scottish Government (September 2001) Calculating Potential Carbon Losses & Savings from Wind Farms on Scottish Peatlands. Windfarms and Carbon savings on peatlands. Technical Note – Version 2.0.1.

Field Survey

9.14 A desk study was undertaken and covered up to a distance of 5km from the site during summer 2012 and is referenced within the results section and Technical Appendices as appropriate.

9.15 The following field surveys were undertaken in order to inform this assessment (extents noted; further information regarding methods and conditions on site are provided within the section below called 'Existing Conditions'):

- Extended Phase 1 habitat survey (across the full site area);
- National Vegetation Classification (NVC) survey (across the full site area);
- Badger survey (across the full site area and outwith the boundary dependent on prevailing habitat type);
- Bat activity and roost survey (across the site relevant to the survey method);
- Fisheries survey (along the Backside Burn and feeder burn on the site);
- Otter survey (across the site and for a distance of 250m up and downstream of the site boundary); and
- Water vole survey (across the site and for a distance of 250m up and downstream of the site boundary).

Consultation

9.16 A consultation exercise was undertaken as part of the EIA process. **Table 9.1** details the responses that were obtained.

Table 9.1: Consultation Responses

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Scottish Natural Heritage	Formal Scoping Consultation	Proximity to and connectivity with Endrick Water SAC – ES to include detailed measures to prevent pollution to the catchment. Otter surveys should be undertaken. If otters are confirmed as being present then a Species Protection Plan (SPP) should be produced. Effects upon bats can be scoped out based on the findings of the surveys completed in 2011; the results should be presented within the ES.	Effects upon the Endrick Water SAC fully assessed within this chapter. Pollution prevention measures detailed within **Chapter 8: Geology, Hydrology and Hydrogeology** and referenced within this chapter where relevant. Otter surveys completed during 2012. SPP to be produced accordingly. Provided as requested (See **Appendix 9.4**)
SEPA	Formal Scoping Consultation	Disruption to wetlands including peatlands; sufficient consideration should be given to these habitats during the design process as informed by findings from Phase 1 and NVC surveys.	Full Phase 1 and NVC surveys undertaken. Groundwater dependent terrestrial ecosystems identified and fed into the design process as appropriate.

Determining Nature Conservation Value

9.17 Value is defined on the basis of the geographic scale given in **Table 9.2** (which follows standard guidance[ii]). Attributing a value to a receptor is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of a value level. For example, an SAC designated under the Habitats Directive is implicitly of European (International) importance. In the case of species, assigning value is less straightforward as "*it is necessary to consider its distribution and status, including a consideration of trends based on available historical records*". This means that even though a species may be protected through legislation at a national or international level, the relative value of the population on site may be quite different (e.g. the site population may consist of a single transitory animal, which within the context of a thriving local/regional/national population of a species, is clearly of local or regional value rather than national or international).

9.18 Where possible, the valuation of habitat/populations within this assessment makes use of any relevant published evaluation criteria (e.g. Nature Conservancy Council guidance on selection of biological Site of Special Scientific Interest (SSSIs)). Furthermore, JNCC/NBN guidance (2008[iii]) has been consulted where relevant in order that cross-referencing of classifications within different systems can be standardised (e.g. correctly matching NVC types with Annex I habitats where relevant etc.).

9.19 The term used for the ecological receptors affected at the site is 'Valued Ecological Receptors' (VERs).

9.20 Where relevant, information regarding the particular receptor's conservation status is also considered in order to fully define its value. This enables an appreciation of current population or habitat trends to be incorporated into the assessment.

Table 9.2 Approach to valuing ecological receptors (adapted from Hill *et al* 2005[iv])

Value	Description
International	An internationally designated site (e.g., SAC), or site meeting criteria for international designations.
	Species present in internationally important numbers (>1% of biogeographic populations).
National	A nationally designated site (SSSI, or a National Nature Reserve, NNR), or sites meeting the criteria for national designation.
	Species present in nationally important numbers (>1% UK population).
	Viable areas of priority habitat listed on Annex I of the Habitats Directive and smaller areas of such habitat that are essential to maintain the viability of that ecological resource.
Regional (Natural Heritage Zone or Local Authority Area)	Species present in regionally important numbers (>1% of Natural Heritage Zone (NHZ) population); and regionally important populations of a species.
	Regionally significant and viable areas of key habitat identified as being of regional value in the appropriate NHZ.
Local	Local Nature Reserves.
	Areas of semi-natural ancient woodland smaller than 0.25 ha.
	Areas of habitat or species considered to appreciably enrich the ecological resource within the local context, e.g., species-rich flushes or hedgerows.
Negligible	Usually widespread and common habitats and species. Receptors falling below local value are not normally considered in detail in the assessment process.

9.21 The following sections further define the methods used to evaluate the magnitude of likely effects and nature conservation value.

Method Used to Evaluate the Magnitude of Likely Effects

9.22 Effect magnitude refers to changes in the extent and integrity of an ecological receptor. The only definition of ecological 'integrity' within Scottish planning policy is found within Circular 6/1995[i] which states that "*The integrity of a site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified".* Although this definition is used specifically regarding SACs and SPAs, it is applied here to wider countryside habitats and species.

9.23 Determining the magnitude of any likely effects requires an understanding of how the ecological receptors are likely to respond as a result of Craigton and Spittalhill Wind Farm. This change can occur during construction and/or, operation of the wind farm.

9.24 Effects can be adverse, neutral or beneficial.

9.25 Effects are judged in terms of magnitude in space and time. There are five levels of spatial effects and temporal effects as detailed in **Tables 9.3** and **9.4**.

Table 9.3: Definition of Spatial Effect Magnitude upon the VERs

Spatial Magnitude	Definition
Very High	Would cause the loss of the majority of a receptor (>80%), or would be sufficient to damage a receptor sufficient to immediately affect its viability.
High	Would have a major effect on the receptor, sufficient to result in short-term losses and impacts upon its long-term viability. For example, more than 20% habitat loss or damage.
Moderate	Would affect the receptor in the short and medium-term, but should not alter its long-term viability. For example, between 10 - 20% habitat loss or damage.
Low	Would have a minor effect upon the receptor, either of sufficiently small-scale or of short duration to cause no long-term harm. For example, less than 10% habitat loss or damage.
Negligible	Minimal change on a very small scale; effects not dissimilar to those expected within a 'do nothing' scenario.

Table 9.4: Temporal Effect Magnitude

Temporal Magnitude	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as 26+ years), except where there is likely to be substantial improvement after this period in which case the category Long Term may be more appropriate.
Long term	Between 15 years up to (and including) 25 years.
Medium term	Between 5 years up to (but not including) 15 years.
Short term	Up to (but not including) 5 years.
Negligible	No effect.

Significance Criteria

9.26 The significance of potential effects is determined by integrating the assessments of Nature Conservation Value, Conservation Status and Magnitude in a reasoned way.

9.27 **Table 9.5** details the significance criteria that have been used in assessing the effects of Craigton and Spittalhill Wind Farm:

Table 9.5: Significance Criteria

Significance Level	Definition
Major	This is a significant effect, as the effect is likely to result in a long term significant adverse effect on the integrity of the receptor.
Moderate	This is a significant effect, as the effect is likely to result in a medium term or partially significant adverse effect on the integrity of the receptor.

Significance Level	Definition
Minor	The effect is likely to adversely affect the receptor at an inconsequential level by virtue of its limited duration and/or extent, but there will probably be no effect on its integrity. This is not a significant effect.
Negligible	No material effect. This is not a significant effect.

9.28 Using these definitions, it must be decided whether there will be any effects which will be sufficient to adversely affect the VER to the extent that its Conservation Status deteriorates above and beyond that which would be expected should baseline conditions remain (i.e. the 'do nothing' scenario). Furthermore, these predictions are given with a level of confidence relative to the effect being assessed (in line with IEEM 2006[ii])

Cumulative Assessment

9.29 Cumulative effects are not possible to evaluate through the study of one development in isolation, but require the assessment of effects when considered in combination with other developments. The context in which these effects are considered is heavily dependent on the ecology of the receptor assessed but in all cases will involve consideration of the cumulative effects upon the receptor extents/populations relevant to that receptor. For example, for water voles it may be appropriate to consider effects specific to individual catchments, should the distance between neighbouring catchments be sufficient to assume no movement of animals between them.

Habitats Regulations Appraisal Methodology

9.30 The Habitats Directive is transposed into domestic legislation by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations). Regulation 48 indicates a number of steps to be taken by the competent authority (in this case Stirling Council) before granting planning permission (the 'Habitats Regulation Appraisal'). In order of application, these steps are noted below:

- Step 1: Consider whether the proposal is directly connected to or necessary for the management of the site (Regulation 48 (1b)). If not:
- Step 2: Consider whether the proposal, alone or in combination, is likely to have a significant effect ('LSE') on the site (Regulation 48 (1a)). If so:
- Step 3: Make an appropriate assessment of the implications for the site in view of that site's conservation objectives (Regulation 48 (1)).
- Step 4: Consider whether it can be ascertained that the proposal will not adversely affect the integrity of the site ('Integrity Test') having regard to the manner in which it is proposed to be carried out or to any conditions or restrictions subject to which they propose that the consent, permission or other authorisation should be given (Regulation 48 (5 & 6)).

9.31 Following on from these first four steps set out in Regulation 48 there are a further four steps set out by the Habitats Regulations, detailed below:

- Step 5: Refuse planning permission, subject to Regulation 49, unless it has been ascertained that site integrity is not adversely affected (Regulation 48 (5)).
- Step 6: If the proposal fails the Integrity Test, consider if alternative solutions exist (Regulation 49 (1)). If there are alternative solutions then the competent authority should refuse planning permission. If no alternative solutions exist then proceed to next step.
- Step 7: Consider whether the proposal must be carried out for imperative reasons of overriding public interest ('IROPI'). (Regulation 49 (1).
- Step 8: If IROPI is considered to exist, consider whether one can secure any compensatory measures considered necessary to ensure the protection of the overall coherence of Natura 2000 (Regulation 53).

9.32 The information provided within this assessment is sufficient to inform the Habitat Regulations Appraisal and the appropriate assessment which falls within this (Step 3 above).

Limitations

9.33 Limitations exist with regard to the knowledge base on how some species, and the populations to which they belong, react to effects. A precautionary approach is taken in these circumstances, and as such it is considered that these limitations do not affect the robustness of this assessment.

Project Assumptions

9.34 All electrical cabling between the proposed turbines and the substation will be underground and follow the proposed access tracks. Connection between the substation and the electrical grid will be subject to a separate consenting process.

9.35 Implementation of appropriate Environmental Management and Pollution Prevention Plans (EM&PPP) will occur across the site as standard (see **Chapter 4 - Development Description**).

Existing Conditions

9.36 This section details the baseline conditions as recorded on the site.

Desk Study

9.37 Information pertaining to designated sites and species of interest was obtained via consultation with online datasets (specifically the SNHi[1] resource).

9.38 No designated sites are present within the site, with the following sites present within 5km (sites designated for their ecological importance only):

- Endrick Water Special Area of Conservation (SAC)/Site of Special Scientific Interest (SSSI) approximately 1km to the south of the site: designated for its importance to Atlantic Salmon *Salmo salar* (SAC only), river lamprey *Lampetra fluviatilis*, brook lamprey *Lampetra planeri* and Scottish dock *Rumex aquaticus* (SSSI only); and
- Double Craigs SSSI approximately 1km to the west of the site: designated for its calcareous grassland habitat.

9.39 In addition, the following species of interest were also recorded as being present within 5km of the Development (as obtained from SNHi):

- Badger *Meles meles*;
- Otter *Lutra lutra*;
- Pipistrelle bat species *Pipistrellus* sp.;

Field Study

9.40 Details regarding field survey methodologies and results are included within **Appendices 9.1 – 9.5**. The following section summarises the baseline conditions as identified during these surveys.

Habitat Description – Phase 1 and NVC Habitat Survey

9.41 A Phase 1 habitat survey was undertaken during July 2012, with specific survey methods detailed in **Appendix 9.1**. **Table 9.6** summaries the habitat extents recorded and these are illustrated in **Figure 9.1**.

[1] Found at www.snh.gov.uk

Table 9.6: Habitat Types by Area (within the site)

Habitat Type	Area (ha)
Wet Modified Bog	235.82
Marshy Grassland	61.91
Semi-improved Acid Grassland	55.65
Acid Fen	3.12
Continuous Bracken	1.78
Wet Dwarf Shrub Heath	1.22
Standing Water	0.25
TOTAL	359.75

9.42 NVC surveys were also completed in July 2012. Surveys followed standard Joint Nature Conservation Committee (JNCC) methods (as detailed within **Appendix 9.2** and illustrated in **Figures 9.2a and 9.2b**) and resulted in the following communities being recorded from the site: (it should be noted that NVC community representation across the site is often within the context of a mosaic habitat and that although the following habitats were recorded, this does not necessarily translate to a dominance within a particular stand).

M6 - *Carex echinata – Sphagnum recurvum/auriculatum* mire;

M15 - *Scirpus cespitosus – Erica tetralix* wet heath;

M19 - *Calluna vulgaris – Eriophorum vaginatum* blanket mire;

M20 - *Eriophorum vaginatum* blanket mire;

M23 - *Juncus effusus/acutiflorus – Galium palustre* rush-pasture;

M25 - *Molinia caerulea – Potentilla erecta* mire;

MG9 - *Holcus lanatus – Deschampsia cespitosa* grassland;

MG10 - *Holcus lanatus – Juncus effusus* rush pasture;

U4 - *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland;

U6 - *Juncus squarrosus – Festuca ovina* grassland; and

U20 - *Pteridium aquilinum – Galium saxatile* community.

9.43 These results were then referenced against SEPA guidance[v] in order to identify those habitats classified as likely to be groundwater dependent (Ground Water Dependent Terrestrial Ecosystems – GWDTEs), as follows:

M6 - *Carex echinata – Sphagnum recurvum/auriculatum* mire;

M15 - *Scirpus cespitosus – Erica tetralix* wet heath;

M23 - *Juncus effusus/acutiflorus – Galium palustre* rush-pasture;

M25 - *Molinia caerulea – Potentilla erecta* mire;

MG9 - *Holcus lanatus – Deschampsia cespitosa* grassland;

MG10 - *Holcus lanatus – Juncus effusus* rush pasture; and

U6 - *Juncus squarrosus – Festuca ovina* grassland.

9.44 Further to the above, only those communities where a GWDTE was considered to be a dominant/important factor in that community's hydrological structure and function is an assessment of effects upon it within a GWDTE context considered. Subsequently, those incidental GWDTEs within a wider non-GWDTE community/mosaic are not considered any further in this regard.

9.45 The following habitat descriptions are illustrated on **Figure 9.1** within **Appendix 9.1**.

9.46 Peat-based habitats dominate the site, with wet modified bog occupying approximately 66% of the study area. This habitat exhibits relatively little botanical diversity and is symptomatic of a heavily degraded blanket bog, and as such is defined more by the absence of key bog species such as *Sphagnum papillosum* and *S. magellanicum.* Hare's-tail cottongrass *Eriophorum vaginatum* is present throughout, to varying extents with heather *Calluna vulgaris* occurring only infrequently and occupying a much-reduced sward length. Bryophyte presence is dominated by *Sphagnum fallax* and, to a lesser extent, *S. palustre* which suggest a shift away from purely ombrotrophic[2] conditions; the localised relative abundance of herb species such as heath bedstraw *Galium saxatile,* common sorrel *Rumex acetosa* and cuckoo flower *Cardamine pratense* would appear to corroborate this further. Elsewhere, an alternative form of wet modified bog exists where purple moor grass *Molinia caerulea* tussocks dominate, to the exclusion of all other species aside from occasional tormentil *Potentilla erecta*. The wet modified bog habitat is heavily degraded throughout, with historic drainage, grazing and vegetation cutting having resulted in a dried substrate and reduced diversity and sward length. The predominant NVC type within this habitat type is almost exclusively M20, with M19 only very localised in its occurrence. M25 communities are also present within this habitat.

9.47 The wet modified bog habitat also supports numerous acid/neutral flush linear features, especially on the slopes in the west of the site. Here, soft rush *Juncus effusus* is almost exclusively dominant and indicative of locally minerotrophic[3] conditions, often in association with *Sphagnum fallax* and as such are relatively typical M6 NVC communities. These features represent discrete linear features as opposed to extensive habitats.

9.48 Marshy grassland is a commonly occurring habitat across the central areas of the site as well as alongside the Backside Burn for parts of its extent along the north-eastern site boundary. The habitat is rush-dominated throughout, with soft rush and sharp-flowered rush *J. acutiflorus* the dominant species. Herb species presence is locally rich, with cuckoo flower, marsh marigold *Caltha palustris,* marsh thistle *Cirsium palustre,* common sorrel, marsh willowherb *Epilobium palustre* and fen bedstraw *Galium uliginosum* all present. Bryophytes are notably absent. The NVC type here is M23, with both M23a and M23b sub-communities represented.

9.49 Heathland habitat on the site is confined to a very small area of wet dwarf shrub heath at the eastern end of the access route. Here bilberry *Vaccinium myrtillus* and deergrass *Trichophorum cespitosum* are dominant, with patchy heather coverage. *Sphagnum fallax* and *Polytrichum commune* dominate the bryophyte layer. The habitat resembles typical M15 NVC type.

9.50 Continuous bracken *Pteridium aquilinum* habitat is at present confined solely to the hillsides in the far east of the access route. The habitat is characteristically devoid of any associate species and is classified as U20 NVC type.

9.51 Semi-improved grasslands are dominant across much of the access route and reflect a more active grazing regime here (cattle were observed here during surveying). These areas are typically reduced in species diversity and sward length as a result of this grazing pressure and are dominated by Yorkshire fog *Holcus lanatus*, sheep's fescue *Festuca ovina* and sweet-vernal grass *Anthoxanthum odoratum*. There are also pockets of semi-improved grassland across the lower ground in the north-west of the site which exhibit lesser levels of improvement but are still relatively lacking in species diversity with wavy hair grass *Deschampsia flexuosa* and tufted hair grass *Deschampsia cespitosa* present amongst the previously mentioned species.

9.52 Acid fen habitat is confined to a single patch adjacent to where the proposed access route joins the main site. The habitat here shows marked similarities with the marshy grassland described above but has a luxuriant rich *Sphagnum* layer present in which *S. fallax* is almost exclusively dominant. In addition to the herb species described above, this habitat also supports meadowsweet *Filipendula ulmaria* and northern marsh orchid *Dactylorhiza purpurella.* This habitat is classified as M6 NVC type.

9.53 A very small standing waterbody is present in the eastern extents of the access route and is likely to be used by livestock for drinking. The pond has almost total coverage of pond weed *Potamogeten* sp.

[2] i.e. receive all their water and nutrients from precipitation

[3] i.e. receive their water and nutrients mainly from groundwater

9.54 Watercourses across the site are numerous and all relatively similar in terms of the associated vegetation and flow characteristics. The site is drained by the Backside Burn (which ultimately feeds into the Endrick Water approximately 500m downstream of the site), which is a medium-sized upland watercourse with a typical array of run, riffle and pool habitats. The substrate is mainly pebble and cobble-dominated although deposited gravels are also present in places. Those watercourses feeding the Backside Burn from the site share many similar characteristics albeit on a smaller scale. There are however areas where the watercourses flow over a bedrock substrate, with falls/cascades present in these areas. Aquatic vegetation is generally relatively sparse, with the smaller watercourses supporting a greater level of marginal rushes and tall grasses, which extend out from the banks and flank the channels for approximately 5m in most places.

Non-avian fauna

Badger

9.55 Full details pertaining to the legal status of badgers are included within **Appendix 9.3**.

9.56 A single record of a badger from 2006 (road kill) within 5km of the site was obtained during a search of online SNH data sets.

9.57 Field survey methods followed standard guidance and are detailed within **Appendix 9.3**.

9.58 No signs of badger presence were recorded during field surveys, with the site considered generally unsuitable for the species due to the general wetness of the peat-dominated substrate together with an overall lack of suitable shelter/cover. The more improved (grassland) areas would appear to offer greater foraging potential, although these are relatively limited in extent.

Bats

9.59 Full details pertaining to the legal status of bats are included within **Appendix 9.4**.

9.60 Records of pipistrelle bats within 5km of the site (from 2004 to 2007) were obtained during a search of online SNH data sets.

9.61 The following field surveys were undertaken, with full methods detailed within **Appendix 9.4**:

- day transects and roost searches;
- night transects; and
- static activity surveys – Anabat survey.

9.62 Field survey methods were based on best practice guidelines (adapted as appropriate for the site) and are detailed within **Appendix 9.4**.

9.63 A total of five bat species were recorded during surveying as follows:

- Common pipistrelle *Pipistrellus pipistrellus*;
- Soprano pipistrelle *Pipistrellus pygmaeus*;
- Pipistrelle (unidentified); and
- *Myotis* sp.

9.64 No bat roosts were identified during surveying and no significant potential for roosting was noted with the nearest such suitable area likely to be at Spittalhill Farm ca. 2km to the south.

9.65 The most exhaustive data was obtained from the Anabat survey (see **Appendix 9.4**), and revealed that bat activity across the site is low, with a maximum of 1.35 passes per hour recorded. In total, 315 bat passes were recorded from 23940 minutes (44 nights) of static surveying. The maximum average was obtained from a location close to an edge feature (stream), whilst open habitat generated a far lesser figure (0.25).

9.66 The vast majority of all the bat passes recorded were soprano pipistrelle (242 passes), with common pipistrelle (24 passes) the second most abundant.

9.67 *Myotis* sp. were recorded at almost negligible levels, with only 12 passes recorded, averaging 0.031 passes per hour.

9.68 The walked transects revealed a similar picture, but to a much lesser extent with low activity recorded throughout. No records of *Myotis* sp. or unidentified common pipistrelle were made during the walked transects.

9.69 Further to the SNH scoping response (see **Table 9.1**) bats have been scoped out of the assessment due to sufficiently low levels of activity across the site.

Otter

9.70 Full details pertaining to the legal status of otters are included within **Appendix 9.3**.

9.71 Online records (SNHi) for the species were obtained for a number of points within 5km of the site; most commonly along the Endrick Water, although none of these records were from within the last 20 years.

9.72 Standard survey methods were employed and are detailed within **Appendix 9.3**.

9.73 Two relatively old spraints were recorded from the site during protected species surveying. Both records were from the Backside Burn in the north-east of the site and it is likely that animals utilise the site for foraging and commuting purposes, with the habitat suitable for such activity. No holts or couches were recorded with no suitable habitat/features identified.

Water vole

9.74 Full details pertaining to the legal status of water voles are included within **Appendix 9.3**.

9.75 Standard survey methods were employed and are detailed within **Appendix 9.3**.

9.76 No records of water vole presence within the vicinity of the site were obtained during a search of online SNH data sets.

9.77 No signs of water vole presence were recorded during surveying. The site does however appear to support suitable habitat for the species, with numerous vegetated minor watercourses/drainage channels which would provide suitable food resource and cover.

Fish

9.78 Electrofishing surveys were undertaken by the Forth Fisheries Trust and are detailed within **Appendix 9.5**.

9.79 Four sites were electro-fished in order to establish fish populations across the site. A total of four brown trout *Salmo trutta* (one adult and three juveniles) were caught during the survey, which represents an exceedingly low density. The highest fish density was recorded from the second survey point where a value of 0.019 trout/m^2. The habitat quality is considered generally suitable for supporting a larger population than was recorded, with no obvious limiting factors in terms of water quality riparian management or additional anthropogenic influence. It is considered possible that the lack of cover (from undercut banks, overhanging trees etc.) may expose the resident fish population to relatively higher levels of predation than would normally be expected.

9.80 No suitable spawning habitat was identified across the site.

9.81 No further fish species were recorded. Impassable falls exist approximately 1km south of the site which will prevent migratory salmonids from colonising those watercourses on the site and may be a contributing factor to the overall low numbers of fish recorded on the site.

Effects Assessment

9.82 This section provides an assessment of the likely effects of Craigton and Spittalhill Wind Farm on the VERs. For each VER, the potential effect is assessed for the construction and operational phases of Craigton and Spittalhill Wind Farm.

9.83 A summary of the habitats and species identified as VERs within the Study Area is given in **Table 9.7**, together with the justification for this qualification.

9.84 Only those receptors confirmed across the Study Area and considered to be 'Valued' (i.e. VERs) are detailed below. Those receptors considered to be of negligible Nature Conservation Value are not considered any further.

Table 9.7: Nature Conservation Value of Confirmed Valued Ecological Receptors within the Study Area

Valued Ecological Receptor (VER)	Nature Conservation Value	Relevant Legislation/Guidance; Justification
Endrick Water SAC **Qualifying features:** **Atlantic Salmon** **Brook Lamprey** **River Lamprey**	International	The Endrick Water is designated as an SAC and is therefore of International Nature Conservation Value.
Wet Modified Bog	Local	The wet modified bog across the site is a very heavily degraded example of blanket bog habitat. Despite this association with Annex 1 blanket bog (both M19 and M20 NVC types correspond with this category), the habitat is degraded to an extent that assigning value higher than Local is not deemed appropriate. Furthermore similar habitat of equivalent and far greater quality is relatively common across the region. The dominant NVC (M20) reflects the level of degradation present here. M25 NVC is also included within this category where purple moor grass is almost exclusively dominant.
Acid/Neutral Flush	Local	Acid/neutral flush habitat has a very localised but dense occurrence across some of the slopes to the west of the site. Acid flush habitats are listed on the Stirling LBAP as 'Upland Flushes, Fens and Swamps'; no greater distinct listing exists, although M6 NVC type (which is included here) is included as a UKBAP priority habitat. The habitat is generally a species-poor example, often with only a dense *Juncus effusus* sward present; the examples here therefore assessed to be of Local Nature Conservation Value.
Marshy Grassland	Local	Marshy grassland within the site has a loose association with the UKBAP habitat purple moor-grass and rush pasture (M23 NVC type is specifically listed on the UKBAP) as well as with 'Fen, Marsh and Swamp' on the Stirling LBAP. Although extensive across some areas within the site, it does not represent a high quality example of the habitat, with low species diversity throughout. It is also a generally common habitat within the wider area and is therefore assessed to be of Local Nature Conservation Value.
Acid Fen	Local	'Upland Flushes, Fens and Swamps' and 'Lowland Fens' are listed as UK BAP priority habitats. The fen habitat on the site is restricted to a single area at the western end of the access route and is defined by its luxuriant *Sphagnum* layer, which sits beneath a relatively diverse herb and dominant sharp-flowered rush community most closely aligned with the M23 NVC type. The habitat is relatively typical and widespread within the region and is not greater than Local Nature Conservation Value.
Standing Water	Local	Standing water ('Ponds') is listed on both the UKBAP and the Stirling LBAP as a priority habitat. A single pond is present towards the eastern end of the access route and is likely to provide drinking water to resident livestock here. The pond supports some marginal vegetation and abundant pondweed but appears relatively degraded through use by cattle and therefore is classified as being of Local Nature Conservation Value.
Running Water		Watercourses are listed on both the UKBAP and on the Stirling LBAP (as Rivers and Burns). The watercourses here are situated entirely within the Endrick Water catchment and thus have an association with the Endrick Water SAC (located approximately 1km downstream of the site). When considering this association, and in light of the watercourses being fairly typical of middle/upper reaches of upland watercourses in terms of the channel characteristics, associated vegetation and fauna, they are considered to be of Regional Nature Conservation Value at a site level.
Otter	Local	Otters in Scotland are listed on Annex II of the Habitats Directive, and fully protected through the Habitats Regulations. Otters are also listed as a priority species on the Stirling LBAP. Otter activity was confirmed on the site through the presence of spraints alongside the Backside Burn, although no holts/couches or potentially suitable holt/couch features were identified. The current increasingly favourable conservation status of the species within Scotland is also noted. In light of this, their Nature Conservation Value across the site is assessed to be Local.

Construction Effects

Predicted Effects

9.85 The most tangible effect during the construction stage of the wind farm will be direct habitat loss. **Table 9.8** below details the estimated relative losses expected to occur, by habitat type.

Table 9.8: Estimated loss of habitat (by area and percentage of habitat type) within the site

Valued Ecological Receptor	Actual Loss (ha)	Relative Loss by Habitat (%)
Running Water (and Endrick Water SAC)	0	0
Wet Modified Bog	3.78	7.16
Marshy Grassland	2.96	9.69
Semi-improved Acid Grassland	1.62	6.79
Acid Fen	0.25	9.38
Continuous Bracken	0.04	5.56
Wet Dwarf Shrub Heath	0	0
Standing Water	0	0

9.86 The following sections assess the effect of these losses for each VER. Only those of local Nature Conservation Value or greater are considered (see **Table 9.6**).

Wet Modified Bog

9.87 Degraded wet modified bog is the most abundant habitat type on the site and is characterised by an absence of key *Sphagnum* species together with the presence of non-*Sphagnum* mosses and a relative abundance of herb species more indicative of minerotrophic conditions. Hare's-tail cottongrass is present throughout with heather only local in its distribution. Evidence of historic and ongoing management to the detriment of the habitat is present in the form of drains and a heavily grazed sward. This broad habitat type also includes densely scattered acid/neutral flush features which occur in the west of the site. These features are heavily soft rush-dominated, with little else in terms of species diversity.

9.88 Effects upon wet modified bog habitat during construction will be direct (through habitat loss) and indirect (through drying effects upon neighbouring bog habitats). The total amount of direct habitat loss will be 3.78 ha, which represents 7.16% of the overall habitat extent within the site. In addition, and for the purposes of this assessment, this figure has been increased to allow for indirect losses as a result of the zone of drainage around infrastructure (assumed 20 m zone of drainage around the infrastructure footprint) and is considered to be 12.05 ha (22.84% of the overall habitat). Furthermore, effects upon the groundwater on which some of the wet modified bog habitat occurs (by virtue of the presence of GWDTE NVC M6) are considered to be of **Minor** magnitude (as assessed within **Chapter 8: Geology, Hydrology and Hydrogeology**). When considering the above, and accounting for the relative abundance of the habitat within the wider area, an effect magnitude of **Low** spatial and **Long Term** temporal is assigned.

9.89 The wet modified bog (and associated flush habitats) within the site has a Nature Conservation Value of **Local**; the overall effect significance is therefore considered to be **Minor** and **Not Significant** under the terms of the EIA Regulations.

Marshy Grassland

9.90 Marshy grassland habitat is locally abundant, especially on the lower slopes and within the vicinity of the Backside Burn. The habitat is generally characterised by the abundance of dense grasses (mainly purple moor grass) and rushes (mainly soft rush and sharp-flowered rush).

9.91 Effects upon marshy grassland during construction will be direct (through habitat loss) and indirect (through drying effects upon neighbouring habitats). The total amount of direct habitat loss will be 2.96 ha, which represents 9.69% of the overall habitat extent within the site. In addition, and for the purposes of this assessment, this figure has been increased to allow for indirect losses as a result of the zone of drainage around infrastructure (see above) and is considered to be 7.61 ha (24.92% of the overall habitat). Furthermore, effects upon the groundwater on which some of the marshy grassland habitat occurs (by virtue of the presence of GWDTE NVC M23) are considered to be of **Minor** magnitude (as assessed within **Chapter 8: Geology, Hydrology and Hydrogeology**). When considering the above, and accounting for the relative abundance of the habitat within the wider area, an effect magnitude of **Low** spatial and **Long Term** temporal is assigned.

9.92 The marshy grassland within the site has a Nature Conservation Value of **Local**; the overall effect significance is therefore considered to be **Minor** and **Not Significant** under the terms of the EIA Regulations.

Acid Fen

9.93 Acid fen habitat is restricted to a single area at the western end of the access route. Here, a relatively diverse herb and sharp-flowered rush community dominates over a rich layer of *Sphagnum fallax*.

9.94 Effects upon acid fen during construction will be direct (through habitat loss) and indirect (through drying effects upon neighbouring habitats). The total amount of direct habitat loss will be 0.25 ha, which represents 9.38% of the overall habitat extent within the site. In addition, and for the purposes of this assessment, this figure has been increased to allow for indirect losses as a result of the zone of drainage around infrastructure (see above) and is considered to be 0.76 ha (28.04% of the overall habitat). , effects upon the groundwater on which some of the marshy grassland habitat occurs (by virtue of the presence of GWDTE NVC M6) are considered to be of **Minor** magnitude (as assessed within **Chapter 8: Geology, Hydrology and Hydrogeology**). When considering the above, and accounting for the relative abundance of the habitat within the wider area, an effect magnitude of **Low** spatial and **Long Term** temporal is assigned.

9.95 The acid fen within the site has a Nature Conservation Value of **Local**; the overall effect significance is therefore considered to be **Minor** and **Not Significant** under the terms of the EIA Regulations.

Standing Water

9.96 Standing water habitat is limited to a single small pond at the eastern end of the access route.

9.97 No standing water will be lost as a result of the wind farm, with the closest works being approximately 200m from the only recorded waterbody meaning that pollution through the water table is very unlikely. The VER is not considered any further within this assessment.

Running Water

9.98 The Backside Burn and two feeder burns are the main watercourse resources on the site, although numerous very minor watercourses, active drains and flushes also contribute to the running water here. The watercourses on site ultimately feed into the Endrick Water SAC, approximately 3km (channel length) downstream.

9.99 No running water is to be lost as a result of the wind farm, although there is the potential for the habitat to be adversely affected as an indirect result of the construction activities, through pollution to the watercourses on the site and increased sedimentation from groundworks. The greatest risk of such pollution would occur around the watercourse crossing points (of which there is one).

9.100 The running water resource on the site is considered to be of **Regional** Nature Conservation Value, by virtue of the connectivity with the Endrick Water SAC. In light of the implementation of EM&PPP as part of the project design (see paragraph 9.35), the effect magnitude in this regard is considered to be **Negligible** both spatially and temporally. The effect is therefore **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Endrick Water SAC

9.101 Although not present on the site, the Endrick Water SAC is considered as a receptor for this assessment by virtue of its close proximity to the site (located approximately 1km downstream).

9.102 There is the potential for the SAC to be adversely affected as an indirect result of the construction activities, through pollution to the watercourses on the site and increased sedimentation from groundworks. The greatest risk of such pollution would occur around the watercourse crossing points (of which there is one).

9.103 The Endrick Water is considered to be of **International** Nature Conservation Value. In light of the implementation of EM&PPP, as part of the project design (see paragraph 9.35), the effect magnitude in this regard is considered to be **Negligible** both spatially and temporally. The effect is therefore **Negligible** and **Not Significant** under the terms of the EIA Regulations.

9.104 With regards to the Habitats Regulations Appraisal detailed in paragraph 9.30 onwards, the proposal is not directly connected to, or necessary for the management of, the SAC (step 1) and it is not considered likely to have a significant effect (by virtue of the assessment above), either alone or in combination, on the SAC (Step 2). It is therefore considered that the risk to the SAC can be excluded on the basis of objective information. Based on this information, the development is **not likely to have a Significant effect** on the SAC under the terms of the Habitats Regulations.

Otter

9.105 Otter presence was recorded from the site in the form of two separate spraint sites and it is considered highly likely that they utilise the watercourses here and within the wider area as a foraging and commuting resource. No holts/couches or suitable habitat for supporting such features were identified during surveys.

9.106 There is the potential for the species to be indirectly affected through pollution to the watercourses (and the indirect effect of an effect to the species' food resource); or directly through collision with onsite vehicles; and disturbance to the animals as they attempt to forage/migrate through the site.

9.107 Although listed on Annex II of the Habitats Directive, and as such a 'European Protected Species', the otter population relevant to the site is considered to be of **Local** Nature Conservation Value by virtue its apparent low level presence and the absence of any holts or couch structures. In addition, the species is in increasingly favourable Conservation Status across Scotland (i.e. increasing in numbers and range), as confirmed within the fourth national otter survey[vi]. The potential effect upon the species is considered to be limited to an interference with animals' movements through the site due to disturbance during construction. The magnitude of this effect in the absence of mitigation is therefore considered to be **Low** and **Short Term**, resulting in a **Minor** and **Not Significant** effect under the terms of the EIA Regulations.

Fisheries

9.108 The fisheries surveys revealed the presence, at very low levels, of brown trout within the watercourses on the site.

9.109 In light of the abundance of more suitable habitat outwith the site (i.e. within the wider Endrick Water and Forth catchments), the brown trout populations on the site are considered to be of **Local** Nature Conservation Value. The main potential effect during construction would be pollution and increased sedimentation to/of the watercourses which render them uninhabitable to the resident fish stocks; given the implementation of EM&PPP as described within paragraph 9.35 the effect magnitude is therefore **Negligible** both spatially and temporally. This results in an effect that is **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Proposed Mitigation

Measures Prior to Construction

9.110 Although no significant effects have been identified as a result of the Development, it is considered necessary that mitigation measures are implemented in order that those non-significant effects identified can be reduced further, where appropriate.

9.111 To ensure all reasonable precautions are taken to avoid effects on protected species during the construction phase, it is recommended that an SPP is agreed in consultation with the Local Authority and SNH. This SPP should detail measures to protect otter and will include but not be limited to: pre-construction surveys; and good practice measures during construction (see paragraph 9.115).

9.112 An EM&PPP (see **Chapter 8: Geology, Hydrology and Hydrogeology**) will be approved by the planning authority in consultation with SNH and SEPA.

Construction Measures

9.113 Good practice measures would be implemented throughout construction in order to minimise the risks associated with a construction site on otters, in line with SNH guidance[vii]. This would involve covering/securing all excavations and piping, and storing all chemicals safely within bunded containers a minimum distance (<100m) from all waterbodies. The EM&PPP will be implemented across the whole site during construction.

9.114 In order to ensure compliance with the measures as described above, an Ecological Clerk of Works (ECoW) will be required to be present on the site during construction. This role would be undertaken by a suitably qualified and experienced consultant, to the confirmation of Stirling Council, SNH and SEPA and would involve the monitoring of the mitigation measures, together with a briefing with regards the ecological sensitivities on the site, to all site personnel prior to their commencing work on the site.

9.115 In order that the potential effect upon otters is reduced further, appropriate measures in the form of a Species Protection Plan (SPP – as agreed with the Local Authority in consultation with SNH) will be implemented. The aforementioned EM&PPP will also serve to reduce effects caused by potential pollution incidents. This will ensure continued and unobstructed use of the site by the species where relevant and will result in a **Negligible** effect under the terms of the EIA Regulations.

9.116 The SPP will be implemented in full and monitored by the ECoW.

9.117 The agreed EM&PPP will be implemented in full and monitored by the ECoW.

9.118 The ECoW would also be required to advise and supervise, where appropriate, and would have the power to stop works at any stage should it be deemed necessary.

9.119 In order that the potential effect upon fisheries is reduced further, the mitigation as proposed within paragraph 9.112.

9.120 is applicable here. With its successful implementation, it is considered that this mitigation will reduce the effect to **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Residual Effects

9.121 With the implementation of the mitigation measures as described above, it is considered that all construction effects will be reduced to either **Minor** or **Negligible** and will be therefore be **Not Significant** under the terms of the EIA Regulations. **Table 9.9** below summarises this process.

Operational Effects

Wet Modified Bog

9.122 During the operational period, the wind farm infrastructure has the potential to cause drying of the bog habitats on the site through increased drainage. The wet modified bog within the site will be directly affected to a greater extent than any other habitat (by virtue of its relative abundance). When considering the relatively low habitat quality and abundance of its kind within the wider area, the effects of the infrastructure during operation are considered to be **Negligible**. The effect would therefore be **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Marshy Grassland

9.123 The wind farm infrastructure would not cause any further loss/disturbance to this habitat during operation. The effect would therefore be **Not Significant** under the terms of the EIA Regulations.

Acid Fen

9.124 The wind farm infrastructure would not cause any further loss/disturbance to this habitat during operation. The effect would therefore be **Not Significant** under the terms of the EIA Regulations.

Running Water

9.125 During the operational phase, a risk exists that pollution would occur to the watercourses on the site from the maintenance activities that would be required.

9.126 With the continued implementation of the EM&PPP, this effect has a potential magnitude of **Negligible** both spatially and temporally, resulting in an effect that is **Negligible** under the terms of the EIA Regulations.

Endrick Water

9.127 During the operational phase, a risk exists that pollution would occur to the watercourses on the site (subsequently affecting the Endrick Water SAC ca. 1km downstream) from the maintenance activities that would be required.

9.128 With the continued implementation of the EM&PPP, this effect has a potential magnitude of **Negligible** both spatially and temporally, resulting in an effect that is **Negligible** under the terms of the EIA Regulations.

9.129 In addition, and based on this information provided within paragraph 9.104, the development will not affect the integrity of the site and is **not likely to have a Significant effect** on the SAC under the terms of the Habitats Regulations.

Otter

9.130 The risks posed to otters during the operational stage of the wind farm exist through the potential for pollution to the watercourses on the site and collision with vehicles associated with site maintenance etc. These effects are very slight, and easily overcome with the implementation of adequate mitigation measures.

9.131 In the absence of mitigation, it is possible that the species would be affected by impacts upon its food source on the site (i.e. mainly fish and amphibians) through pollution to the watercourses. This however is not considered to be of greater than **Low** and **Short Term** magnitude by virtue of the very small and seemingly transient population present on the site, together with its context within the increasing national population. The effect is therefore considered to be **Minor** and **Not Significant** under the terms of the EIA Regulations.

9.132 In order that this effect can be reduced in scale, the implementation of the EM&PPP is relevant here. An effect that is **Negligible** and **Not Significant** is therefore concluded.

Proposed Mitigation

9.133 The EM&PPP and SPP will be implemented in full during the operational period of the proposed development.

Residual Effects

9.134 With the implementation of the mitigation measures as described above, it is considered that all effects will be reduced to either **Minor** or **Negligible** and will be therefore be **Not Significant** under the terms of the EIA Regulations. **Table 9.9** summarises this process.

Confidence of Predictions

9.135 In light of the low level effects identified, it is considered that all effects assessed within the sections have been identified with certain/near-certain confidence (i.e. probability estimated at 95% or higher) (IEEM 2006[ii]).

Cumulative Effect Assessment

9.136 A number of other wind farms/proposed wind farms are present within the wider area; however, given the limited scale and nature of the predicted effects for Craigton and Spittalhill Wind Farm and with the application of appropriate mitigation measures, it is not considered likely that any significant cumulative effects will arise.

Summary of Effects

9.137 **Table 9.9** below summarises the predicted effects of Craigton and Spittalhill Wind Farm on the VERs present.

Table 9.9: Summary of Effects

Predicted Effect	Significance/LSE	Mitigation	Significance of Residual Effect
Construction			
Running Water (Endrick Water SAC) Qualifying features: Atlantic Salmon Brook Lamprey River Lamprey	No likely significant effect	Implementation of the EM&PPP (see **Chapter 8: Geology, Hydrology and Hydrogeology**) ECoW presence on the Site.	No likely significant effect
Running Water (wider-countryside context)	Negligible	Implementation of the EM&PPP (see **Chapter 8: Geology, Hydrology and Hydrogeology)** ECoW presence on the Site.	Negligible
Wet Modified Bog (inc. Acid/Neutral Flush)	Minor	None	Minor
Marshy Grassland	Minor	None	Minor
Acid Fen	Minor	None	Minor
Standing Water	n/a	n/a	n/a
Otter	Minor	Implementation of the SPP and EM&PPP (**Chapter 8: Geology, Hydrology and Hydrogeology**) ECoW presence on the Site.	Negligible
Fisheries	Negligible	Implementation of the EM&PPP (see **Chapter 8: Geology, Hydrology and Hydrogeology**)	Negligible
Operation			
Running Water (Endrick Water SAC) Qualifying features:	No likely significant effect	Implementation of the EM&PPP (see **Chapter 8: Geology, Hydrology and**	No likely significant effect

Predicted Effect	Significance/LSE	Mitigation	Significance of Residual Effect
Atlantic Salmon Brook Lamprey River Lamprey		**Hydrogeology**) ECoW presence on the Site.	
Running Water (wider-countryside context)	Negligible	Implementation of the EM&PPP (see **Chapter 8: Geology, Hydrology and Hydrogeology**)	Negligible
Wet Modified Bog (inc. Acid/Neutral Flush)	Negligible	n/a	Negligible
Marshy Grassland	n/a	n/a	n/a
Acid Fen	n/a	n/a	n/a
Standing Water	n/a	n/a	n/a
Otter	Minor	Implementation of the SPP and EM&PPP (see **Chapter 8: Geology, Hydrology and Hydrogeology**)	Negligible

[i] SERAD (Scottish Executive Rural Affairs Department) 2000. Habitats and Birds Directives, Nature Conservation: Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and 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

ii IEEM (2006) Guidelines for ecological impact assessment in the UK

iii JNCC/NBN. 2008. NVC & Other Classification (webpage and link to corresponding xls) http://jncc.defra.gov.uk/page-4266

iv Hill, D., Fasham, M., Tucker, G., Shewry, M & Shaw, P. Handbook of Biodiversity Methods – Survey, Evaluation and Monitoring. Cambridge University Press.

v SEPA. 2011. Note 4 - Planning Advice on Windfarm Developments.

vi Strachan, R. (2007). National survey of otter Lutra lutra distribution in Scotland 2003–04. Scottish Natural Heritage Commissioned Report No. 211 (ROAME No. F03AC309

vii SNH (2008) Otters and Development online publication, http://www.snh.org.uk/publications/online/wildlife/otters/default.asp

10 Ornithology

Introduction

10.1 This chapter considers the potential effects of the proposed Craigton and Spittalhill Wind Farm on birds. It details the methods used to establish the bird populations within the site and its surroundings, together with the process used to determine the Nature Conservation Importance of the bird populations present. The ways in which birds might be affected (directly or indirectly) by the construction and operation of Craigton and Spittalhill Wind Farm are explained. In addition, any cumulative effects of Craigton and Spittalhill Wind Farm are considered, taking together effects of other wind farms in the area whether operational, consented or at application, along with the significance of any predicted effects of Craigton and Spittalhill Wind Farm. The ornithology assessment was undertaken by MacArthur Green Ltd.

10.2 This chapter complements the assessment of potential ecological effects presented in **Chapter 9: Ecology**.

10.3 This chapter is supported by **Appendix 10.1** which contains the following Annexes:

- Annex A – Legal Protection.
- Annex B – Bird Survey Methodologies.
- Annex C and D – Survey Effort and Results.
- Annex E – Collision Risk Assessment.

Study Area Description

10.4 The assessment focuses on the Development Area (hereafter referred to as 'the site') and appropriate survey buffers have been applied, as recommended by Scottish Natural Heritage (SNH) Guidance[i] (see **Appendix 10.1** and **Figure 10.1**).

10.5 A further definition exists for the area in which birds are at risk of collision with turbines. This area comprises a 250m buffer around each turbine and collectively is defined as the 'Collision Risk Analysis Area' for the purposes of this assessment (see **Figure 10.4**). This is required to inform accurate collision risk modelling.

10.6 There are no statutory designations within the site. Designated sites (with regards to ornithological interests) that fall within 20km of Craigton and Spittalhill Wind Farm are detailed in **Table 10.6** and shown in **Figure 10.2**.

Effects Assessed in Full

10.7 The following effects have been assessed in full in relation to construction and operation of Craigton and Spittalhill Wind Farm:

- Direct habitat loss for birds through construction of the wind farm infrastructure.
- Displacement of birds through indirect loss of habitat where birds avoid the wind farm, and its surrounding area due to construction, turbine operation and maintenance and visitor disturbance. Displacement can also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds.
- Habitat modification due to change in land cover (e.g. felling or effects on hydrology), and consequent effects on bird populations.
- Death or injury through collision with turbine blades, overhead wires (if any), met masts, or fences (if any) associated with the wind farm.
- Cumulative effects of Craigton and Spittalhill Wind Farm in the context of other nearby wind farms.

Effects Scoped Out

10.8 No effects were scoped out prior to commencement of surveys.

10.9 A total of 37 bird species were recorded at, or within, respective survey buffers, to Craigton and Spittalhill Wind Farm during the ornithological surveys (see **Appendix 10.1 Annex D**). Species of Low Nature Conservation Importance (as defined by Table 10.4) have been 'scoped out'.

10.10 On the basis of the survey work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, effects on a number of Target Species1 have been 'scoped out'. The activity recorded by these species and the reasons for scoping them out are detailed below:

- Effects upon the Slamannan Plateau Special Protection Area (SPA), Loch Lomond SPA, and Firth of Forth SPA have been scoped out due to the distance at which the wind farm lies from these designated sites (15-20km), the species for which these site have been designated (see **Table 10.6**), and the very low level of activity of the species recorded within the survey area[2] (most qualifying species not recorded during any surveys).
- Effects upon hen harrier have been scoped out due to the very low levels of activity recorded for this species during surveys. Only a single hen harrier flight was recorded during vantage point surveys on 04/05/2011. This bird passed through the Collision Risk Analysis Area for 67.6 seconds of which 59.2% was at Potential Collision Height. The only other record of hen harrier came during a raptor survey in 2012 when a single bird was observed more than 1km from the site. No hen harrier nest sites were recorded within the site or within a 2km buffer distance during 2011 and 2012 surveys.
- Effects upon red kite have been scoped out due to the low levels of activity recorded for this species during surveys. Four red kite flights were recorded during vantage point surveys, all flights were recorded in 2011 with three being on the same day; 14/06/2011. Two of these flights consisted of two birds and no flights passed through the Collision Risk Analysis Area. Further incidental records of red kite were made during upland breeding bird surveys on one occasion in 2011 and one occasion in 2012. No red kite nest sites were recorded within the site or within a 2km buffer distance during 2011 and 2012 surveys.
- Effects upon peregrine falcon have been scoped out due to the very low levels of activity recorded for this species during surveys. Only one record of peregrine falcon was made on site or within the 2km survey buffer during a raptor survey in 2012. No peregrine falcon nest sites were recorded within the site or within a 2km buffer distance during 2011 and 2012 surveys. Historical data provided by the local Raptor Study Group indicates there have been peregrine nest sites on the edge of the 2km survey buffer in the past.
- Effects upon lapwing have been scoped out due to the limited nature of the records for this species; a single lapwing was incidentally noted outwith the site area during a raptor survey in April 2011 but was not exhibiting breeding signs. No further records of this species were made at the site or within the survey buffer across surveys.
- Effects upon herring gull have been scoped out due to the limited nature of the records for this species; three herring gull flights with a maximum of two birds passing through the site on three occasions during vantage point surveys.
- Effects upon passerine species have been scoped out as it has been assumed, following SNH guidance[i], that collision risk for small passerine birds (e.g. pipits, finches, buntings, thrushes) is negligible and would have no effect on their populations because survival rates of small passerines in Britain are naturally low. Bird species that have high natural adult mortality rates tend to produce large, but often variable, numbers of young each year. For such species, low levels of additional mortality will have little influence on their population dynamics which tend to fluctuate from year to year.

[1] Target species are those species considered of High or Moderate Nature Conservation Importance or deemed at risk from wind farm developments. Table 2 of **Appendix 10.1** details a full list of target species recorded within the site and associated survey buffers, their Nature Conservation Importance and Conservation Status.
[2] The relevant survey areas are defined within the Technical Report.

Assessment Methodology

Assessment Structure

10.11 The assessment is structured around the consideration of potential effects, including construction, operational and cumulative effects, of Craigton and Spittalhill Wind Farm, within which the following 'scoped in' birds species are considered:

- Bird populations of High Nature Conservation Importance (see **Table 10.7**) are known to be present in the general area (as confirmed through survey work and consultations). These comprise: greylag geese only.
- Bird populations of Moderate Nature Conservation Importance (see **Table 10.7**) known to be present in the general area. These comprise: osprey and black grouse.

10.12 The assessment makes the following assumptions:

- Construction of the site access tracks, turbine hard standings, substation and site compound and erection of the turbines are predicted to last up to 12 months. The number of bird breeding seasons potentially disrupted would depend on the month in which construction commences and the breeding season of the potentially affected species. The breeding season of most birds at Craigton and Spittalhill Wind Farm extends from April to July although some birds breed earlier[ii]. For the purposes of this assessment it is assumed that, for any given species of bird, construction activities would commence during the breeding season and would therefore potentially affect breeding for a maximum of two years, assuming that construction will take approximately 12 months.
- It is assumed that a Breeding Bird Protection Plan will be agreed in consultation with SNH in advance of construction. This plan will ensure that all reasonable measures are taken to avoid disturbance to breeding birds and to avoid damage to, or destruction of, nest sites.
- All electrical cabling proposed between the turbines and the site substation will be underground and follow tracks.
- The permanent meteorological mast will be of lattice tower design.

Data Sources and Guidance

10.13 The assessment has been undertaken in line with the following European legislation, policy, and guidance:

- Directive 2009/147/EC on the Conservation of Wild Birds (Birds Directive);
- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (Habitats Directive);
- The Environmental Impact Assessment Directive 85/337/EEC (as amended).

10.14 The following national legislation, policy and guidance are considered as part of the assessment:

- The Wildlife and Countryside Act 1981 (as amended);
- The Nature Conservation (Scotland) Act 2004 (as amended);
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011;
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (The Habitats Regulations);
- SERAD (Scottish Executive Rural Affairs Department) 2000. Habitats and Birds Directives, Nature Conservation; Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and 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[iii];
- The UK Biodiversity Action Plan (BAP)[iv];
- Birds of Conservation Concern (BoCC) 3 'Red List' (2009)[v];
- Scottish Natural Heritage (2000) Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action. SNH Guidance Note. SNH[vi];
- Scottish Natural Heritage (2006) Assessing significance of impacts from onshore windfarms on birds outwith designated areas[vii];
- Scottish Natural Heritage (2005, revised 2010) Survey methods for use in assessing the impacts of onshore windfarms on bird communities)[i];
- Scottish Natural Heritage (2005). Cumulative effects of windfarms. SNH[viii];
- Policy Advice Note PAN1/2013 – Environmental Impact Assessment (Scottish Government 2013);
- Planning Circular 3 2011; the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011;
- Scottish Natural Heritage (September, 2009) Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees[ix];
- Scottish Natural Heritage (March 2008) Natural Heritage Assessment of Small Scale Wind Energy Projects which do not require formal Environmental Impact Assessment (EIA)[x].

10.15 The following data sources were considered as part of the assessment:

- SNH Site Link (www.snh.gov.uk/sitelink);
- NBN Gateway (www.searchnbn.net);
- BTO BirdTrack (http://blx1.bto.org/birdtrack/grid-refs/grid-species-by-location.jsp);
- Central Raptor Study Group.

Field Survey

10.16 All surveys followed recommended methods and associated survey buffer zones (see **Appendix 10.1 Annex B**).

10.17 Ornithological fieldwork commenced in March 2011 and was completed in August 2012 and comprised of the following surveys (see **Appendix 10.1**, **Annexes C** and **D** and **Figures 10.1 and 10.2** and **10.5 to 10.16** for further details):

- flight activity Vantage Point (VP) surveys (within the site and a 250m buffer of the site). Fieldwork carried out from March 2011 to August 2012;
- Upland Breeding Birds Surveys (BBS) (within the site and a 500m buffer around the site). Fieldwork carried out in spring-summer 2011 and 2012;
- breeding diurnal raptor (including short-eared owl) surveys (within the site and a 2km buffer around the site). Fieldwork carried out in spring-summer 2011 and 2012;
- Black grouse lek surveys (within the site and a 1.5km buffer around the site). Fieldwork carried out in spring-summer 2012;
- non-breeding bird/winter walkover surveys (winter period) (within the site and a 500m buffer around the site). Fieldwork carried out in winter 2011/2012.

Consultation

10.18 The following organisations were contacted for information and advice to inform the EIA: Stirling Council, SNH and the Central Raptor Study Group. Issues identified through these consultations are detailed within **Table 10.1**.

Table 10.1: Consultation Responses

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Stirling Council (Email of 25/10/2012)	Formal Scoping Consultation	No issues regarding ornithology raised	n/a
SNH (Letter of 22/10/2012)	Formal Scoping Consultation	The potential impact on hen harrier, osprey and greylag goose needs to be considered.	Potential effects on hen harrier, osprey and greylag goose are considered in this chapter.

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
		Full survey details including raw data, workings for calculations and flight maps with labelled flight lines referenced to a table of flight data, etc., should be presented in the ES. Information on direct and indirect effects, along with details of any mitigation should be presented. Assessment of the cumulative effects on birds will be required.	These details are presented in this chapter, associated Appendix, and Annexes. This chapter assess the cumulative effects on birds.
Central Raptor Study Group (Emails of November & December 2012)	Contacted by MacArthur Green Ltd for data on breeding raptors in the survey area	Available data supplied	Data used to inform ornithological assessment

Assessing Significance

10.19 The assessment method follows the process set out in the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 ('the EIA Regulations') and guidance on the implementation of the Birds and Habitats Directive[iii].

10.20 In assessing the effects, emphasis is given to the national and regional populations of the species as appropriate (or the SPA where relevant).

Methodology for Assessing Wider-Countryside Ornithological Interests

10.21 The evaluation for wider-countryside interests (interests unrelated to a Special Protection Area) involves the following process:

- identification of the potential effects of Craigton and Spittalhill Wind Farm;
- consideration of the likelihood of occurrence of potential effects where appropriate;
- defining the Nature Conservation Importance of the bird populations present;
- establishing the population's Conservation Status;
- establishing the Magnitude of the likely effect (both spatial and temporal);
- based on the above information, a judgement is made as to whether or not the identified effect is significant with respect to the EIA Regulations;
- if a potential effect is determined to be significant, measures to mitigate or compensate the effect are suggested where required;
- opportunities for enhancement are considered;
- residual effects after mitigation, compensation or enhancement are considered.

10.22 For clarity, the following sections further define the methods used to evaluate Conservation Status, Magnitude of Likely Effects and Nature Conservation Importance.

Methods Used to Evaluate Conservation Status of Bird Populations

10.23 As defined by SNH, the Conservation Status of a species is *"the sum of the influences acting on it which may affect its long-term distribution and abundance, within the geographical area of interest (which for the purposes of the Birds Directive is the EU)"*[vii] (Para. 14).

10.24 Conservation Status is considered favourable under the following circumstances[vii] (Para.15):

- *"Population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats; and*
- *the natural range of the species is not being reduced, nor is likely to be reduced for the foreseeable future; and*
- *there is (and probably will continue to be) a sufficiently large habitat to maintain its population on a long-term basis"*.

10.25 SNH states that, *"An impact should be judged as of concern where it would adversely affect the favourable conservation status of a species, or stop a recovering species from reaching favourable conservation status, at international or national level or regionally"* [vii] (Para. 17).

10.26 The relevant scale for breeding species is considered to be the appropriate Natural Heritage Zone(s) (NHZ) which the development falls within. Craigton and Spittalhill Wind Farm falls within the West Central Belt NHZ (NHZ 17). For wintering or migratory species, the national population is often considered to be the relevant scale for determining effects on the Conservation Status[vii] (Para. 20 & 21) and this approach is applied here.

Methods Used to Evaluate the Magnitude of Likely Effects

10.27 An effect is defined as a change to the abundance and distribution of a population as a result of the development. Effects can be adverse, neutral or favourable.

10.28 There can often be varying degrees of uncertainty over effects as a result of limited information. A precautionary approach is adopted where the response of a population to an effect is uncertain.

10.29 In determining the magnitude of effects, the resilience of a population to recover from temporary adverse conditions is considered in respect of each potentially affected population.

10.30 The sensitivity of individual species to disturbance during relevant behaviours is considered when determining spatial and temporal magnitude of effect and is assessed using guidance described by Bright et al[xi], Hill et al[xii] and Ruddock and Whitfield[xiii].

10.31 In the case of non-designated sites, magnitude is assessed in respect of an appropriate ecological unit. In the present case, the appropriate unit for breeding species is taken to be the West Central Belt NHZ (NHZ 17) as defined by SNH[vii].

10.32 Effects are judged in terms of magnitude in space and time. There are five levels of spatial effects and temporal effects as detailed in **Tables 10.2** and **10.3** below respectively.

Table 10.2: Spatial Effect Magnitude

Spatial Magnitude	Definition
Very High	Total/near total loss of a bird population due to mortality or displacement. Total/near total loss of productivity in a bird population due to disturbance. Guide: >80% of population lost through additive mortality.
High	Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 21-80% of population lost through additive mortality.
Moderate	Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 6-20% of population lost through additive mortality.

Spatial Magnitude	Definition
Low	Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 1-5% of population lost through additive mortality.
Negligible	Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation. Guide: < 1% population lost through additive mortality.

Table 10.3: Temporal Effect Magnitude

Temporal Magnitude	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period. Where this is the case, Long-Term may be more appropriate.
Long-term	Approximately 15 - 25 years or longer (see above).
Medium-term	Approximately 5 – 15 years.
Short-term	Up to approximately 5 years.
Negligible	<12 months.

Methods Used to Evaluate the Nature Conservation Importance of Bird Populations

10.33 There are three levels of Nature Conservation Importance (NCI) as detailed below in **Table 10.4**.

Table 10.4: Determining Factors of a Population's Nature Conservation Importance

Importance	Definition
High	Populations receiving protection by a SPA, proposed SPA, Ramsar Site, SSSI or which would otherwise qualify under selection guidelines.
Moderate	The presence of species listed in Annex 1 of the Birds Directive (but population does not meet the designation criteria under selection guidelines). The presence of breeding species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The presence of species noted on the latest Birds of Conservation Concern (BoCC) 'Red' list[v]. Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to Craigton and Spittalhill Wind Farm. Species present in regionally important numbers (>1% regional breeding population).
Low	All other species populations not covered by the above categories

10.34 'Target species' were taken to be those species of High and Moderate Nature Conservation Importance (**Table 10.4**).

Significance Criteria

10.35 The predicted significance of the effect has been determined through a standard method of assessment based on professional judgement, considering both sensitivity (i.e. each bird species' relative sensitivity to disturbance) and magnitude of change. The significance criteria used in this assessment are listed below in **Table 10.5**.

Table 10.5: Significance Criteria

Significance of Effect	Description
Major	The effect is likely to result in a long-term significant adverse effect on the integrity of a receptor.
Moderate	The effect is likely to result in a medium-term or partially significant adverse effect on the integrity of a receptor.
Minor	The effect is likely to adversely affect a receptor at an insignificant level by virtue of its limitations in terms of duration or extent, but there will probably be no effect on its integrity.
Negligible	No effect.

10.36 Major and moderate effects are considered significant in with the context of the EIA Regulations.

10.37 Minor and negligible effects are considered not significant in the context of the EIA Regulations.

Cumulative Assessment

10.38 The same assessment method as described within the 'Assessment Methodology' section will be used to undertake the cumulative assessment. Guidance on undertaking cumulative assessments is used[viii-ix].

10.39 By definition, cumulative effects are not possible to evaluate through the study of one development in isolation, but will require the assessment of effects when considered in combination with other wind farm developments. The context in which these effects are considered will be heavily dependent on the ecology of the species in question. For example, it may be appropriate to consider cumulative collision risk to wildfowl associated with an SPA within the context of their wider foraging range and as such may involve the consideration of developments within 20km of the SPA (dependent on existing data pertaining to the species in question).

10.40 For breeding species, it will be necessary to consider the cumulative effects of other wind farm developments within 20km of Craigton and Spittalhill Wind Farm whereby the overall displacement area is increased. In isolation, it may be considered that local displacement will result in breeding birds moving to adjacent habitats, whereas in reality, these 'receptor sites' are subject to development themselves and will thus be unavailable.

Planning Policy

10.41 Planning policies of relevance to this assessment are provided in **Chapter 5: Planning Policy Context**.

Existing Conditions

10.42 This section details:

- Statutory Nature Conservation Designations for birds within 20km of the wind farm;
- birds recorded during bird surveys (for details see **Appendix 10.1**);
- the conservation status of the birds recorded during bird surveys.

Statutory Nature Conservation Designations

10.43 There are no statutory nature conservation designations within the site. Information pertaining to sites within 20km of the site, with ornithological qualifying features, is listed in **Table 10.6**.

Table 10.6: Statutory Nature Conservation Designations within 20km of the site

Distance from the site	Designated Site	Ornithological Qualifying Features
Within 5km	None	
Within 10km	None	
Within 15km	Lake of Menteith SSSI	Non-breeding birds Pink-footed goose
Within 20km	Loch Lomond SPA	Non-breeding birds Greenland white-fronted goose Breeding birds Capercaillie
	Loch Lomond RAMSAR	Non-breeding birds Greenland white-fronted goose
	Firth of Forth SSSI	Breeding birds Eider, ringed plover, shelduck, Sandwich tern (passage) Non-breeding birds Bar-tailed godwit, common scoter, cormorant, curlew, dunlin eider, golden plover, goldeneye, great crested grebe, grey plover, knot, long-tailed duck, mallard, oystercatcher, pink-footed goose, red-breasted merganser, redshank, red-throated diver, ringed plover, scaup, shelduck, Slavonian grebe, turnstone, velvet scoter, wigeon, and lapwing.
	Firth of Forth RAMSAR	Non-breeding birds Sandwich tern (passage), Slavonian grebe, waterfowl assemblage, bar-tailed godwit, goldeneye, knot, pink-footed goose, redshank, shelduck, and turnstone.
	Firth of Forth SPA	Non-breeding birds Oystercatcher, ringed plover, shelduck, velvet scoter, bar-tailed godwit, common scoter, cormorant, curlew, dunlin, eider, golden plover, goldeneye, great-crested grebe, grey plover, knot, lapwing, long-tailed duck, mallard, pink-footed goose, red-breasted merganser, redshank, red-throated diver, sandwich tern, scaup, Slavonian grebe, turnstone, wigeon, and waterfowl assemblage.
	Slamannan Plateau SPA	Non-breeding birds Taiga bean goose
	Slamannan Plateau SSSI	Non-breeding birds Taiga bean goose
	Endrick Mouth & Islands SSSI	Non-breeding birds Greenland white-fronted goose, Greylag goose Breeding birds Breeding bird assemblage
	Loch Mahaick SSSI	Non-breeding birds Pink-footed goose
	West Fannyside Moss	Non-breeding birds Taiga bean goose

Birds Recorded During Surveys

10.44 The following paragraphs summarise the nature of the ornithological survey findings. To avoid repetition, 'Target Species' observed but scoped out of the assessment are only detailed in paragraph 10.10 above. Full results can be found within **Technical Appendix 10.1 Annex D** and **Figures 10.5** to **10.16**.

Raptors

10.45 Osprey was the most frequently occurring Target Species during vantage point surveys with nine flights recorded between March 2011 and August 2012. Seven of these flights passed through the Collision Risk Analysis Area (CRAA) of which six were in the 2012 breeding season. The total flight time for osprey in the CRAA during the 2011 breeding season was 58.3 seconds of which 79.8% was at Potential Collision Height (PCH). The total flight time for osprey in the CRAA during the 2012 breeding season was 114 seconds of which 61.9% was at PCH.

10.46 Four osprey flights were also recorded within the 2km survey buffer during raptor surveys in 2012, none of these flights passed through the CRAA. Three of the four flights were in the vicinity of Loch Walton or the north-west corner of Carron Valley Reservoir near the edge of the 2km survey buffer. On one occasion an osprey was observed carrying fish. No osprey nest sites were recorded within the site or within a 2km buffer distance during 2011 and 2012 surveys. The Central Raptor Study Group confirmed the nearest know osprey nest site to be well over 5km from the site.

10.47 Observations of other birds of prey on site and within the survey area included buzzard, kestrel and sparrowhawk. Their activity recorded as secondary species during vantage point surveys and as observations during raptor surveys. Only buzzard (one pair) bred within the 2km survey buffer.

Black Grouse

10.48 Black grouse are present within the site and wider area. A single black grouse observation was made during vantage point surveys on 13/08/2012 and consisted of five birds flying low. Dedicated black grouse surveys in spring-summer 2012 revealed the presence of a lek within the site which consisted of four lekking males. This lek is 170m from the nearest turbine, 162m from the nearest crane hardstanding, and 170m from the nearest proposed access track.

Geese

10.49 Greylag geese were the second most frequently occurring Target Species during vantage point surveys with seven flights recorded between March 2011 and August 2012; all seven flights passed through the CRAA. These occurred in 2011 breeding season (five flights), the 2011/2012 non-breeding season (one flight), and the 2012 breeding season (one flight). All flights were recorded in the spring and autumn migratory periods for geese (i.e. flights were recorded in October, April and May). The total flight time for greylag geese in the CRAA during the 2011 breeding season was 227.5 seconds of which 61.8% was at PCH. The total flight time for greylag geese in the CRAA during the 2011/2012 non-breeding season was 192.6 seconds of which 100% was at PCH. The total flight time for greylag geese in the CRAA during the 2012 breeding season was 62.3 seconds of which 100% was at PCH.

10.50 The numbers of greylag geese making these flights were low with the largest flock recorded consisting of 16 birds on one occasion. All other flights were of two to four birds.

10.51 In addition to the findings of the vantage point survey, a flock of 25 greylag geese were observed passing through the survey area during a winter walkover on 23/12/2011. Greylag geese were incidentally noted flying over the site during breeding bird surveys in 2012 with the largest flock consisting of seven birds.

10.52 A single flight of 50 'grey geese' was made during a vantage point survey on 20/10/2011. The term grey geese has been used as positive identification was not possible at the distance and height the birds were observed (offsite and flying >125m in height). This flock of geese did not pass through the CRAA. It is likely these were greylag geese given the nature of other observations made during surveys; however the possibility of these birds being pink-footed geese cannot be discounted.

Other Birds

10.53 Breeding bird surveys revealed the presence of 16 breeding bird species, mostly passerine.

10.54 Breeding bird surveys in 2011 noted three curlew territories, one snipe territory and one red grouse territory within the survey area. Background context (these species are not Target Species because they are of low nature conservation importance see table re low nature conservation importance)

10.55 Breeding bird surveys in 2012 noted five curlew territories and four red grouse territories within the survey area.

10.56 Gull species were recorded during vantage point surveys as secondary species although activity was very low. Herring gull, which is considered a Target Species due to its Conservation Status, was only recorded on three occasions with a maximum of two birds on any one of those occasions.

10.57 A number of passerine species were recorded during various surveys and notable species included grasshopper warbler, linnet and skylark. Passerine species have been scoped out of the assessment as per paragraph 10.10 above.

Wind Farm Layout Design Considerations

10.58 No revisions to the layout were required for ornithological reasons.

Effects Assessment

10.59 The assessment of effects is based upon the project description outlined in **Chapter 4: Development Description** and is structured as follows:

- construction effects;
- operational effects;
- cumulative effects.

10.60 The assessment is applied to those 'scoped-in' populations of High and Moderate Nature Conservation Importance as defined within **Table 10.7.**

Table 10.7: Nature Conservation Importance of Recorded Bird Populations

Species	Nature Conservation Importance	Reason
Greylag goose	High	Endrick Mouth & Islands SSSI qualifying species (within 20km)
Osprey	Moderate	Annex 1 and Schedule 1 listed species
Black grouse	Moderate	Listed in Annex 1 and BoCC Red List

10.61 In addition, it is necessary to consider the species' current Conservation Status when assessing the likely impacts, relevant Conservation Status information for the 'scoped in' Target Species is detailed within **Table 10.8.**

Table 10.8: Conservation Status of Recorded Bird Populations

Species	Conservation Status Information	Conservation Status
Greylag goose	Amber List	Greylag goose is a common resident bird in much of Scotland and also a winter visitor from Iceland. Numbers of resident greylag geese were reduced by exploitation and their distribution shrank to north-west Scotland and especially the Outer Hebrides by the 1960s. Since the 1940s, greylag geese have been reintroduced to many areas of Scotland and populations have increased. There are now about 20,000 greylag geese in north-west Scotland and at least 5000 in the rest of Scotland. In autumn, tens of thousands arrive from Iceland to overwinter in lowland Scotland, though since the 1960s the numbers wintering in Scotland have decreased considerably as many now remain in Iceland in winter. Many of those wintering in Scotland now occupy pastures in Orkney rather than the central belt.
Osprey	Amber List	Breeding numbers in Scotland (182-200 pairs) represent 97% of the UK population, and have been increasing since natural re-colonisation in the 1950s. Breeding distribution in Scotland has spread from initial colonisation in Speyside to almost the whole of Scotland occupied by breeding ospreys now, though there is scope for further increases in areas such as southern Scotland. Some Scandinavian migrants pass though Scotland in spring and autumn.
Black grouse	Red List	Breeding numbers in the UK declined by 80% between 1991 and 2004. Sim et al.[xiv] estimated there to be 5,078 male black grouse in the UK, with approximately two-thirds of these occurring in Scotland. However, Forrester et al.[ii] estimate that in Scotland there are now around 3,550 to 5,750 lekking males, representing about 71% of the British population. In Scotland the breeding range is contracting and numbers are declining, though the rate of decline varies regionally, being highest in southern Scotland. Numbers declined by 49% in SW Scotland between 1995 and 2005.

Construction Effects

Predicted Effects

10.62 The main potential effects of construction activities are the displacement and disruption of breeding and foraging birds as a result of noise and visible disturbance. Effects on breeding birds would be confined to areas in the locality of temporary construction compounds, turbines, tracks and other site infrastructure. Few attempts have been made to quantify the disturbance of birds due to activities of this type, and

much of the available information is inconsistent. However, as a broad generalisation, larger bird species, those higher up the food chain, or those that feed in flocks in the open, tend to be more susceptible to disturbance than are small birds living in structurally complex habitats (such as woodland, scrub and hedgerow)[xii].

10.63 The following assessments only relate to those effects considered relevant to the species.

Greylag goose

10.64 Effect: Greylag goose activity within the CRAA and survey area was limited (seven flights during vantage point surveys and few records during other surveys). Activity was of low numbers of birds flying through (generally less than five geese) so disturbance effects on geese are unlikely. During construction work, greylag geese may alter flight paths marginally to keep further away from Craigton and Spittalhill Wind Farm, but energy costs of any extra flight will be insignificant in the context of their normal daily activities.

10.65 Nature Conservation Importance: Due to their association with the Endrick Mouths & Islands SSSI within 20km of Craigton and Spittalhill Wind Farm they are classified as **High** Nature Conservation Importance (**Table 10.7**).

10.66 Conservation Status: The Conservation Status of the SSSI population was assessed as '**Favourable Maintained**' by SNH on 28 February 2009 (Site Link V3).

10.67 Magnitude of Effect: Given that greylag geese do not use the site and only overfly it, and that construction will occur over a short time period in a small area, the spatial effect is assessed as **Negligible** magnitude and the temporal effect is assessed as Short Term.

10.68 Significance of Effect: The effect on greylag goose during construction is therefore considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Osprey

10.69 Effect: Nine osprey flights were observed during vantage point surveys (seven within the CRAA), these birds appeared to be passing by or commuting and spent little time over the Development Area. During construction work ospreys may alter flight paths marginally to keep further away from the activity, but energy costs of any extra flight will be insignificant in the context of their normal daily activities.

10.70 Nature Conservation Importance: Due to their Schedule 1 and Annex 1 status they are classified as **Moderate** Nature Conservation Importance (**Table 10.7**).

10.71 Conservation Status: Their current conservation status is considered to be '**Favourable**' (**Table 10.8**).

10.72 Magnitude of Effect: The magnitude of the construction effect on this species is assessed as **Negligible** spatial and temporal.

10.73 Significance of Effect: The effect on osprey during construction is therefore considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Black grouse

10.74 Effect: Lekking and foraging black grouse may be displaced from the wind farm area during construction. Black grouse surveys in 2012 recorded a lek consisting of four lekking males within the site, this lek was 170m from the nearest proposed turbine and 170m from the nearest proposed access track (see **Figure 10.16**). Black grouse were also noted during vantage point and winter walkover surveys.

10.75 Nature Conservation Importance: Due to their BoCC Red List status they are classified as **Moderate** Nature Conservation Importance (**Table 10.7**).

10.76 Conservation Status: Their current Conservation Status is considered to be **Unfavourable, declining** (**Table 10.8**).

10.77 Magnitude of Effect: There are two main areas of research relevant to determining the magnitude of effect; impacts of human disturbance and impacts of wind farms. These are discussed in turn below.

10.78 Susceptibility to Human Disturbance: Disturbance of forest associated wildlife by human recreational activity is widespread and can strongly influence bird populations and distribution (Steven et al.[xv] and Marzano and Dandy[xvi]). Following changes to English law allowing greater access onto upland areas, Warren et al.[xvii] found evidence that black grouse in northern England were disturbed by recreational activity on rights of way across moorland and changed distribution across habitat as a consequence, and as a precautionary approach Natural England excluded human access from these rights of way between October and March to avoid possible impacts on black grouse breeding success. However, Miquet[xviii] reported no impact on breeding numbers and breeding success of high levels of human disturbance of black grouse in winter. Herzog and Krueger[xix] looked for impacts of human disturbance on black grouse population trend in the Ore Mountains, but found little evidence for this but clear evidence for an impact of habitat change and some evidence for an impact of climate change. Baines and Richardson[xx] carried out an experiment to test the impact of human disturbance on black grouse; birds that were disturbed more regularly flushed at greater distances, especially in spring. However, there were no differences in survival rates, clutch sizes or breeding success between birds experimentally subjected to low, moderate and high levels of deliberate human disturbance. The authors concluded that the disturbance regimes imposed had no discernible impact on black grouse population dynamics.

10.79 Susceptibility to impacts from wind farms: Bright et al.[xxi] assessed the likely sensitivity of black grouse to population level impacts of wind farms as 'moderate', based on black grouse research reported in Johnstone[xxii], Cayford[xxiii], Anon[xxiv] and Warren and Baines[xxv], although none of those studies involved studies of the species at wind farms. Direct study of black grouse at wind farms indicated that black grouse behaviours show no obvious signs of being affected by wind farm construction disturbance, but that the amount of time birds spend attending leks may decline[xxvi]. In addition, Zeiler and Grünschachner-Berger[xxvii] reported cases of collision mortality, and strong declines in black grouse numbers in local populations in areas where three wind farms were constructed in the Alpine zone in Austria. In a follow-up study at one of the same locations, Grünschachner-Berger and Kainer[xxviii] reported that black grouse strongly avoided using the area within a wind farm, but in winter did feed on ground nearby that was heavily disturbed by activities on a ski run.

10.80 Similar concerns exist in North America. The sage grouse is a game bird of conservation concern, with some similarities to black grouse, and has shown a decline in numbers of up to 93% due to habitat loss, possibly exacerbated recently by West Nile virus and climate change. Concerns over possible additional impacts from wind farms in sage grouse habitat have so far turned out to be largely unsubstantiated, with evidence from radio tracking studies that sage grouse continue to feed around wind turbines and are subject to only a low collision mortality rate[xxix].

10.81 Construction activities may temporarily displace black grouse from existing foraging areas and this could lead to a reduction in foraging efficiency and therefore effects on productivity and survival. If the current population of black grouse is limited by habitat then any displacement of foraging grouse from the areas presently used is likely to have a material effect on its viability. Any reduction in lekking at the traditional lek site may also have adverse effects on the productivity of the local population and its social coherence. On the other hand, if population trend is ultimately dependent on the performance of the wider population then it is probable that any local and temporary displacement effects would be immaterial. Given the uncertainty over this, a precautionary approach is adopted here and the former scenario is assumed.

10.82 Based on the above considerations, a lek site may be lost or displaced due to construction activity. Magnitude of effect of construction activity on black grouse is considered to be **High Spatial** and **Short-Term** temporal.

10.83 Significance of Effect: The effect is classified as **Moderate** and is therefore **Significant** under the terms of the EIA Regulations.

Proposed Mitigation

10.84 Surveys for lekking black grouse following the methodology detailed within SNH, 2010[i] will be completed during the construction phase during April and May. Should any leks be identified on the site, a 500m disturbance buffer will be established and no activity should occur in these areas during the period of 1hr before and after dawn.

10.85 Supplementary feeding of black grouse should occur throughout the construction period. This will involve setting up 10 feed hoppers to the north and east of the recorded lek location.

10.86 The Ecological Clerk of Works should oversee the implementation of the above mitigation measures.

Residual Effects

10.87 The proposed mitigation reduces the effect from Moderate to Minor and therefore not significant under the terms of the EIA Regulations.

Operational Effects

Predicted Effects

Bird Collision Mortality Risks

10.88 Those birds that continue to utilise the Collision Risk Analysis Area during the lifetime of Craigton and Spittalhill Wind Farm will be at risk of collision with the turbines. The risk of collision with moving wind turbine blades is presumed to be dependent on the amount of flight activity over the site and the ability of birds to detect and manoeuvre around rotating turbine blades. On this basis, it is clear that collision risk is likely to increase with a wind farm's proximity to large concentrations of birds, whether this is breeding and foraging birds, wintering birds, or those utilising specific areas for local or large-scale migration[xxx].

10.89 The majority of studies of bird collisions with wind turbines have recorded very low levels of mortality[xxxi-xxxv]. This is perhaps largely a reflection of the fact that many wind farms are located away from large concentrations of birds. It is also important to note that many records are based only on finding corpses, with no correction for corpses that are overlooked or are removed by scavengers[xxxv]. It also reflects the fact that birds have been found by direct observation to be very efficient at avoiding wind turbines[xxxvi].

10.90 Band et al.[xxxvii] describe a method of quantifying potential bird collisions with turbines, in which the likelihood of a collision is calculated, and then an 'avoidance rate' [xxxvi] applied to account for behavioural adaptation of birds to the presence of turbines. This results in a figure for the likely mortality rate at the wind farm which is then assessed within the context of the species' relevant populations to determine the significance of any losses. Collision Rate Modelling (CRM) results are detailed in the accompanying **Appendix 10.1**, **Annex E**.

10.91 It has been accepted by SNH, RSPB and the Joint Nature Conservancy Council (JNCC) that this CRM method is more suitable for some bird species than for others. For some species, species-specific avoidance rates have been measured at a number of wind farms (for example for various species of geese and birds of prey). For other species which have not been studied in detail, a precautionary generic avoidance rate estimate has to be used where species-specific data is lacking. A recent update produced by SNH has increased the avoidance rate for wintering geese to 99.8% **Error! Bookmark not defined.**. This rate was used in the CRM for greylag geese presented below.

10.92 A major criticism of CRM is that the value of the avoidance rate has a strong influence on predicted mortality, yet there is little empirical basis for rate estimation for most species[xxxviii]. Since this method was developed, the CRM has progressively become better informed by specific avoidance rate studies, which are applied accordingly[xxxvi]. In general, the trend in recent years has been for species-specific avoidance rates to be found to be higher (closer to 100%) than had been conservatively estimated in the past[xxxvi]. Thus, collision rate estimates based on generic avoidance rate estimates give conservative results (i.e. are likely to overestimate actual bird mortality.

10.93 For the avoidance of repetition, reference is made to previous paragraphs with regards to the Nature Conservation Importance and Conservation Status of the various target species.

Greylag goose

10.94 Effect: Seven flight lines of greylag goose, containing a total of 31 geese, were recorded within the Collision Risk Analysis Area at collision risk height. Movements across and around the site occurred mainly in autumn and spring migration periods. Estimated collision rates from the SNH (Band) CRM model for greylag geese are 0.018 collisions per year (equivalent to one bird killed every 54.5 years). Details of collision modelling data and calculations are in the **Appendix 10.1**, **Annex E**.

10.95 Nature Conservation Importance and relevant Conservation Status: **High** and **Favourable**.

10.96 Magnitude of Effect: Although the temporal magnitude of the potential effect is **Long Term**, the spatial magnitude is considered to be **Negligible** due to the low level of predicted mortality. Indeed, geese have been found to be highly adept at avoiding wind turbines (e.g. Plonczkier et al.[xxxix]) further supporting this assessment.

10.97 Significance of Effect: The effect is classified as **Minor** and is therefore **Not Significant** under the terms of the EIA Regulations.

Osprey

10.98 Effect: Seven osprey flights were recorded within the Collision Risk Analysis Area at potential collision risk height. Estimated collision rates from the SNH (Band) CRM model for osprey are 0.035 collisions per year (equivalent to one bird every 28.2 years). Six of the seven flights were recorded in 2012, however even when collision risk was estimated using just the 2012 data the number of collisions only increased to the equivalent of one bird every 11 years. Details of collision modelling data and calculations are in the **Appendix 10.1**, **Annex E**.

10.99 Nature Conservation Importance and relevant Conservation Status: **Moderate** and **Favourable**.

10.100 Magnitude of Effect: The pattern of flight lines observed (see **Figures 10.10** and **10.11**) suggested that during the 2012 breeding season osprey were using the valley on a regular basis, possibly for commuting between foraging areas and nest sites. While this might be predicted to generate a high risk of collision, the estimated number of collisions was found to be low, even when estimated using just the data from the year of higher activity. This is due to the nature of the flights which were mostly rapid transit ones with consequent low risks of collision. Therefore the temporal magnitude of the potential effect is assessed as **Long Term** and the spatial magnitude is considered to be **Negligible,** due to the low level of predicted mortality.

10.101 Significance of Effect: The effect is classified as **Minor** and is therefore **Not Significant** under the terms of the EIA Regulations.

Black grouse

10.102 Effect: A single black grouse flight was observed within the Collision Risk Analysis Area for a total of 25 seconds (five birds in a five second flight), but with 0% at potential collision risk height. However, black grouse are known to be at risk of colliding with structures close to ground level, such as fences and wires; deer fencing has proved to be a particular hazard for this species. Zeiler and Grünschachner-Berger[xxvii] reported cases of black grouse mortality resulting from collisions with various structures close to ground level, and they report strong declines in black grouse numbers in local populations in areas where three wind farms were constructed in the Alpine zone in Austria.

10.103 Nature Conservation Importance and relevant Conservation Status: **Moderate** and **Unfavourable, declining**.

10.104 Magnitude of Effect: Since no flight was at collision risk height, the magnitude of the effect of collisions with turbine blades is negligible, but there is likely to be some hazard to black grouse from any structures such as railings of the steps associated with wind turbines. Thus the magnitude of effect of collision with turbine infrastructure on black grouse is considered to be **High Spatial** and **Long-Term** temporal.

10.105 Significance of Effect: The effect is classified as **Moderate** and is therefore **Significant** under the terms of the EIA Regulations.

Displacement Effects

10.106 The displacement of nesting and foraging birds from the site has the potential to extend beyond the construction phase, as described above, and to occur during the operational phase of Craigton and Spittalhill Wind Farm, although lower levels of disturbance during operation compared to construction suggest that displacement effects will be less than those reviewed for the construction phase above. Displacement away from operational turbines has been found to occur in a number of individual wind farm studies, generally over distances of up to 100m or 200m from turbines, although the effects vary considerably between sites and species[xl]. Additional existing information[xli] suggests that these effects are minimal, with most species affected only slightly, if at all, whilst Drewitt and Langston[xxxv] highlighted the need for further study in order to accurately quantify displacement effects. Devereux et al.[xlii] showed that wind farms had no, or at most a minimal effect, on the local distribution of wintering farmland birds. Considering a range of breeding bird species but predominantly waders and passerines at upland wind farms, Pearce-Higgins et al.[xliii] showed that there were no displacement impacts on any bird species from wind farms during the operational phase other than those that had already occurred during construction, and for some species the impacts during construction were reversed during operation with numbers returning to pre-construction numbers. So the overall picture from Pearce-Higgins et al.[xliii] is that disturbance is only an issue requiring consideration for the construction phase and not for wind farm operation.

10.107 Those studies mentioned above were focused on direct displacement (i.e. avoidance of areas surrounding wind farm installations); an additional consideration is the displacement of birds from larger areas where the turbines act as a barrier to bird movement. The likelihood of this effect occurring tends to increase with wind farm size, where large turbine arrays can force birds to alter their regular flight-paths, resulting in an increase in distance flown and so energy expended. However, a review of the literature suggests that none of the barrier effects identified so far have significant effects on populations[xxxv]. This was also the conclusion from modelling of energy costs to those bird species most likely to be sensitive to barrier effects (large and long-lived breeding birds such as seabirds) by Masden et al.[xliv].

10.108 Pearce-Higgins et al.[xl] observed certain species experiencing localised population increases with proximity to wind farm infrastructure installations, so while some birds may be displaced locally, others may benefit from the introduction of new structures into the habitat, or some other consequence of construction. This finding was further supported by Pearce-Higgins et al.[xliii] who reported significant increases in breeding numbers of skylarks and stonechats at wind farms.

Greylag geese

10.109 Effect: Greylag geese may suffer localised disturbance should they avoid Craigton and Spittalhill Wind Farm during flight activity across the area (paragraph 10.94).

10.110 Nature Conservation Importance and relevant Conservation Status: **High** and **Favourable**.

10.111 Magnitude of Effect: Although the temporal magnitude of the potential effect is **Long Term**, the spatial magnitude is considered to be **Negligible** due to the small area occupied by Craigton and Spittalhill Wind Farm, the relatively low level of goose flight line activity across it, and the ease with which it can be avoided. No geese landed on Craigton and Spittalhill Wind Farm area, and so there will be no loss of foraging habitat for geese. Small numbers of geese flying through the area at relatively low height may possibly increase their flight time to fly around the wind farm, but such an effect is likely to be trivial in the context of bird daily energy budgets[xliv].

10.112 Significance of Effect: The overall effect on Greylag geese is considered to be **Minor** and therefore **Not Significant** under the terms of the EIA Regulations.

Osprey

10.113 Effect: No ospreys were recorded as breeding within the site or 2km survey buffer, and therefore there will be no displacement of osprey nest sites in the local area.

10.114 Nature Conservation Importance and relevant Conservation Status: **Moderate** and **Favourable**.

10.115 Magnitude of Effect: In keeping with most other studies of raptor displacement, it appears that osprey have a low sensitivity to disturbance at operational wind farms and it is reasonable to conclude that if displacement occurs, then it will likely be limited to within 100m of wind turbines if it occurs at all[xxxviii]. This implies that any avoidance of the area close to turbines would be a negligible effect at the population level. With this in mind, although osprey may be displaced from turbines during wind farm operation, the magnitude of such an effect is considered to be **Negligible** spatial, but **Long Term** temporal.

10.116 Significance of Effect: The overall effect on osprey is therefore assessed as **Minor** and therefore **Not Significant** under the terms of the EIA Regulations

Black grouse

10.117 Effect: One lek was recorded in 2012 with four lekking males, this lek was 170m from the nearest proposed turbine and 170m from the nearest proposed access track (see **Figure 10.16**).

10.118 Nature Conservation Importance and relevant Conservation Status: **Moderate** and **Unfavourable, declining**.

10.119 Magnitude of Effect: The literature reviewed in paragraphs 10.78 to 10.80 suggests that black grouse are more sensitive to disturbance than are most other species, and that wind farm operation may continue to cause some displacement of breeding and foraging black grouse from areas close to turbines. This may lead to the loss of the lek site. Given the Nature Conservation Importance and relevant Conservation Status of black grouse the magnitude of effect is considered **High Spatial** and **Long Term Temporal**.

10.120 Significance of Effect: The effect is classified as **Moderate** and is therefore **Significant** under the terms of the EIA Regulations.

Proposed Mitigation

10.121 Chestnut paling fencing (or similar) will be erected around the two easternmost turbines (i.e. those nearest the lek site) to reduce the likelihood of collision with towers and of railings of steps leading into turbines.

10.122 A Habitat Management Plan will be implemented for black grouse. The HMP should be agreed in advance of construction commencing. This will involve the planting of 30 hectares of scattered woodland to enhance foraging habitat for black grouse. Tree planting will occur in small (20-30m^2 coupes) and the density within coupes will be 1600 stems per hectare; overall planting density will be 1100 stems per hectare. Tree species will comprise: common willow, downy birch, European larch and scots pine. Tree planting should be undertaken during the first year of construction.

Residual Effects

10.123 The proposed mitigation reduces effects from moderate to minor and therefore not significant under the terms of the EIA Regulations.

Cumulative Effects Assessment

10.124 This section presents information about the potential cumulative effects of Craigton and Spittalhill Wind Farm in combination with other nearby existing or proposed wind farm developments. SNH has provided guidance on assessing the cumulative impacts of wind farms on birds[vii,xlv]. This assessment follows the principles set out in that guidance. The primary concern with regard to the assessment of cumulative impacts is to identify situations where impacts on populations that may be acceptable from individual developments, are judged to be unacceptable in combination with impacts from other developments[xlvi]. This could be the case, for example, where there are two developments predicted to lead to a minor loss of foraging within the territory of a single pair of eagles. While these impacts may be minor in isolation, taken together they could cross a critical threshold that leads to the abandonment of a territory. Other situations where cumulative impacts could be significant are where there are several minor impacts on a population (considered to be acceptable in isolation) that in combination may threaten the integrity of that population. Thus in a hypothetical case, described by SNH[xlv], wind farm A gives rise to a low level of bird mortality, which lies well within the capacity of that bird population for regeneration and hence has little effect on the overall bird population level. The same would apply to a second wind farm B, taken on its own. However, the level of bird mortality caused by wind farms A and B taken together could exceed the capacity of the population for regeneration, in which case the population would go into decline. Whereas the impact of A and B, each on their own, was not of concern, the impact of A + B is to cause population decrease which is of concern. According to SNH[xlv] "*Cumulative impact assessment can be expensive and time consuming, as it requires knowledge, at least in outline, of the effects of each existing or proposed development within the vicinity. We therefore only seek cumulative impact assessments where it is considered that a proposal could result in significant cumulative impacts which could affect the eventual planning decision. In some situations, a Habitats Regulations Appraisal may be required and this may involve a wider consideration of in combination and other impacts. The key principle for all cumulative impact assessments is to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process".* Cumulative impacts may include cumulative collision mortality, disturbance, habitat loss or barrier effects, all of which should be considered in turn. Cumulative impacts of collision risk should be summed quantitatively, but according to SNH[xlv] "*In practice some effects, such as levels of disturbance or the barrier effect, may need considerable additional research work to assess impacts quantitatively. A more qualitative process may need to be applied until this quantitative information is available, e.g. from post-construction monitoring or research*".

10.125 Some of the birds using the site may forage over a wider area, up to a distance of about 20km (e.g. goose species[xlvii]). Those species using such a large area may be affected by other wind farms within that range. This cumulative effects assessment considers effects up to 20km from Craigton and Spittalhill Wind Farm, in order to assess whether bird populations may be significantly affected by multiple small effects at different sites within their home range.

10.126 There are several other wind farms within 10km of the site. These include Earlsburn North (consented, probably 9 turbines), Fintry Community Wind Farm (operational, 1 turbine), Earlsburn (operational, 14 turbines), Balafark Farm (operational, 1 turbine), Craigengelt (operational, 8 turbines). More than 10km from the site, but within 20km are Loaninghead (scoping), Durrieshill (consented), Ard Ghaoth (scoping), and Tod Hill Community Wind Farm (consented). This is a total of probably 33 turbines within 10km (not including the turbines at Craigton and Spittalhill Wind Farm), and perhaps another 24 in the ring between 10 and 20km distant. This gives a total of about 57 wind turbines within a 20km radius.

Predicted Cumulative Effects

10.127 Disturbance during construction is considered to be likely to have negligible residual effects on local populations of greylag geese and osprey and minor residual effects on black grouse at Craigton and Spittalhill Wind Farm. Cumulative effects of construction disturbance will be negligible, since of the nine other wind farm developments within 20 km, four are already operational, three are consented so are likely to be constructed before work begins at Craigton and Spittalhill Wind Farm, and two are only at the scoping stage so cannot be taken into account within this cumulative assessment. . Temporary disturbance to birds at a landscape scale will be minor with only two wind farm developments under construction at the same time within a land area of over 1300 km^2. According to Pearce-Higgins et al.[xliii], disturbance/displacement effects of operational wind farms on birds are negligible, and for most species, the short-term impacts of construction disturbance are reversed during the operational phase, so cumulative effects of disturbance at these sites where probably no more than two wind farms would be under construction at the same time, can be assessed as **Negligible** and **Not Significant** under the terms of the EIA Regulations.

10.128 Collision rates estimated by the Collision Risk Model for Craigton and Spittalhill Wind Farm should be considered alongside collision mortality caused by other wind farms in the area. However, it has not been possible to source Environmental Statements summarising Collision Risk Model results for these neighbouring wind farms. Therefore, the approach here has been to consider whether scaling up the collision rates predicted at Craigton and Spittalhill Wind Farm would have any impact on populations of target birds.

10.129 The collision rate predicted for greylag goose at Craigton and Spittalhill Wind Farm is 0.018 birds per year. If a similar rate occurred at all wind farms in the area (which is likely to be a precautionary assumption given that not all sites will be in suitable habitat for the species) this would scale up to around 0.18 birds per year for the cumulative sum for all wind farms within the area. Such a rate would be **Minor** and **Not Significant** under the terms of the EIA Regulations, for the greylag goose population (which numbers many thousands of birds within the Region and has a natural mortality of many hundreds per year).

10.130 The collision rate predicted for osprey at Craigton and Spittalhill Wind Farm is 0.035 birds per year. If a similar rate occurred at all wind farms in the area (which is likely to be a highly precautionary assumption given that probably few sites will used by commuting birds) this would scale up to around 0.35 birds per year for the cumulative sum for all wind farms within the area. Such a rate would be **Negligible** and **Not Significant** under the terms of the EIA Regulations, for the osprey population (which numbers tens of birds within the Region, has a natural mortality of several birds per year, and is currently increasing in numbers).

10.131 The collision rate predicted for black grouse at Craigton and Spittalhill Wind Farm is 0.0 birds per year as a result of collisions with turbine blades. However, black grouse are susceptible to collisions with other structures close to ground level. The deployment of chestnut paling fence to reduce this risk, and the Habitat Management Plan to support the black grouse population, together reduce this hazard to the population, and may potentially enhance the local black grouse numbers, in which case, Cumulative Impact Assessment for this species would suggest a potential to increase numbers. However the effect is assessed as **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Proposed Mitigation

10.132 Given the negligible levels of cumulative effects on target bird populations in this area, no mitigation is considered necessary additional to the deployment of chestnut paling and Habitat Management Plan for black grouse.

Residual Cumulative Effects

10.133 Residual cumulative effects on bird populations are considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Further Survey Requirements and Monitoring

10.134 Pre-construction breeding bird surveys will be undertaken as part of the Breeding Bird Protection Plan.

10.135 Black grouse lek surveys should be completed during construction and years 1, 2, 3, 5, 10 and 15 during the operational period.

Summary of Effects

10.136 **Table 10.9** below summarises the predicted effects of Craigton and Spittalhill Wind Farm on birds.

Table 10.9: Summary of Effects

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Construction			
Greylag Goose: Displacement	Negligible	None	Negligible
Osprey: Displacement	Negligible	None	Negligible
Black Grouse: Displacement	Moderate	Restriction on activity one hour before and after dawn during breeding season. Supplementary feeding using feed hoppers.	Minor
Operation			
Greylag Goose: Collision	Minor	None	Minor
Osprey: Collision	Minor	None	Minor
Black Grouse: Collision	Moderate	Chestnut Paling Fencing to reduce collision risk around turbines close to lek sites.	Minor
Greylag Goose: Displacement (of flight lines)	Minor	None	Minor
Osprey: Displacement	Minor	None	Minor
Black Grouse: Displacement	Moderate	Habitat Management Plan to create additional foraging habitat.	Minor

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Cumulative			
Collision	Minor	None	Minor
Disturbance/Displacement (Construction)	Negligible	None	Negligible
Disturbance/Displacement (Operation)	Negligible	None	Negligible

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11 Archaeology and Cultural Heritage

Introduction

11.1 This chapter considers the potential effects of the proposed Craigton and Spittalhill Wind Farm on archaeology and cultural heritage. It details the baseline situation based on the results of a desk-based study and a walkover survey and the potential physical and setting effects of the proposed development. The assessment was undertaken by CgMs Consulting Limited.

11.2 Visualisations for viewpoints common to both the Landscape and Visual Impact Assessment and the cultural heritage study are presented in **Chapter 6: Landscape and Visual Amenity**.

Study Area Description

11.3 The following concentric study areas have been applied:

- Inner Study Area (**Figure 11.1**). Based on the application boundary (the Development Area), data has been gathered for this area to identify potential physical effects.
- Middle Study Area (**Figure 11.2**). This extends 5km from the Development Area boundary. Data has been gathered for this area to identify potential setting effects relating to all designated assets: scheduled monuments, listed buildings, inventory battlefields, world heritage sites, inventory gardens and designed landscapes (IGDL), and conservation areas. Data relating to undesignated assets was also recovered from this area to inform assessment of the potential for previously unrecorded assets in the inner study area.
- Outer Study Area (**Figure 11.3**). This extends 10km from the inner study area. Information for this area has been gathered to identify potential setting effects relating to inventory battlefields, world heritage sites, and IGDL.

11.4 There is no guidance on appropriate study areas for the assessment of effects on the setting of cultural heritage assets. The study areas used here are based on professional experience, which indicates that significant effects on the settings of most designated assets are unlikely beyond a distance of 5km. Inventory battlefields, world heritage sites and IGDLs can be (although, not always) more susceptible to effects from development at greater distances and hence are included up to a distance of 10km. It is acknowledged that there can be exceptions to the above and potential effects on assets outside these study areas have been considered where identified during consultation. One such asset has been identified. The scheduled monument of Inchmahome Priory (AM 90169; **Figure 11.3**) lies outside the outer study area but potential effects on its setting were raised by Historic Scotland in their scoping response. Consequently, an assessment of effects on this asset has been included here.

Effects Assessed in Full

11.5 The following effects have been assessed in full:

- direct physical effects resulting from the construction of the wind farm, including all infrastructure and accidental damage;
- indirect setting effects resulting from the operation of the wind farm. Setting has been considered with reference to Managing Change in the Historic Environment: Setting, which states that: 'Setting should be thought of as the way in which the surroundings of a historic asset or place contribute to how it is experienced, understood and appreciated'.i

Effects Scoped Out

11.6 There are pockets of peat, with depths in excess of 1.5 m, in the base of the valley of the Backside Burn (described in **Chapter 8: Geology, Hydrology and Hydrogeology**). The pockets are not in proximity to known archaeological sites and their archaeological interest is limited; the palaeoenvironmental information (for example: pollen, preserved wood and insect remains) that may be recovered from the peat would only inform our understanding of human activity in the area at a very general level. The proposed development will not impact on our ability to retrieve this general information in the future and the effects of the proposed development on any palaeoenvironmental information contained within peat are scoped out.

11.7 There are no inventory battlefields in the outer study area. The site of the Battle of Kilsyth is the closest to the site, lying some 10.5km from the nearest turbine. The sites of Bannockburn, Sheriffmuir and Stirling Bridge also lie over 10km away. None of these sites lie within the ZTV of the proposed development and potential effects on inventory battlefields have been scoped out. Similarly, there are no potential effects on the settings of world heritage sites and these have been scoped out.

11.8 Potential setting effects on features outside the outer study area have been scoped out; with the exception of those included in consultation responses (i.e. Inchmahome Priory; AM 90169).

11.9 Given the nature of cultural heritage assets within the inner study area, and the potential for previously unrecorded cultural heritage assets, cumulative construction effects associated with the proposed development have been scoped out.

Assessment Methodology

Assessment Structure

11.10 The assessment is structured around the consideration of potential effects on the following:

- physical fabric of onsite archaeology;
- setting of designated cultural heritage assets in the surrounding area.

Data Sources and Guidance

11.11 The following data sources have been used.

- Historic Scotland Geographic Information System (GIS) datasets for designated assets;
- National Monuments Record of Scotland (NMRS), including aerial photography;
- Stirling and Clackmannanshire Sites and Monuments Record (S&CSMR);
- Historic Land Use Assessment data (Royal Commission on the Ancient and Historical Monuments of Scotland);
- National Library of Scotland;
- other readily available documentary sources, including Statistical Accounts.1

11.12 The study has been undertaken with reference to relevant Institute for Archaeologists' guidance and the requirements of Stirling Council's Planning Officer (Archaeology) as outlined in their scoping response .[ii] In response to the scoping report, Historic Scotland indicated that they welcomed the preparatory consideration given to the assessment of the potential level of impact on the historic environment outlined therein, and were content with the methodology proposed.[iii]

Field Survey

11.13 For reasons related to access, field survey of the inner study area was undertaken during two visits. Field survey was designed to verify and augment the findings of the desk-based study and assess potential direct physical effects. The first visit (7th November 2012) was in wet conditions with reasonable visibility, the second (4th December 2012) in good visibility. The survey was targeted on the turbine locations and associated infrastructure. The location and extents of assets were recorded using consumer grade GPS (Global Positioning System) handset with EGNOS (European Geostationary Navigation Overlay Service) correction, accurate to 3m.

11.14 Assets with potential setting effects in the middle and outer study areas were visited during good visibility from October to December 2012.

[1] The Statistical Accounts of Scotland consist of three series of documentary publications covering life in Scotland in the 18th, 19th and 20th centuries. They comprise accounts of each parish produced by the relevant minister. The first two, published from 1791-99 and 1834-45, are valuable sources of local historical information.

Consultation

11.15 A table of consultation responses is included below (see **Table 11.1**).

Table 11.1: Consultation Responses

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Stirling Council Planning Officer (Archaeology)	E-mail (13/11/12)	Agreed on scope of the study regarding direct effects on undesignated remains, likely mitigation and advised on position regarding setting effects.	The study included a walkover survey and potential direct effects on undesignated remains were assessed in full.
Historic Scotland	Formal Scoping Consultation (letter dated 10/10/12)	Consideration should be given to potential direct effects related to three scheduled monuments within the proposed site boundary: Fintry Castle (AM 7085), Double Craigs (AM 608) and Craigton (AM 2556).	These assets are no longer within the proposed site boundary due to a revision in the site boundary and there are no potential direct effects (indirect setting effects were still assessed).
		Consideration should be given to effects on the settings of the following scheduled monuments: Todholes cairn (AM 4491), Todholes cairn (AM 2492), Sir John de Graham's Castle (AM 4278), Dunmore fort (AM 2575), Stronend cairn (AM 7005), Stronend cairn (AM 7030), Keir Knowe motte (AM 2561) and Inchmahome Priory (AM 90169).	This chapter considers potential effects on the setting of the specified assets and appropriate visualisations are provided **(Figures 6.10 and 6.11; Figures 11.4 and 11.5)**.
		Consideration should be given to effects on the settings of the following Listed Buildings and Designed Landscapes: Cardross House, Gargunnock House and Touch.	This chapter considers potential effects on the setting of the specified assets and appropriate visualisations are provided **(Figure 6.15)**.
		Requested that cumulative photomontages be	Cumulative wireframes **(Figure 6.27; Figure 11.4 and 11.5)** were
		supplied from Sir John de Graham's Castle (AM 4278), either of the Todholes cairns (AM 4491 and 2492) and either of the Stronend cairns (AM 7005 and AM 7030).	supplied to Historic Scotland and it was confirmed that these provided sufficient information to assess effects (email dated 29/10/12).

Assessing Significance of Effects

11.16 The assessment of an effect's significance depends on the sensitivity of the asset affected and the magnitude of predicted change. The following sets out the framework used here and draws on the following guidance.

- Scottish Historic Environment Policy;[iv]
- Managing Change in the Historic Environment: Setting.[v]

11.17 The sensitivity of an asset to effects has been determined on the basis of designation and in the case of undesignated assets, with reference to the criteria provided in Annex 1 of *Scottish Historic Environment Policy* for the determination of national importance for scheduling. Sensitivity to effects reflects the level of importance of the asset as presented below (**Table 11.2**).

Table 11.2: Sensitivity Criteria

Sensitivity	Importance	Description
Very High	International	World Heritage Sites.
High	National	Nationally important designated assets (scheduled monuments, Category A listed buildings, inventory gardens and designed landscapes and inventory battlefields) or assets meeting the criteria for national importance. Some conservation areas are of national importance.
Medium	Regional	Category B listed buildings, conservation areas and undesignated cultural heritage assets and historic buildings of regional importance. Assets of regional importance.
Low	Local	Category C listed buildings and undesignated cultural heritage assets and historic buildings of local importance.
Negligible	-	Poorly preserved sites with little intrinsic, contextual or associative value.

11.18 The magnitude of change has been assessed with reference to the degree of change in the asset's cultural significance (**Table** 11.3). The term 'cultural significance' is as used in *Scottish Historic Environment Policy* Annex 1; and is distinct from sensitivity and significance of effects (as used in standard Environmental Impact Assessment terminology). The cultural significance of an asset can be characterised by reference to one or more characteristics, namely:

- Intrinsic – those inherent in the monument;
- Contextual – those relating to the monument's place in the landscape or in the body of existing knowledge; and

- Associative – more subjective assessments of the associations of the monument, including with current or past aesthetic preferences.

11.19 The cultural significance of each asset potentially affected has been described and the degree to which the overall cultural significance of the asset is affected is used to arrive at a magnitude of predicted change as set out below.

Table 11.3: Magnitude Criteria

Magnitude of Change	Description
Major	Total loss or major/substantial alteration to key elements of the asset or its setting, such that post-development cultural significance of the asset and the degree to which this may be appreciated will be fundamentally changed.
Moderate	Loss or alteration to one or more key elements of the asset or its setting, such that post-development cultural significance of the asset and the degree to which this may be appreciated will be materially changed.
Minor	Minor shift away from the baseline conditions. Change arising from the loss/alteration will be readily detectable but not material: post-development the asset's cultural significance and the degree to which this may be appreciated will be similar to prior to the development.
Negligible	Very little change from baseline conditions. Change barely detectable, approximating to a 'no change' situation.

11.20 The sensitivity of the asset, together with the magnitude of change, defines the significance of the effect (**Table 11.4**). Where there is scope for two levels of effect (e.g. major or moderate), professional judgement has been used. Effects of 'major' or 'moderate' significance are considered to equate to significant effects in the context of the EIA Regulations (see **Chapter 2**, Section 2.27).

Table 1111.4: Significance of Effects Criteria

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

Planning Policy

11.21 Planning policies of relevance to this assessment are provided in **Chapter 5: Planning Policy Context**.

Existing Conditions

11.22 This section details:

- Topography as relevant to an assessment of effects on cultural heritage (e.g. where it informs consideration of potential for previously unrecorded assets). A detailed description of the Development Area and proposed wind farm is found in Chapter 4: Development Description.
- Heritage assets recorded within the Development Area boundary.
- The potential for previously unrecorded assets to be present within the Development Area boundary.
- Designated assets in all the study areas, as defined in section 11.3.

11.23 The condition of heritage assets within the Development Area is stable, i.e. they are unlikely to degrade substantially due to natural processes and there are no on-going human activities that are likely to result in their loss or substantial disturbance. Therefore baseline conditions would remain unchanged if the 'Do Nothing' scenario were to be played out.

11.24 The settings of the designated assets considered in this assessment are not liable to change substantially in the foreseeable future, with the exception of those affected by forestry plantations in the Carron Valley (Carron Valley and Cairnoch). These plantations are sustainably managed by Forestry Commission Scotland as set out in current strategy.[vi] Any felling undertaken as part of this management would affect the setting of Sir John de Graham's Castle (AM 4278) and would restore views to the surrounding area. It is assumed that in line with current strategy felling would be followed by re-planting and in time views would be screened once again.

11.25 The location of heritage assets within/or adjacent to the inner study area is shown in **Figure 11.1** and designated assets in the middle and outer study areas are shown on **Figure 11.2** and **11.3**. Non-designated assets are referred to by numbers issued in the course of the current study prefixed 'CH'. Detailed descriptions of undesignated assets and lists of designated assets are presented in **Appendix 11.1**.

Topography

11.26 The Development Area takes in land between 400m AOD and 250m AOD. The land is moor used for grazing and grouse shooting; some limited drainage has been undertaken.

11.27 The Development Area occupies the western slopes of a valley formed by the Backside Burn, which flows to the south-east where it joins the Burnfoot Burn to form the Endrick Water. The valley divides the Fintry Hills to the west from the Gargunnock Hills to the east. Both these ranges have rocky escarpments to the north, and in the case of the Fintry Hills the west and south. A more accessible approach to the hilltop is offered by the valley of the Endrick. The hills overlook the Forth Valley to the north and east, and the much narrower valleys of the Endrick and Carron to the south. The valley floors are hilly, and occupied by small settlements including Fintry, Gargunnock and Kippen. The landscape is dotted with farmsteads and stands of trees separated by mainly pasture fields. There are some conifer plantations; especially in the Carron Valley to the south, which also contains the large Carron Valley Reservoir, created in the 20th century.

11.28 In the Historic Land Use Assessment data the Development Area is within an area classified as moorland and rough grazing; from the 20th century to present, with no relict landscapes identified within the inner study area.

Assets within the inner study area

11.29 There are no designated assets within the inner study area.

11.30 Several previously recorded undesignated assets lie across the boundary of the inner study area. These are: a group of shielings (CH 13; **Figure 11.1**) and two possible hut circles (CH 5 and 6; **Figure 11.1**). The shielings are a common feature and of local importance and low sensitivity. The possible hut circles cannot be conclusively dated on the basis of their surface appearance. They are either related to prehistoric settlement or post-medieval agriculture. In the former case they are considered, at most, of regional importance and medium sensitivity; in the latter of local importance and low sensitivity. The group of shielings (CH 13) is around 80m from the proposed access track. The possible hut circles (CH 5 and 6) are adjacent to an existing track that will not be subject to any proposed development works. There are no predicted effects on these assets and they are not considered further except to inform consideration of the potential for unrecorded assets.

11.31 The field survey identified four cultural heritage assets that had not been recorded previously. Furthest north was an upstanding drystone wall with up to three small possible twinning pens adjoining (CH 3; **Figure 11.1**). The wall follows an unnamed tributary of the Backside Burn on its north-west side. It runs from a rock escarpment at its south-west end and peters out in the north-east. The wall is not continuous; a substantial gap separates two sections. It had not been recorded or mapped previously and is assumed to be of post-medieval or later date. It is of local importance and low sensitivity. The proposed access track will run through the gap that separates the wall's two sections.

11.32 A circular banked enclosure (CH 14), approximately 7 m in diameter, a series of drystone enclosures with a twinning pen (CH 15) and a stone dyke (CH 16) were recorded to the south. The banked enclosure (CH 14) is around 5m to the east of the proposed access track. The date and function of the

banked enclosure is unknown and cannot be determined on the basis of surface form alone. It may be a prehistoric hut-circle or a sheepfold of substantially later date. In the former case it is considered, at most, of regional importance and medium sensitivity; in the latter of local importance and low sensitivity. There are potential direct effects on the banked enclosure (CH 14) and this asset is considered further below. The remaining enclosures (CH 15) and stone dyke (CH 16) are clearly related to agriculture and are likely to be of medieval or later date. They are of local importance and low sensitivity. The enclosures and stone dyke (CH 15 and 16) are not in proximity to the proposed development footprint, there are no predicted effects on these assets and they are not considered further.

11.33 Two possible undesignated cultural heritage assets identified during the desk-based work within the inner study area were discounted by field survey. A possible building recorded within a group in the S&CSMR (CH 1, **Figure 11.1**; post-medieval enclosures, dykes and sheepfolds) was within the inner study area. It is not shown on first edition Ordnance Survey mapping[vii] or subsequent editions up to 1952[viii] nor was it identifiable on aerial photographs (**Appendix 11.2**). It appeared on Ordnance Survey mapping in 1978 and no trace of it could be identified during the field survey. It is assumed to have been a modern, temporary stock enclosure and has been discounted (as a result the area covered by CH 1 no longer extends into the inner study area). Inspection of vertical aerial photographs resulted in the identification of some remains potentially relating to post-medieval cultivation (rig and furrow) at the confluence of the Shelloch and Backside Burns. These provisional findings were checked during field survey and no upstanding remains were identified; therefore these possible features can also be discounted.

Potential for unrecorded assets

11.34 Past human activity is likely to have been concentrated on land along valley floors, as is still the case. The late 18th century Statistical Account of Fintry[ix] notes that only two valleys in the parish were occupied: that of the Endrick and that of the Carron. The site is located at higher elevations. However, in the immediate surroundings, and at the same altitude, there are sites dating to both the later prehistoric and post-medieval periods.

11.35 Presumed later prehistoric burial cairns at Stronend (AM 7005 and 7030; **Figure 11.2**) and Todholes (AM 2492 and 4491; **Figure 11.2**) are upstanding and positioned in prominent locations. It seems probable that should further cairns exist within the Development Area they will also be upstanding; none were identified during field survey. The possible hut circle at Double Craigs (AM 608; **Figure 11.2**) suggests that there may have been later prehistoric settlement as high as 380m AOD. Several other possible hut circles are recorded to the northeast of Todholes (CH 4-7; **Figure 11.1**). One of these was sample excavated during construction of the adjacent Earlsburn Wind Farm[x]. This did not conclusively establish whether the site was archaeological or natural in origin. An archaeological evaluation and walkover survey also undertaken in advance of construction of the Earlsburn Wind Farm[xi] noted evidence of quarrying, which could have been prehistoric.

11.36 The Statistical Account of the late 18th century notes that the agriculture of the parish largely concerned raising black cows and sheep on the surrounding grazing, which would have included the uplands during summer. The lower elevations were conducive to producing winter fodder as well as some other crops. To the east of the proposed access track, and outside the Development Area boundary, are remains recorded in the S&CSMR related to post-medieval cultivation and a sheep enclosure (CH 2; **Figure 11.1**). Post-medieval settlements and agricultural remains are recorded at Burnfoot (CH 8; **Figure 11.1**), Backside (CH 9; **Figure 11.1**) and Cringate (CH 10; **Figure 11.1**) and buildings at these locations can be seen on the first edition Ordnance Survey maps of the area.[xii] That at Backside is noted to be ruinous at that time (the Statistical Account of 1791-99 notes that depopulation of farms had been common in the preceding 40 years)[xiii]. Roy's map made in the mid 18th century[xiv] seems to depict some unnamed buildings in the same approximate location as Backside and records a 'West Cringett' in roughly the same location as Cringate. It is notable that all these settlements lie on the east side of Backside Burn or Endrick Water; markedly fewer structures are recorded to the west, where the proposed development is located. Roy does record a settlement to the west named 'Newfield'. Roy cannot be used to accurately locate features and this settlement is not shown on later maps. However, the group of structures recorded as CH 1 (**Figure 11.1**), and marked as a sheepfold on OS mapping from the first edition onward[xv], are in the same approximate location as Roy's 'Newfield'. This structure is still extant, outside the Development Area boundary, and may have earlier origins as a settlement.

11.37 Less substantial agricultural remains are noted at higher elevations within 1km of the proposed development and to the west of Backside Burn. These include remains relating to transhumance agriculture (a stock enclosure CH 11 and shielings CH 12 and 13; **Figure 11.1**).

11.38 The results of the desk based assessment suggested that there was potential for previously unrecorded post-medieval and prehistoric remains to be present in the inner study area and that any such remains could be expected to be upstanding and therefore identifiable during field survey. Field survey confirmed this assessment and identified one banked enclosure, of unknown date and function, in close proximity to the proposed access track (CH 14; **Figure 11.1**). The field survey also identified some remains relating to post-medieval stock management (CH 3 and CH 15-16; **Figure 11.1**). If the banked enclosure (CH 14) is related to prehistoric settlement there is some potential for associated sub-surface remains in the vicinity. Elsewhere the potential for further unrecorded assets is considered to be low.

Scheduled Monuments

11.39 There are 19 scheduled monuments within the middle study area (**Table 11.5**, **Figure 11.2**). These comprise five cairns, five duns or forts, two mottes, two castles, a single standing stone and a group of two standing stones, a bridge, a hut circle and a deserted village. There are two cairns at Stronend on the summit of Fintry Hills. There are a further two cairns near to the proposed access route and one to the east at Carleatheran. There are several monuments on the sides or valley base of the Endrick Water, including Fintry Castle and Sir John de Graham's Castle. All scheduled monuments are of high sensitivity and all are considered to have intrinsic value as potential sources of data.

Table 11.5: Scheduled Monuments Within the Middle Study Area

AM no	Name
608	Double Craigs, hut circle
701	Endrick Water, low bridge 1830m ESE of Fintry
2229	Fintry, motte 400m WSW of Fintry Bridge
2492	Todholes, cairn 1000m NNE of
2547	Brokencastle, dun 600m NE of Dasher
2556	Craigton, dun 460m N of
2561	Keir Knowe, motte 460m W of Easter Glinns
2575	Dunmore, fort
2696	Knochraich, standing stone 340m NW of
2719	Waterhead, two standing stones 800m ENE of
3394	Harvieston, deserted village E of
4278	Sir John de Graham's Castle
4491	Todholes, cairn 1300m NNW of
5681	Dunbeg, fort 700m W of Fintry Bridge
7005	Stronend, cairn at summit, Gargunnock Hills
7009	Dasher, fort 600m ENE of
7010	Carleatheran, cairn at summit, Gargunnock Hills
7030	Stronend, cairn 300m SSW of summit, Gargunnock Hills
7085	Fintry Castle, remains of

11.40 The cairns at Stronend (AM 7005 and 7030; **Figure 11.2**) are upstanding and are assumed to be Bronze Age funerary monuments. The cairns are prominently situated at the north-western edge of the Fintry Hills and they were positioned to be visible over a wide area. Similarly, the cairn at Carleatheran (AM 7010; **Figure 11.2**) is positioned on a summit of the Gargunnock Hills overlooking the Forth Valley to the north. The cairns are visible from one another and this intervisibility adds to an appreciation of their wider context and prehistoric use of the landscape. The existing views from these monuments are panoramic when looking out over the Forth Valley to the north, north-east and north-west and add to an appreciation that these monuments were built to be visible from the valley floor. It follows that the cairns are visible from many points on the valley floor to the north and west; and views into the assets also contribute to their setting. These attributes of the cairns' settings add to their contextual value and are important to understanding their function. The panoramic views from the cairns over the valleys contain many modern features but are essentially rural in character with a backdrop of mountains at the other side of the Forth Valley (including the Braes of Doune and Ben Vorlich). The views to the south, south-east and south-west, to the interior of the Fintry or Gargunnock Hills, are of undulating moor. The latter views are devoid of modern features with the exception of existing wind turbines (related to the Earlsburn and Craigengelt Wind Farms) and a mast; they do not add to an appreciation of the cairns except where intervisibility is apparent.

11.41 The cairns at Todholes are thought to be a 'double ring' cairn of later Neolithic or Bronze Age date (AM 4491; **Figures 11.1 & 11.2**) and a cairn with possible kerb (AM 2492; **Figure 11.2**). The former is located on a knoll on the eastern slopes of the Fintry Hills and surrounded by rough-grazing. It has striking open views to the south and east to the Carron Valley, with the Campsie Fells and Kilsyth Hills beyond. Areas of forestry and the Carron Valley Reservoir occupy the middle distance. The view to the north is constrained by Cringate Law, upon which the turbines of the Earlsburn Wind Farm are clearly visible. The view west is restricted by the Fintry Hills. It is thought that the views to the east and south are likely to have been important to the cairn's function, certainly these views take in the second Todholes cairn (AM2492), areas of probable contemporary farming in the Carron Valley and around the Endrick Water and take in prominent landforms that the cairn's builders may have referenced. The cairn's structure, whilst appreciable at short range, is not readily identifiable from distances of more than a few metres. Consequently, only the views from the cairn are considered to contribute to its cultural significance; these, specifically those to the east and south, are important to an appreciation of the cairn's probable intended function. The cairn's remains are so slight that they do not contribute to the sense of place or the aesthetics of the views. Hence only the functional relationship between the cairn and its surroundings is considered relevant to its cultural significance.

11.42 The second cairn at Todholes (AM 2492, **Figure 11.2**) is located on a large terrace of the Endrick Water, which flows north/south approximately 430m to the east. It survives as a large, mutilated mound and is quite conspicuous on the otherwise flat terrace. Although lower than the neighbouring cairn, the views from it are essentially the same, with the exception that views westwards along the Carron Valley are available. As with its neighbour, views over the valley are important to an appreciation of its probable intended function. However, views of the cairn from the terrace and its immediate surroundings are relevant as the cairn is locally prominent and this was presumably intentional. Consequently, it is considered that views from the cairn to the Carron Valley and of the cairn from the terrace and its immediate surroundings are important to an appreciation of its function and therefore contribute to its contextual value.

11.43 Double Craigs hut circle (AM 608; **Figure 11.2**) is a low turf-covered ring, assumed to relate to prehistoric settlement. It is located at a prominent location; although is not prominent in itself. It has an appreciable relationship to other visible prehistoric sites in the vicinity (such as the Dun at Craigton; AM 2556) and the surrounding land presumably farmed by the occupants.

11.44 The duns or forts at Brokencastle (AM 2547; **Figure 11.2**), Dasher (AM 7009; **Figure 11.2**), Craigton AM 2556; **Figure 11.2**), Dunmore (AM 2575; **Figure 11.2**) and Dunbeg (AM 5681; **Figure 11.2**) are all upstanding monuments. Dunmore, Dunbeg and Craigton occupy sides of the valley of the Endrick Water while Brokencastle and Dasher occupy the side of Boquhan Glen to the north. All the forts are situated in positions that offer good natural defences. This and views of surrounding lower-lying areas contribute to an understanding of their function and contribute to their contextual value. Intervisibility between any of these monuments (for example, that between Dunmore and Craigton) will also add to their appreciation and contribute to their setting.

11.45 There are several medieval mottes and castles within the middle study area, which share similar characteristics. A presumed motte at Keir Knowe (AM 2561; **Figure 11.2**) is described as consisting of an artificial bank on the top of a natural knoll. The monument is not prominent in the landscape. The immediate setting of the asset, its positioning on a knoll beside an unnamed tributary of the Pow Burn and overlooking lower ground to the north, is important in appreciating its defensive attributes. Views from this monument to the south-east, toward the proposed development, are currently screened by a stand of broad-leaf mature trees at the margins of a pasture field. The motte at Fintry consists of an oval mound with broad, encircling ditch up to 1.5m deep (AM 2229; **Figure 11.2**). The top is level and measures around 37m by 30m. It occupies the crest of a slight ridge from which the ground falls steeply to the valley floor on the north-east. Sir John de Graham's Castle (AM 4278; **Figure 11.2**) is the most thoroughly recorded, and prominent, of these assets. The motte is traditionally held to be the residence of Sir John Graham of Dundaff who was killed in 1298 at the Battle of Falkirk. It occupies a commanding position on a promontory of raised ground and consists of a rectangular platform, surrounded by a wide, flat-bottomed ditch (crossed by wooden stairs). Immediately northeast, and outside the ditch, are the remains of stone structures. The asset is currently surrounded by a conifer plantation (Cairnoch managed by Forestry Commission Scotland), although this does not encroach on the monument itself. One open aspect to the south along a watercourse that runs to the Carron Valley Reservoir, is preserved by means of an unplanted corridor, and this allows some appreciation of the asset's deliberate location to control the entrance to the valley of the Endrick Water. There is some parking on the B818 at the end of this open corridor, where most visitors presumably gain access to the monument. The view into the monument from the end of this open corridor includes part of a turbine of the Earlsburn Wind Farm directly behind the motte and emerging from behind the plantation. Fintry Castle (AM 7085; **Figure 11.2**) is a ruinous stone castle estimated to be of 15th-16th century date and was likewise positioned on a knoll. All the medieval mottes and castles are positioned to control movement along the valleys they occupy and their relationship to their surroundings contributes to their contextual value. Intervisibility between monuments, whether they operated contemporaneously or succeeded one another, will also contribute to an appreciation of these assets where it survives. Indeed, such visibility between Sir John de Graham's Castle and Fintry Castle is noted in an early account of the history of the parish.[xvi] The conifer plantation that now surrounds Sir John de Graham's Castle currently screens Fintry Castle from view.

11.46 There are two presumably prehistoric standing stones within the middle study area, which share some characteristics. The standing stone at Knochraich (AM 2696; **Figure 11.2**) stands about 1m high and bears an inscription of a human figure of unknown date as well as two cup-marks of presumed Bronze Age date. The two stones at Waterhead (AM 2719; **Figure 11.2**) occupy a small knoll and one bears cup-marks. Their immediate surroundings add to an appreciation of their cultural significance as they appear to have been positioned so as to be prominent in the valley floors they occupy.

11.47 The bridge over Endrick Water (AM 701; **Figure 11.2**) was built in 1750, it is also a Category B listed structure. Its setting is contributed to by the road it forms part of and the river it crosses.

11.48 A scheduled monument at Harvieston (AM 3394; **Figure 11.2**) comprises the upstanding remains of a post-medieval settlement. Its contextual value is contributed to by the roadway it was positioned next to and the surrounding farmland.

11.49 The Zone of Theoretical Visibility (ZTV) of the proposed development (**Figure 11.2**) includes the cairns at Stronend, Carleatheran and Todholes. Most scheduled monuments on the valley floor and sides of the Endrick Water do not fall within the ZTV; the exceptions are Sir John de Graham's Castle (AM 4278) and the motte at Keir Knowe (AM 2561). The remaining scheduled monuments outside the ZTV do not have relevant viewpoints from third locations that will be affected by the proposal and are not considered further.

Listed Buildings

11.50 There are nineteen listed buildings (LBs) in the middle study area (**Table 11.6**, **Figure 11.2**):

Table 11.6: Listed Buildings Within the Middle Study Area

LB no	Category	Name
8191	A	Kippen, Gribloch House
8191	A	Kippen, Gribloch House, Swimming Pool
10467	A	Culcreuch Castle Hotel

LB no	Category	Name
4203	B	Mains of Glinns
8155	B	Wright Park
8192	B	Kippen, Gribloch House, Garage Block
8193	B	Kippen, Gribloch House, Lodge
10444	B	Auldhall
10465	B	Old Fintry Parish Church
10466	B	Old Fintry, Dunmore Cottage
10468	B	Fintry Bridge
10469	B	Gonachan Low Bridge
12513	B	Fintry, Main Street, Telephone Call Box
8156	C	Baille Bow's Bridge
8175	C	Kippen, Main Street
12514	C	Kippen, Main St, Post Office, Grocer & Post Box
45586	C	Glentirranmuir, Bochastle Cottage
45586	C	Glentirranmuir, Glentirran Cottage
49005	C	Balgair Muir, Lernock Burn, Bridge

11.51 Of these, three are Category A structures. Gribloch House and Swimming Pool (listed under a single number HB 8191; **Figure 11.2**) are 20th century structures by Basil Spence and Perry Duncan. They were built as a private dwelling from 1937-9. The house has a curved entrance front facing north-east with projecting west bay. The garden front faces south-west and has two deep, splayed bay windows flanking a swimming pool and a lower service wing to the east. The structure has 2-storeys and the garden front has a full-height five-light stair window.[xvii] A staff and garage block to the east is Category B listed (HB 8192; **Figure 11.2**); as is a lodge positioned on the B822 to the north (HB 8193; **Figure 11.2**). An article that explores the house's design in detail[xviii] notes that the front of the house faces north, giving each of the rooms on this elevation spectacular views over the Grampians. To the south a tree-lined avenue was cut through existing wood to afford views of the Fintry Hills. This avenue survives in somewhat overgrown form. It is aligned south-west (as shown on **Figure 11.2**), perpendicular to the garden front. It is clear that this vista was part of the original design of the gardens (by JE Grant White); and gives a '*lovely view of the Fintry Hills from the staircase window*'.[xix] With the exception of this avenue the house and garden is screened by mature trees to the south. The incorporation of key views or vistas into the design of Gribloch House was an integral part of its design and they contribute greatly to an appreciation of its cultural significance.

11.52 Culcreuch Castle (HB 10467; **Figure 11.2**) is a late medieval tower integrated into an 18th century mansion and is also Category A listed. Other listed structures include bridges, domestic dwellings, a church and a phone box. They occupy the valley floors to the southwest, west and north of the proposed development; with most concentrated around Fintry and Kippen.

11.53 Of the Category A listed buildings, Gribloch House falls within the ZTV and is considered further below. Culcreuch Castle Hotel is outside the ZTV and does not have relevant viewpoints from third locations that will be affected by the proposal and is not considered further. Of the remaining listed structures Wrightpark (HB 8155, Category B; **Figure 11.2**) is an early 18th century mansion[xx] that lies 3.9km north of the nearest turbine and falls within the ZTV of up to three turbines (to tip). Its principal elevation faces north-east, away from the proposed development, and there are no relevant viewpoints from third locations that will be affected. It is concluded that there are no effects on its setting and it is not considered further. The remaining listed structures all fall outside the ZTV and are not considered further with the exceptions of those associated with Gribloch House, which are included in a consideration of the Category A listed building.

Conservation Areas

11.54 There are three Conservation Areas within the middle study area (Fintry, Kippen West and Kippen; **Figure 11.2**). They do not fall within the ZTV and do not have relevant viewpoints from third locations that will be affected by the proposal and are not considered further.

Inventory Gardens and Designed Landscapes

11.55 There are three IGDLs in the Outer Study Area (**Figure 11.3**, **Table 11.7**):

Table 11.7: IGDL Within the Outer Study Area

Name	Brief description
Cardross House	Early mid to late 19th century parkland. Significant architectural features including Category A listed building.
Gargunnock House	Attractive gardens and parkland around a Category A listed house.
Touch	Designed landscape associated with the Seton family.

11.56 The summary inventory entry for Cardross House designed landscape says that Cardross is '*an ancient site which may have gardens and a designed landscape from as early as the 15th century. Today's attractive early to mid-19th parkland is of importance scenically and for nature conservation. The architectural features and potential archaeology are also very significant.*' Within the designed landscape is the Category A listed Cardross House and several other listed structures. The house is of several different phases; the earliest being medieval. The entrance is to the north-west and the building is broadly rectangular in form. The south-eastern front of the house has an outlook over parkland and the River Forth toward the proposed development. This south-eastern aspect, over the Forth to farmland with the Fintry and Gargunnock Hills in the distance, is the principal view from many parts of the surrounding parkland. The view is essentially rural in character with few modern elements. As noted above the setting of the house is important for scenic reasons. The immediate surroundings also contribute to an understanding of the strategic importance of the location as it relates to the building's medieval origins. Later adaptation and extension of both the house and gardens have taken advantage of surrounding views; principally toward the Fintry and Gargunnock Hills and the proposed development.

11.57 Gargunnock House and Touch both contain Category A listed structures set within parkland with some formal elements. They lie outside the ZTV and there are no views from other locations that include either of these assets and the turbines. For those reasons they are not considered further.

Other assets considered

11.58 Inchmahome Priory (AM 90169; **Figure 11.3**) is situated on an island in the middle of the Lake of Mentieth. The island was the location for an Augustinian Priory founded around 1238.[xxi] The upstanding remains consist of the church, cloister, chapter house, most of the east range and fragments of the south and west ranges. Much of the church is still standing. The island (in the care of Historic Scotland) is dominated by mature trees, with some open views to the north and north-east where seating benches are located. The priory is reached using a boat that travels from a jetty at the Port of Mentieth on the north-east shore of the lake and effectively transports the visitor from 'the modern world to the medieval'. Visitors disembark on the north side of the island where the priory ruins are located. They are encouraged to walk around the island by signage. On the south side of the island views out toward the proposed development are screened by mature trees both on the island itself and on a tongue of land that extends out from the south shore of the lake. The distinctive skyline of the Fintry and Gargunnock Hills is not visible. During the boat trip to and from the island the skyline is visible to the south; on the visitor's left on approach and right on departure. Both the trip to the island and the mature trees that

screen the ruins contribute to a sense of removal from the modern world and very few modern elements are visible from the island. The most obvious modern intrusion is traffic noise from the adjacent A873. The cultural significance of the asset is enhanced by aesthetic and contextual characteristics related to the priory's location on an island screened by mature trees. These elements of the priory's setting add substantially to its appreciation and give the asset a unique sense of place.

Wind Farm Layout Design Considerations

11.59 No modifications to the proposed development layout were deemed necessary in terms of potential effects on cultural heritage assets.

Effects Assessment

11.60 The assessment of effects is based upon the project description outlined in **Chapter 4: Development Description** and is structured as follows:

- construction effects;
- operational effects;
- cumulative effects.

Construction Effects

Predicted Effects

11.61 Construction works have the potential to have a direct effect on any assets that survive within the proposed development footprint through physical disturbance. The proposed new access track passes some 5m to the west of an upstanding banked enclosure (CH 14; **Figure 11.1**) identified by field survey. The date and function of the enclosure are not known, however it is either prehistoric, and related to settlement or agriculture, or post-medieval and related to agriculture. In the former case the feature is at most of medium sensitivity and in the latter case of low sensitivity. Although the enclosure lies outside the construction footprint, the construction of the proposed access track, and any adjacent excavation, has the potential to directly affect this asset through accidental damage. The magnitude of this change is predicted to be moderate at worst (there may be loss or alteration to one or more key elements of the asset) and therefore in a 'worst case scenario' the significance of the effect is predicted to be Moderate. Construction also has the potential to damage currently unidentified sub-surface features associated with this asset which may extend into the footprint of the works. The magnitude of this change is predicted to be minor at worst (there will be a minor shift away from baseline conditions) and therefore in a 'worst case scenario' the significance of the effect is predicted to be Minor.

11.62 The proposed new access track passes through an existing gap in a drystone wall with associated possible twinning pens identified during field survey (CH 3; **Figure 11.1**). Sub-surface traces of the wall or associated features may be damaged by construction of the new access track. The sensitivity of the asset is assessed as low; the magnitude of the predicted change is assessed as minor. The significance of the effect is assessed as Negligible, rather than minor, because the upstanding and visible part of this asset will be preserved.

Proposed Mitigation

11.63 Mitigation of predicted effects on the banked enclosure (CH 14; **Figure 11.1**) and any previously unidentified sub-surface features in its vicinity is proposed. To prevent inadvertent damage to the asset during construction the upstanding banked enclosure will be marked out prior to works commencing in its vicinity. The marking will provide a clear boundary to prevent machine movements or any other works affecting the upstanding remains. Relevant contractors will be made aware of the boundary's purpose. Topsoil stripping for the proposed access track, and any adjacent excavation works, for a length of 150m either side of the asset (**Figure 11.1**) will be monitored by an archaeologist. If monitoring identifies archaeological remains construction work shall be halted in the vicinity to allow for the archaeological excavation and recording of the remains. The results of the work will be included in a report to be submitted to Stirling Council. A full specification for the works (Written Scheme of Investigation) will be agreed with the Stirling Council Planning Officer (Archaeology) prior to work commencing.

11.64 No mitigation is proposed for effects on sub-surface remains of the drystone wall (CH 3).

Residual Effects

11.65 Following the implementation of the above mitigation there will be no effect on the upstanding banked enclosure (CH 14) and any effects on associated sub-surface remains will be mitigated by the implementation of a programme of works that allows for preservation by record. Any residual effects will be of Negligible significance as the physical loss of any archaeological features will be offset by their preservation by record.

11.66 Residual effects on any sub-surface remains associated with the drystone wall and twinning pens (CH 3) are of Negligible significance.

Operational Effects

Predicted Effects

11.67 The two cairns at Stronend are considered together (AM 7005 and 7030; **Figure 11.2**). The sensitivity of both assets is high. Both lie approximately 3km from the nearest proposed turbine and within the ZTV (to tip) of up to seven turbines; visualisations have been prepared from the larger cairn (AM 7005; **Figure 11.4**). This demonstrates that the blades of four turbines will be visible as well as the very top of the hub of two turbines. The proposed turbines occupy the middle distance, are backclothed by hills and will be to a large degree screened by topography. The proposed turbines will introduce an additional modern element into views from the assets into the undulating moor of the Fintry Hills. The elements of the assets' setting that principally contribute to an appreciation of their cultural significance are views over the Forth Valley floor to the north and west, intervisibility with each other and the cairn at Carleatheran (AM 7010). None of these elements will be affected by the proposed turbines because of the locations of the turbines (i.e. they are not in the relevant lines of sight). Key views into the assets (from each other, Carleatheran and valley floors) will not be affected. For these reasons the magnitude of the change is assessed as minor. The significance of the effect is assessed as Minor rather than moderate because the cultural significance of the assets will not be materially affected and, although detectable, the turbines' visibility will be limited by topography and distance.

11.68 The cairn at Carleatheran (AM 7010) lies approximately 4km from the nearest proposed turbine and within the ZTV (to tip) of up to seven turbines (**Figure 11.2**). The cairn is of high sensitivity to effects and visualisations have been produced (**Figure 6.11**). These demonstrate that the tops of the hubs of six turbines will be visible and the blades of one; all in the middle distance. The proposed turbines will be backclothed by hills and are partially screened by topography. The proposed turbines will introduce an additional modern element into views from the asset to the undulating moor of the Gargunnock Hills. The elements of the asset's setting that principally contribute to an appreciation of its cultural significance are views over the Forth Valley floor to the north and intervisibility with the cairns at Stronend to the west (AM 7005 and 7030). None of these elements will be affected by the proposed turbines because of the locations of the turbines (i.e. they are not in the relevant lines of sight). Key views into the asset (from the other cairns and valley floors) will not be affected. Therefore, the magnitude of the change is assessed as minor. The significance of the effect is assessed as Minor, rather than moderate, because the cultural significance of the asset will not be materially affected and, although detectable, the turbines' visibility will be limited by topography and distance.

11.69 A cairn at Todholes lies approximately 1.5km to the south-east of the nearest proposed turbine (AM 2492; **Figure 11.2**). It is within the ZTV to tip of up to two turbines. The asset is of high sensitivity and visualisations have been produced (**Figure 11.5**) which demonstrate that visibility will be restricted to part of the blade of one turbine and the very tip of a second. These will be seen within a surrounding landscape that contains existing clearly visible turbines (in the Earlsburn Wind Farm). The turbines will not affect the views south, east and west that are considered to be important to an appreciation of the cairn's intended relationship with its surroundings nor will they affect the prominence of the cairn in the landscape. It is concluded that the cairn will be subject to a change of negligible magnitude and Minor significance.

11.70 Another cairn at Todholes lies approximately 1km south-east of the nearest proposed turbine (AM 4491; **Figure 11.2**). Two turbines will be visible, but visibility will be restricted to the hub and blades of one turbine and part of the blades of the second. These will be seen within a surrounding landscape that contains existing clearly visible turbines. Parts of the access track will be visible approximately 150m to the northeast, approximately 40m downslope. The key views from the cairn are those to the south and east, in terms of probable functional relationships with the landscape and, possibly, the sky. These views will be unaffected. Given this, the restricted visibility of the turbines and the distance of the track from the cairn, it is considered that any change in the setting of the cairn will be of negligible magnitude. The cairn is of high sensitivity and it is concluded that the effect is of Minor significance.

11.71 Sir John de Graham's Castle (AM 4278; **Figure 11.2**) lies approximately 2.5km south-east of the nearest proposed turbine and is of high sensitivity. It is within the ZTV to tip of up to three turbines. Visualisations have been produced (**Figure 6.10**) which demonstrate that visibility will be restricted to the blade of one turbine. It will protrude above the skyline of the Fintry Hills to the north-west, and above the trees of a surrounding mature conifer plantation managed by the Forestry Commission Scotland (Cairnoch; part of the Scottish Lowlands Forest District). In line with current strategy[xxii] the plantation will be sustainably managed and it is assumed that this will include felling followed by replanting. The element of this asset's setting that principally contributes to an appreciation of its cultural significance is a view over the lower-lying Carron Valley to the south and its communication routes, which the motte was constructed to control. This view has been preserved by means of a clear, unplanted, corridor within the plantation that surrounds the asset. The proposed turbines will not affect this view, or the corresponding view into the monument from the valley floor, regardless of any felling, because of the turbines' location on higher ground to the north-west. Intervisibility with Fintry Castle to the west would be an important attribute of the asset's setting if the mature conifers were removed. Similarly, this potential attribute will not be affected by the proposed turbines regardless of any felling because of the location of the turbines. Given this, and the restricted visibility of the turbines from the asset, the magnitude of change is assessed as negligible (it will be barely perceptible) and the significance of the effect is concluded to be Minor.

11.72 The motte at Keir Knowe (AM 2561) lies approximately 2.5km to the north-west of the nearest proposed turbine and is of high sensitivity. It is within the ZTV to tip of up to three turbines. The views from this monument to the south-east, toward the proposed development, are currently screened by mature trees at the margins of agricultural land and presumed to be under the control of a private landowner. The key element of the setting of this asset that contributes to an appreciation of its cultural significance is its location on a small natural knoll that immediately overlooks lower ground on all sides. There are also some open views from the asset to the north, toward the Forth Valley and away from the proposed development, which contribute to an understanding of its postulated function as a motte, positioned to control communication routes. Neither of these elements of the asset's setting will be affected if the mature trees that potentially screen the proposed turbines were to be felled. The asset is not prominent in the landscape until in close proximity to it and no views into the monument are considered relevant. Given this the magnitude of the change is assessed as negligible and the significance of the effect is assessed as Minor.

11.73 The Category A listed house at Gribloch (HB 8191) lies approximately 4km north-west of the nearest proposed turbine and within the ZTV of up to four turbines. The asset is of high sensitivity and a visualisation has been produced (**Figure 11.6**) which shows that the blades of three turbines and a small part of the hub of one protrude above the skyline in the shoulder between the Fintry and Gargunnock Hills. Mature mixed woodland on the south side of the house currently screens the proposed turbines from the house and the adjacent listed garage block (HB 8192; **Figure 11.2**); the listed lodge is outside the ZTV and has no intervisibility with the proposed development (HB 8193; **Figure 11.2**). The woodland is part of the house's grounds and presumably under the control of its owner. The woodland forms an integral part of the house's design; an avenue cut through the wood, from the house to the south-west (shown as a black arrow on **Figure 11.2**), was designed to provide a scenic view aligned on the Fintry Hills some distance to the west of the proposed turbines. The other key views from Gribloch are to the north and west. The key views from the house, down the avenue to the south-west and to the north, will not have visibility of the proposed turbines. There are some limited views into the house from the north; because of the mature trees to its rear (or south) the proposed development will not be visible in these views. Given this, it is concluded that the elements of the setting of Gribloch House that add to an appreciation of its cultural significance will not be changed by the proposed development. The sensitivity of the asset is assessed as high; the magnitude of the change is assessed as negligible. Therefore, the significance of the effect is assessed as Minor.

11.74 The IGDL of Cardross House (**Figure 11.3**) lies approximately 8km north-west of the proposed development. It is within the ZTV to tip of up to seven turbines. A visualisation from the B8034 near the house has been produced (**Figure 6.15**) which shows that the upper parts of the hubs of four turbines and the blades of three will be visible. The proposed development will be visible on the horizon from some parts of the designed landscape and the Category A listed Cardross House. The general scenic surroundings of the house and landscape add to an appreciation of its cultural significance. The principal views from the house and gardens are to the south-west, over the Forth, and toward the proposed development. The skyline is formed by the Fintry and Gargunnock Hills and the proposed turbines will be visible, but not prominent, within a dip between the two and as part of a wide panoramic view. The sensitivity of the asset is assessed as high; the magnitude of the change is assessed as minor because of the distance from the proposed development (change will be detectable but not material). Given the limited change to baseline conditions, and that the cultural significance of the asset will not be materially affected, the significance of the effect is assessed as Minor rather than moderate.

11.75 The Priory of Inchmahome (AM 90169; **Figure 11.3**) lies approximately 11km north-west of the proposed development. It is within the ZTV to tip of up to seven turbines. The presence of mature trees both on the island on which the priory is sited, and on the surrounding shores of the Lake of Menteith screen the asset from the proposed development. The proposed turbines will be visible to one side as part of a wide panorama during the boat trip to and from the island. The trip to the island contributes to the asset's setting, as do the trees which screen the priory from view. During the trip the proposed turbines will be barely perceptible due to their distance. The sensitivity of the asset is assessed as high; the magnitude of the change is assessed as negligible. Therefore, the significance of the effect is assessed as Minor.

Proposed Mitigation

11.76 No mitigation is proposed.

Residual Effects

11.77 There will be Minor residual effects on: the two cairns at Stronend (AM 7005 and 7030); the cairn at Carleatheran (AM 7010); the motte at Keir Knowe (AM 2561); the Category A listed house at Gribloch (HB 8191); the IGDL of Cardross House; and the Priory of Inchmahome (AM 90169).

Cumulative Effects Assessment

11.78 This section considers cumulative effects, that is, incremental effects of adding the proposed wind farm to other developments, on cultural heritage assets. It considers operational cumulative effects (incremental effects on the settings of cultural heritage assets by the addition of this development).

11.79 The other developments included in cumulative visualisations are shown in **Chapter 6: Landscape and Visual Amenity, Figure 6.24**. For the purposes of assessing cumulative effects on cultural heritage only other developments within 10km (consistent with the outer study area) have been considered. These are:

- Earlsburn North (consented);
- Fintry Community Windfarm (operational);
- Earlsburn (operational);
- Balafark Farm (operational);
- Craigengelt (operational).

11.80 Cumulative visualisations have been produced where appropriate, and these locations have been agreed in consultation with Historic Scotland. The visualisations provided include the baseline situation used for the LVIA assessment (operational and under construction schemes); additional 360 degree wireframes showing consented developments (Scenario 2) and proposed developments (Scenario 3).

Predicted Cumulative Effects

11.81 Operational cumulative effects on the settings of cultural heritage assets are not relevant to those assessed to the north-west of the proposed development as there is minimal visibility of the other

schemes noted above. For that reason, the following are not considered further with regard to cumulative effects: the IGDL of Cardross House, the Priory of Inchmahome (AM 90169), the motte at Keir Knowe (AM 2561) and the Category A listed house at Gribloch (HB 8191).

11.82 Cumulative visualisations have been produced from one of the cairns at Stronend (**Figure 11.4**; AM 7005). The proposed turbines will be partially visible around 3km away and in the middle distance within the angle of view occupied by the operational Earlsburn (6km distant) and Craigengelt Wind Farms (8km distant). Earlsburn North (consented) will add further to the group when built and be around 4km distant. The proposed turbines will only be partially visible because of the screening effects of topography (they are located in the valley of the Backside Burn). They will appear as closer, but less visible, members of a group incorporating the Earlsburn and Earlsburn North turbines when the latter is constructed. The proposed turbines will not widen the angle of view that includes turbines or increase the prominence of turbines in views from this asset. It is concluded that the proposed development has Negligible cumulative effects on this asset when both consented developments (Scenario 2) and proposed developments (Scenario 3) are taken into consideration.

11.83 Cumulative visualisations have been produced from Carleatheran (**Figure 6.28**; AM 7010). The upper parts of the proposed turbines will be visible, where they protrude above the valley of the Backside Burn, around 4km away in the middle distance to the north of the operational Earlsburn Wind Farm (just over 1km distant). The consented Earlsburn North will extend the Earlsburn cluster to the north, at a distance of around 2.5km, and incorporate the proposed turbines in the angle of view occupied by turbines. The proposed development will add some partially visible turbines into an existing group (once Earlsburn North is constructed). Turbines within Earlsburn North will be more visible, because they are closer to the asset and built on the plateau of the Gargunnock Hills. The proposed turbines will not widen the angle of view that includes turbines or increase the prominence of turbines in views from this asset. It is concluded that the proposed development has Negligible cumulative effects on this asset when both consented developments (Scenario 2) and proposed developments (Scenario 3) are taken into consideration.

11.84 Cumulative visualisations have been produced for a Todholes cairn (**Figure 11.5**; AM 2492). The blades of one proposed turbine and the blade tips of another will be visible at a distance of 1.5km to the west of the operational Earlsburn Wind Farm, which is also around 1.5km away; Craigengelt is also visible but at a greater distance (around 5km) and further east. The consented Earlsburn North will introduce turbines adjacent to the proposed turbines at a similar distance; because of topography much more of the Earlsburn North turbines will be visible. The proposed turbines will extend the angle of view occupied by turbines marginally; they will be adjacent to more visible turbines in Earlsburn North (once constructed) and will be seen as a less visible part of that group. For that reason, it is concluded that the proposed development has Negligible cumulative effects on this asset when both consented developments (Scenario 2) and proposed developments (Scenario 3) are taken into consideration.

11.85 Cumulative visualisations have been produced from Sir John de Graham's Castle (**Figure 6.27**; AM 4278). The blade of one turbine will be visible some 2.5km distant to the west of the operational Earlsburn Wind Farm, which is at a similar distance. As with the Todholes cairns above, and because of topography, more of the consented Earlsburn North turbines will be visible when constructed and again at around 2.5km distant. The Earlsburn North turbines will extend the existing Earlsburn group toward the proposed turbines. The proposed turbines will extend the angle of view occupied by turbines slightly to the west; they will be adjacent to more visible turbines in Earlsburn North (once constructed) and will be seen as a less visible part of that group. For that reason, it is concluded that the proposed development has Negligible cumulative effects on this asset when both consented developments (Scenario 2) and proposed developments (Scenario 3) are taken into consideration.

Proposed Mitigation

11.86 No mitigation is proposed.

Residual Cumulative Effects

11.87 There are no significant cumulative effects.

Further Survey Requirements and Monitoring

11.88 No further survey work or monitoring is proposed.

Summary of Effects

11.89 **Table 11.8** below summarises the predicted effects of the wind farm on cultural heritage assets.

Table 11.8: Summary of Effects

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Inadvertent damage to upstanding banked enclosure CH14 during construction	Moderate (worst case)	Marking out prior to commencement of works	Negligible
Damage to sub-surface remains associated with CH14 within construction footprint	Minor (worst case)	Archaeological monitoring of defined area, recording of any exposed remains and reporting on results.	Negligible
Potential construction effect on sub-surface, previously unrecorded elements of undesignated post-medieval boundary wall CH4.	Negligible	None	Negligible
Operational effect on setting of: two cairns at Stronend (AM 7005 and 7030), cairn at Carleatheran (AM 7010), two cairns at Todholes (AM 2492 & 4491), motte at Keir Knowe (AM 2561), Category A listed house at Gribloch (HB 8191), Inventory Garden and Designed Landscape of Cardross House and the Priory of Inchmahome (AM 90169).	Minor	None	Minor

[i] Historic Scotland (2010) *Managing Change in the Historic Environment: Setting*, 3. HMSO.
[ii] Institute for Archaeologists (2012) *Standards and Guidance for Desk-Based Assessment* and Stirling Council Planning Officer (Archaeology) email dated 13/11/12.
[iii] Letter dated 10/10/12.
[iv] Historic Scotland (2011) *Scottish Historic Environment Policy*. HMSO.
[v] Historic Scotland (2010) *Managing Change in the Historic Environment: Setting*. HMSO.
[vi] Scottish Executive (2006) *The Scottish Forestry Strategy*.
[vii] Ordnance Survey (1864) *Stirlingshire* XXII (surveyed 1859-61).
[viii] Ordnance Survey (1899) *Stirlingshire* XXII.NW (revised 1896); Ordnance Survey (1922) *Stirlingshire* Sheet XXII (revised 1913); Ordnance Survey (1952) *Stirlingshire* Sheet XXII (revised 1946).
[ix] Statistical Account of Scotland (1791-9) *Fintry, County of Stirling*, 371 (http://stat-acc-scot.edina.ac.uk).
[x] NMRS Record : NS68NE5.
[xi] NMRS Record: NS68NE22.

[xii] Ordnance Survey (1864).
[xiii] Statistical Account of Scotland (1791-9), 376.
[xiv] Roy, W (1747-55) *Military Survey.*
[xv] Ordnance Survey (1864).
[xvi] Statistical Account of Scotland (1834-45) *Fintry, County of Stirling*, 42 (http://stat-acc-scot.edina.ac.uk).
[xvii] Information supplementary to the statutory list (HB 8191)
[xviii] MacGregor C.A. (online 1994) 'Gribloch: The Evolution of the Architectural and Interior Design of a 1930s Scottish Country House' in Architectural Heritage, Vol.5, 73-96.
[xix] MacGregor, 92.
[xx] Information supplementary to the statutory list (HB 8155).
[xxi] NMRS Record: NN50SE4.
[xxii] Scottish Executive (2006).

12 Access, Traffic and Transport

Introduction

12.1 This chapter assesses the likely traffic and transport effects associated with the construction of Craigton and Spittalhill Wind Farm, which is located off the B818 to the east of Fintry. The local transport network is shown in **Figure 12.1**. The chapter includes the identification of the development area access and route of traffic from port to site, traffic volumes generated by site activities during construction, and considers the impact of changes to traffic volumes on the surrounding road network. It also identifies the routing to the site for Heavy Goods Vehicles (HGVs) and abnormal loads. The site is accessed via one site access directly off the B818, which is an existing access on the B818.

12.2 The traffic and transport assessment has been undertaken by Grontmij.

Study Area Description

12.3 The Development Area is located within the Stirling Council area in central Scotland, near the Carron Reservoir on the B818 road between Carron Bridge and Fintry. The site is approximately 17miles south-west of Stirling.

12.4 **Figure 12.1** shows the area surrounding the Wind Farm considered within this assessment. The red line highlights the proposed routing of construction traffic to the site along the B818 and B872 and on to the trunk road network.

Effects Assessed in Full

12.5 The project description, on which this assessment is based, is contained in **Chapter 4: Development Description**, with further specific details provided in the sections below.

12.6 The effects assessed are:

- construction traffic;
- construction Programme;
- routing to the site;
- abnormal loads;
- operational traffic;
- the cumulative effect.

12.7 Typically for a wind farm development, the number of vehicles generated during the operational phase will be considerably fewer than during the construction phase with 1 or 2 weekly maintenance visits. Therefore whilst this assessment will mainly focus on the traffic effects during construction , at the request of Stirling Council, consideration will also be given to operational and cumulative traffic effects.

Effects Scoped Out

12.8 The effects on the M9 Motorway have not been considered as the additional number of vehicles generated by Craigton and Spittalhill Wind Farm will be insignificant against the existing very large base flow on the M9.

12.9 The rural nature of the site means that access by bus, rail, bicycle or on foot is not considered a feasible option for staff accessing the site or the transportation of materials. Therefore, these modes are not considered further in this assessment.

12.10 The potential effects of noise associated with construction traffic are assessed in **Chapter 7: Noise**.

Assessment Methodology

Assessment Structure

12.11 The assessment has been undertaken with reference to The Institute of Environmental Management and Assessment (IEMA) publication '*Guidance Notes 1: Guidelines for the Environmental Assessment of Road Traffic 1993*'[1].

12.12 Baseline road traffic data for the B818 and A872 was obtained from an adjacent application; Earlsburn Wind Farm (supplied by Falkirk Council Development Services) for the 12 hour period of 0700 to 1900 from 2005 and 2007.

12.13 This assessment has been informed by site visits to review the area and road network, a desk-based study of the surrounding road network reviewing maps and adjacent applications, discussions with Stirling Council, a Site Access Route Review (see **Appendix12.1**) and estimates of construction traffic based on Grontmij's experience of previous projects of this scale. Consultations were carried out during the EIA scoping process and thereafter to gain further information on the scoping response.

12.14 Consultation responses are detailed in **Table 12.1**.

Table 12.1: Consultation Responses

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Stirling Council	Formal Scoping Consultation	Advised that ES should identify: • traffic generation during construction, operation and decommissioning, as well as any junction capacity issues; • anticipated timeframe of operations; • suitable traffic routes and road network including existing structures (bridges and culverts) to accommodate anticipated heavy loads during construction; • proposed modifications to the network; • predicted impacts on the network; • impact mitigation; • the development of a Traffic Management Plan to the satisfaction of Stirling Council; and • an agreement under Section 96 of the Roads (Scotland) Act 1984 to cover any extraordinary damage to the public road network.	This chapter addresses the issues raised by Stirling Council in their scoping response.
Stirling Council	Discussions – Telephone and emails 04/12/12 and 07/12/12	Discussions were held with Roads Dept of Stirling Council regarding traffic and transport issues relating to deliveries, traffic figures and access to the proposed Craigton and Spittallhill Wind Farm. Drawings were provided and the Council did not anticipate that there would be any major road related issues	Noted
Transport Scotland	Formal Scoping Consultation	The Wind Farm would be likely to create a minimal impact upon the Trunk Road network	No action required

Access

12.15 It is proposed that all vehicles approaching the site (including abnormal loads) will use the A872 and B818, as the A872 provides a strategic link to the motorway network and the Forth Valley area.

12.16 Upon leaving the B818, traffic will use the existing Earlsburn Wind Farm access track. This junction with this access will be surveyed and, where necessary, upgraded in agreement with the Roads Authority (Stirling Council).

12.17 General site traffic, such as HGVs delivering concrete, steel, etc. have been assumed to approach the A872 from the M9. Staff working on the site have been assumed to be accommodated locally in Denny or the surrounding area of Stirling, therefore it has been assumed that 50% staff cars and LGV effects the A872 and 100% the B818.

12.18 Turbine components will arrive into Grangemouth, which is a large sea port suitably developed for the petro-chemical industry. The port and the surrounding road A904 – which connect onto the M9 - are capable of accommodating large loads. Vehicle routing within the port will be in agreement with the appropriate authorities. The petro-chemical plants in the area mean the additional HGV movements, along with a lack of receptors, are unlikely to be noticeable, therefore these roads are not included in the assessment.

12.19 The delivery route proposed for abnormal loads is joining the M9 heading north, leave at Junction 9 and travel round the gyratory system at Pirnhall Roundabout. Take the A872 exit and travel south through Dunipace to Denny. At Denny, take the B818 heading west for around 10 miles before reaching the existing Earlsburn Wind Farm access, which provides the access into the Development Area.

12.20 No major modifications are anticipated to be needed on the route, however minor works, such as the temporary removal of signs may be necessary to accommodate the swept path of abnormal loads. Townfoot Bridge will require some temporary works to the parapet. All minor works will be agreed with the appropriate Roads Authority (Stirling or Falkirk Council) and any items removed will be reinstated as soon as possible after abnormal load deliveries have been completed. Full details of the swept paths and minor amendments required are provided in **Appendix 12.1**.Access to the site is taken from an existing track (pink section), a new section of road (black section) will be built approximately 3.5km in length linking to the proposed seven wind turbines as shown in Section 4.

Assessing Significance

12.21 The IEMA's guidance advises that assessments are undertaken when there is an estimated increase of over 30% on baseline traffic flows or the percentage of HGVs is projected to increase by over 30%. Increases of this order can represent a significant change in environmental conditions. In areas with sensitive receptors, increases of 10% in the above circumstances may be considered significant. There are no sensitive receptors in this area such as a school.

12.22 Where the predicted increase is less than this threshold, the guidelines suggest that the significance of the change to the traffic flow is low or insignificant and does not require further assessment. The % impact can be seen in **Table 12.6**.

Planning Policy

12.23 Planning policies of relevance to this assessment are provided in **Chapter 5: Planning Policy Context**.

12.24 Relevant local and national planning policy is discussed in Transport Scotland's *Planning Advice Note: PAN 75 – Planning for Transport*[ii]. It states:

> *"All planning applications that involve the generation of person trips should provide information which covers the transport implications of the development. The level of detail will be proportionate to the complexity and scale of impact of the proposal."*

12.25 PAN 75 also includes discussion of travel plans, to encourage sustainable travel once a development becomes operational. It is not anticipated that a travel plan would be required for Craigton and Spittallhill Wind Farm as the numbers of operational vehicles are expected to be insignificant.

Existing Conditions

Study Area

12.26 The Development Area is located adjacent to the B818 with Fintry 5km to the west, Denny 16km to the east and north of the Campsie Fells range of hills. The B818 is a typical rural road which accommodates a two-way flow, although HGVs may have to slow to pass each other. However, the carriageway width reduces to single track in some areas. The road is generally well maintained – the geometry is of a mixed standard with a number of sharp bends. The B818 connects the A872 in Denny to the A875 just south of Balfron. The B818 is relatively lightly trafficked as shown by the traffic flows in **Table 12.2**.

12.27 The A872 runs along the western periphery of Denny and is, generally, a wide single carriageway and is suitable for HGVs. The area is generally urban with a mixture of residential and retail frontages onto the carriageway. Junctions on the A872 are either signal controlled or priority (some with turning lanes). The A872 is considerably more heavily trafficked than the B818.

12.28 The A872 commences at Pirnhall Roundabout, which forms a grade separated junction with Junction 9 of the M9 Edinburgh to Dunblane Motorway and Junction 9 of the M80 Glasgow to Stirling Motorway. Both the M9 and M80 are highly strategic routes in Scotland, and form part of the Scottish Trunk Road Network.

12.29 There are a number of constraints along the A872 and B818 route identified in **Appendix 12.1**. A swept path analysis has been undertaken and some minor amendments are required. These are also detailed in **Appendix 12.1**.

Road Traffic Data

12.30 Baseline traffic data has been obtained from a previous survey undertaken for Fankerton Main Street as part of Earlsburn Wind Farm application. This data was collected and averaged between the 20th and 26th July 2005, for a 12 hour period between 0700 and 1900. The 2005 flows have been factored to 2013 using a central NRTF growth factor of 1.1132. This is presented in **Table 12.2**.

12.31 Baseline traffic has been supplied for the A872 at the Stirling Council Boundary. This data was collected and averaged for a 5 day period in September 2007, for a 12 hour period between 0700 and 1900. The 2007 flows have been factored to 2013, as shown in **Table 12.3** using central NRTF growth factor of 1.0948.

12.32 The factored 2013 traffic flows have been used as the baseline for this assessment.

Table 12.2 - Factored Baseline 2013 Traffic Flows on B818

Vehicle Class	2005	2013
Car, LGV, Car + trailer	557	631
HGV	67	76
Bus or Coach	2	2
Other	60	668
Total	686	777

Table 12.3 - Factored Baseline 2013 Traffic Flows on A872

Vehicle Class	2007	2013
Car, LGV, Car + trailer	5357	5865
HGV	723	792
Bus or Coach	73	80
Other	20	22
Total	6,173	6,759

Effects Assessment

12.33 The assessment of effects is based upon the project description outlined in **Chapter 4** and is structured as follows:

- construction effects;
- operational effects;
- cumulative effects.

Construction Effects

Predicted Effects

12.34 The assumed construction programme outlined in **Table 12.4** indicates the durations of various stages of the construction works. The precise numbers of staff on site each day will depend on the activities being undertaken, however three distinct phases have been identified to ensure a realistic estimate has been made with 20 staff during phase 1, 30 staff during phase 2 and 10 staff during phase 3.

Table 12.4 - Proposed Construction Programme

Task	Month												Duration
	1	2	3	4	5	6	7	8	9	10	11	12	
Site Establishment													2
Site Operations													12
Civils													7
Electrical Works													4
Drainage & Culverts													4
Turbine Foundations													5
Turbine Components													2
Crane for turbines - 2 per turbine													2
Site staff phase 1													2
Site staff phase 2													9
Site staff phase 3													1

12.35 Traffic flows have been calculated for each of the stages in the assumed construction programme. The levels of traffic generated are based on Grontmij's experience of similar projects in Scotland and requirements to construct a 3.5km section of new access track. Once the 3.5km section of road to the borrow pit is constructed, the site will be self-sufficient in stone and traffic volumes will reduce significantly.

12.36 The traffic movements reflect the construction tasks/processes outlined in **Chapter 4,** and **Table 12.5** shows this traffic as both daily and monthly two-way traffic movements.

12.37 These figures are typical daily traffic flows – the precise traffic on a particular day would be affected by site activities and other factors such as weather. The daily flows are based on the site being operational for 26 days per month – effectively equivalent to six days per week over a 12 month period of construction.

12.38 For the purposes of estimating the number of HGVs associated with various phases of the construction programme the following assumptions have been made:

- stone material will be delivered in 20 tonne HGVs;
- steel will be delivered using 24 tonne HGVs;
- concrete will be delivered in six cubic metre HGVs;
- ten abnormal loads will be required per turbine, along with two escort vehicles per abnormal load;
- deliveries of turbine parts to the site will arrive as abnormal loads and depart as regular HGVs with retractable trailers reducing from 40m to approximately 16m.

Table 12.5 - Two Way Vehicle Movements During Construction Phase

	Vehicle type	Two way movements per Month											
		1	2	3	4	5	6	7	8	9	10	11	12
Site Establishment													
Delivery of plant & accomodation	HGV	30											
Removal of plant & accomodation	HGV												30
Site Operations													
Fuel for site	HGV	8	8	8	8	8	8	8	8	8	8	8	8
Water for site	HGV	8	8	8	8	8	8	8	8	8	8	8	8
Site waste disposal	HGV	8	8	8	8	8	8	8	8	8	8	8	8
Civils													
Type 1 material	HGV		81	81	81	81	81	81	81				
6F material	HGV		129	129	129	129	129	129	129				
6N material	HGV		54	54	54	54	54	54	54				
Geogrids etc	HGV		3	3	3	3	3	3	3				
Met. mast	HGV		1	1	1	1	1	1	1				
Electrical Works													
Cables, sand	HGV			15	15	15	15						
Substation	HGV						14						
Drainage & Culverts													
Miscellaneous items	HGV			10	10	10	10						
Turbine Foundations													
Reinforcing steel	HGV						5	5	5	5	5		
Concrete	HGV						187	187	187	187	187		
Turbine Components													
Blades, tower & nacelle (ab. load)	AL										70	70	
Escorts for abnormal loads	LGV/Car										140	140	
Miscellaneous deliveries	HGV										4	4	
Crane for turbines - 2 per turbine													
Delivery of crane (incl 1 ab. load)	HGV										14		
Removal of crane (incl 1 ab. load)	HGV											14	
Escort for crane delivery	LGV/Car										2		
Escort for crane removal	LGV/Car											2	
Site Staff													
Site staff phase 1	LGV/Car	960	960										
Site staff phase 2	LGV/Car			1440	1440	1440	1440	1440	1440	1440	1440	1440	
Site staff phase 3	LGV/Car												480
Month vehicle total (2 way)		**1014**	**1251**	**1756**	**1756**	**1756**	**1962**	**1923**	**1923**	**1656**	**1886**	**1694**	**534**
Daily vehicle total (2 way)		**39**	**48**	**68**	**68**	**68**	**75**	**74**	**74**	**64**	**73**	**65**	**21**
Month HGV total (2 way)	HGV	**54**	**291**	**316**	**316**	**316**	**522**	**483**	**483**	**216**	**234**	**42**	**54**
Daily HGV total (2 way)	HGV	**2**	**11**	**12**	**12**	**12**	**20**	**19**	**19**	**8**	**9**	**2**	**2**
Month abnormal load total (2 way)											**70**	**70**	
Daily abnormal load total (2 way)											**3**	**3**	

12.39 Construction effects are described for the A872 and B818. As discussed in previous sections of this chapter, all materials (including abnormal loads) will use the A872 and the B818 to access the site. Staff are assumed to reside in Denny or the Stirling area. To ensure the most rigorous condition is assessed, the month with the highest traffic generation will be considered – this is month six. This is assessed in **Table 12.6**.

Table 12.6 - Traffic and HGV Increase on A872 and B818

	A872				B818			
	Baseline	HGV Construction Traffic	Baseline plus Construction	**% increase**	Baseline	Staff and HGV Construction Traffic	Baseline plus Construction	**% increase**
Total	6759	48	6806	**0.7**	777	75	852	**9.7**
HGV	792	20	812	**2.5**	76	20	96	**26.3**

12.40 The largest increase is in HGVs on the B818, mainly due to the low baseline, however this is still lower than the 30% significance threshold and therefore does not merit further assessment in this chapter as no sensitive receptors have been identified on the route. All other increases are less than ten percent. This is not considered a significant impact in the context of the EIA Regulations.

Proposed Mitigation

12.41 If Craigton and Spittallhill Wind Farm is granted planning permission there will be no significant effects during construction however minor mitigations will be required during this period as requested by Stirling Council. A Traffic Management Plan (TMP) will be prepared and implemented for the construction works. The TMP will include a more detailed timetable of works including how traffic associated with the site will be managed including: permitted delivery times, traffic control measures and any mitigation measures required to accommodate the passage of abnormal loads (detailed in **Appendix 12.1**). The content of the TMP will be agreed with the Road Authorities and the Police. It is likely that the TMP will be subject to a planning condition, prior to the commencement of the site works, under Section 56 of the Roads (Scotland) Act 1984.

12.42 The TMP will include provision of temporary speed restrictions and appropriate traffic management measures comprising as specified by Stirling Council as:

- Temporary 30mph limit on the C10, for 120m each side of the B818/ C10 junction at Carron Bridge Hotel;
- Temporary 30mph limit on the B818, for 120m each side of the B818 / C10 junction at Carron Bridge Hotel;
- Temporary 30mph limit on the B818, for about 470m straddling the bend where access is taken to Drum Farm;
- Temporary 30mph limit in Carron Valley, for about 400m through the settlement.

12.43 Prior to commencement of construction works, the developer will undertake a local road condition survey in the presence of the Road Authority. The survey will include an assessment of any structures along the route along with video evidence of the road's condition prior to commencement of any works. Deterioration of the local road network will be monitored by the council and the developer will be responsible for all costs of repair work required as a result of development traffic. A legal agreement will be in place between the developer and Stirling Council to recover any extraordinary expense incurred in repairing roads damaged by construction vehicles associated with the site, through the Roads (Scotland) Act 1984 Section 96(3) or 96(1).

12.44 Any road improvements within the Stirling Council Area highlighted within the Road Traffic Management Plan required to be undertaken shall be made via an application/s Under Section (56) of the Roads (Scotland) Act 1984 for a Minor Roadworks Consent for the formation of any improvement works to allow for the safe passage of large vehicles HGVs or (abnormal loads) prior to the works commencing on site including the Site Access Arrangements.

12.45 All abnormal loads will be escorted to the site by police vehicles and will be timed to avoid peak traffic periods on the local road network. Any temporary traffic management measures required for local roads will be implemented under the appropriate Acts and Agreements to ensure safe access. No traffic management will be required on the Trunk Road network.

12.46 Minor work will be needed at Townfoot Bridge in order to accommodate the swept path of turbine vehicles. All works will be agreed with the roads authority.

Residual Effects

12.47 No significant residual effects are predicted as the numbers of additional vehicles using these routes is not significant.

Operational Effects

Predicted Effects

12.48 Traffic movements will comprise occasional maintenance vehicles (typically small vans) accessing the wind farm for turbine servicing or repair. These movements are unlikely to exceed two to three per week. If more extensive maintenance were to be needed, a crane may be required. On the basis of the limited traffic movements, including the potential infrequent use of a crane, no significant effects are predicted during operation.

Proposed Mitigation

12.49 As no significant effects are likely to occur, no mitigation measures are proposed.

Residual Effects

12.50 No significant residual effects are predicted as the numbers of vehicles associated with the operation of the development are likely to be minimal.

Cumulative Effect Assessment

12.51 We are not aware of any other projects that will be under construction. Should such circumstances arise, liaison will take place between the contractors appointed for the affected project(s) and the police and the Roads Authority in the development of the construction Traffic Management Plan.

Summary

12.52 This assessment has identified the traffic likely to be generated by the construction and operation of the Craigton and Spittalhill Wind Farm. The increase in traffic during all assessed phases of the project's life cycle has been estimated to be less than 30% and therefore not significant in the context of the EIA Regulations.

Table 12.7: Summary of Effects

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Construction traffic to the site	Not Significant	Traffic Management Plan, Video Survey of route	Not Significant

The Institute of Environmental Management and Assessment (IEMA) publication 'Guidance Notes 1: Guidelines for the Environmental Assessment of Road Traffic 1993'

13 Socio-Economics

Introduction

13.1 This chapter considers the potential social and economic effects of Craigton and Spittalhill Wind Farm ('the Development'). It details the likely direct employment generation and any likely indirect economic benefits as a result of the Development. It also considers potential effects in relation to public access and recreation and tourism. The socio-economic assessment has been completed by LUC.

Study Area Description

13.2 The assessment focuses on the Development Area in terms of direct effects on public access and the Development Area and surrounding area with regard to effects on recreation.

13.3 With respect to direct employment and the wider economic and tourism effects of the Development, the assessment considers potential effects at the Stirling Council administrative area level.

13.4 The cumulative assessment of effects considers the effect of the construction and operation of schemes within 35km of the Development Area, as identified in **Chapter 6: Landscape and Visual Amenity**.

Effects Assessed

13.5 The following effects have been considered:

- direct employment generation during construction and operation of the Development and associated indirect economic benefits, such as effects on local commerce;
- direct effects of the Development on public access (including Rights of Way (RoW) and Core Paths) and recreation during construction and operation;
- direct and indirect effects on tourism during construction and operation of the Development.

13.6 Effects on recreational amenity during construction and operation relating to the visibility of the Development are considered in **Chapter 6: Landscape and Visual Amenity**.

Effects Scoped Out

13.7 On the basis of desk based work, the professional judgement of the EIA team and experience from other similar projects, the following effects have been scoped out:

- disruption of services such as electricity , gas and public water supply during construction and operation of the Development as none of these services will be affected by the Development;
- direct effects on 'formal' recreation (i.e. activities which require purpose built facilities such as pitches, tracks etc.) during construction and operation of the Development, as no such facilities will be affected by the Development.

Assessment Methodology

Assessment Structure

13.8 The assessment is structured around the consideration of potential effects on the following:

- effects on employment and associated benefits during construction and operation of the Development;
- direct effects on public access and recreation during construction and operation of the Development;
- effects on tourism resulting from construction and operation of the Development.

Data Sources and Guidance

13.9 The following data sources were used to inform the assessment:

- Clackmannanshire and Stirling Structure Plan 2002[i];
- Stirling Council Local Plan 1999[ii];
- Stirling Community Planning Partnership Community Plan 2005-2020[iii];
- Stirling Council Core Path Plan 2009[iv];
- Scottish Neighbourhood Statistics[v];
- Census and population information from 'scrol' Scotland's Census Results Online and any relevant local authority publications)[vi];
- The Scottish Index for Multiple Deprivation (2012)[vii];
- General Register Office for Scotland (GRO Scotland) data[viii];
- Nomis official labour market statistics[ix];
- Scottish Government Labour Market Statistics (2011)[x];
- Tourism statistics (from VisitScotland and specific tourist attractions in the area)[xi];
- Local websites (referenced as appropriate throughout text).

Field Survey

13.10 No specific field survey was considered necessary to inform the assessment.

Consultation

13.11 As detailed in **Chapter 2: Approach to the EIA**, a request for a Scoping Opinion was submitted to Stirling Council in September 2012, however, no specific comments relating to socio-economic issues were received as part of the Scoping Opinion.

Assessing Significance

13.12 Criteria for determining the significance of socio-economic, recreation and tourism effects are provided in **Table 13.1**. The significance criteria have been devised by LUC based on professional judgement and previous experience of undertaking socio-economic assessments. The criteria primarily consider the magnitude of effects (e.g. the number of people, recreational activities or economic activities affected). However, when applying the criteria, professional judgement has been employed and consideration taken of the receptor sensitivity, where appropriate.

13.13 Effects associated with the construction phase of the Development are considered to be temporary and short-term and effects during operation are considered to be long-term effects.

Table 13.1: Effect Significance Criteria

Significance of Effect	Description
Major	Where the extent of the effects on economic activities, local businesses, recreation, tourism or the local population is large in scale or magnitude, and a large number of people or activities will be affected (either positively or negatively).
Moderate	Where the extent of effects on economic activities, local businesses, recreation, tourism or the local population is small in scale or magnitude, but a large number of people or activities will be affected (either positively or negatively). or Where the extent of effects on economic activities, local businesses, recreation, tourism, or the local population is large in scale or magnitude, but only a small number of people or activities will be affected (either positively or negatively).

Significance of Effect	Description
Minor	Where the extent of effects on economic activities, local businesses, recreation, tourism or the local population is small in scale or magnitude and will only affect a small number of people (either positively or negatively).
Negligible	Where the extent of effects on economic activities, local businesses, recreation, tourism, or the local population is barely noticeable in scale or magnitude, and will only affect a small number of people or activities (either positively or negatively).

13.14 'Major' and 'moderate' effects are considered to be significant in the context of the EIA Regulations.

Planning Policy

13.15 Planning policies of relevance to this assessment are identified in **Chapter 5: Planning Policy Context**.

Existing Conditions

13.16 This section details:

- the current socio-economic conditions in Stirling Council administrative area and the locality within which the Development Area is located, including population, demographics and employment;
- tourism and recreation information and statistics for the same area;
- public attitudes to wind farms, specifically in terms of amenity of local residents and effects on tourism.

Population Profile

13.17 The Stirling Council administrative area had an estimated population of 91,020 in 2012, which accounted for 1.7% of Scotland's population as a whole. By 2035 the population of Stirling is expected to be approximately 104,292, an increase of 16.1% compared to 2010 levels[viii]. **Table 13.2** below provides an age demographic breakdown for the Stirling Council area and for Scotland as a whole based on population estimates for 2011.

Table 13.2: Age Demographics of Stirling and Scotland based on 2012 estimates

Age Group	Stirling (no.)	Stirling (%)	Scotland(no.)	Scotland (%)
0-15	16,148	17.8	913,317	17.4
16-29	18,738	20.6	984,025	18.7
30-44	15,542	17.1	1,028,454	19.6
45-59	18,716	20.6	1,104,630	21.0
60-74	14,501	16.0	811,300	15.4
75+	7,125	7.8	413,074	7.9
Total	90,770	100.0	5,254,800	100

13.18 Scotland's population as a whole is expected to rise by 10.2% from 2010 to 2035. Over the 25 year period the age group which is projected to increase the most in size in Stirling is the 75+ group, and this trend will be common across Scotland as a whole.

13.19 An increase in the number of older people is likely to result in greater demands on the social and healthcare systems in Stirling and across Scotland as a whole.

Deprivation

13.20 Published by the Scottish Government, the Scottish Index of Multiple Deprivation (SIMD) 2012[vii] measures area deprivation based on categories such as income, education, unemployment, health, access to services, housing and crime, to calculate the average deprivation for small 'data zones'. Within Stirling in 2012, there were seven data zones that were in the 15% most deprived areas in Scotland. This equated to a 0.7% share of the 15% most deprived areas in Scotland. The number of people living in these most deprived areas in Stirling at the time of the 2012 SIMD study was 2,812, which was around 3% of the population. The figure for Scotland was 14.5%; therefore, proportionally, there were significantly fewer people living in deprived areas in Stirling than there were nationally.

Employment and Unemployment

13.21 The Office for National Statistics (ONS)[ix] provides the employment and unemployment rates across local council regions. From April 2012 to March 2013, 3,600 people were unemployed in Stirling, equating to 8.2% of Stirling's population. This was lower than Scotland's overall rate of 7.8%. Across the same period the employment rate for Stirling was 68.3% compared to 70.7% for Scotland as a whole.

13.22 The ONS also provides the employment by occupation figures within Stirling for the period April 2012 to March 2013. **Table 13.3** shows employment by occupation for the working population (age 16+) for Stirling and Scotland as a whole. The table indicates that the highest proportion of people is employed within 'professional occupations' such as health and education within both Stirling and Scotland as a whole. Overall, there is a similar trend in the employment by occupation levels across both Stirling and Scotland.

Table 13.3: Employment by Occupation in Stirling and Scotland 2012-2013

Occupation type	Stirling (%)	Scotland (%)
Managers, directors and senior officials	9.2	8.6
Professional occupations	22.1	19.8
Associate professional & technical	12.3	12.7
Administrative & secretarial	9.3	10.9
Skilled trades occupations	11.7	11.2
Caring, leisure and Other Service occupations	7.1	9.3
Sales and customer service	12.1	9.2
Process plant & machine operatives	4.7	6.4
Elementary occupations	10.9	11.3

13.23 **Table 13.4** shows the destination of school leavers in Stirling after secondary school, in comparison to national figures[xii]. It highlights that a larger proportion of secondary school leavers in Stirling entered into higher education in 2011/2012 than across Scotland as a whole. There were however fewer secondary school leavers entering into further education in Stirling than there were overall across Scotland.

Table 13.4: School Leaver Destination 2011/2012

	Higher Education (%)	Further Education (%)	Training (%)	Employment (%)	Voluntary work (%)	Unemployed (Seeking) (%)	Unemployed (Not seeking)	Unknown (%)
Stirling	42.0	17.8	3.4	24.5	/	10.2	1.2	/
Scotland	35.6	25.0	3.8	23.9	0.8	8.2	1.8	0.6

Public Access and Recreation

13.24 **Figure 13.1** shows one RoW and one Core Path (9078Gg/09) within approximately 200m of the Development Area (at the closest point). There are no RoWs or Core Paths within the Development Area.

13.25 Both the RoW and Core Path 9078Gg/09 originate at the access to Cringate on the unclassified road which links the B818 and Easter Cringate. The Core Path veers west from this point towards Endrick Water, before leading northwards and intersecting with the RoW approximately 700m north of Cringate on the flanks of Cringate Law. The RoW initially leads north to Cringate, then northwest to converge with the Core Path.

13.26 From Burnfoot the RoW and Core Path follow the same route, running in a north-westerly direction, parallel to the east of the Development Area and Backside Burn, to the Spout of Ballochleam and Ballochleam beyond.

13.27 The existing Earlsburn Wind Farm access track, which branches off the B818 in the vicinity of Todholes, is used by walkers to access the wind farm and surrounding hills. Approximately 1km of the Earlsburn Wind Farm access track is within the Development Area.

13.28 The Development is located in an area that is popular for walking. Popular walking destinations include the summit of Stronend (511m), located approximately 2.5km northwest of the Development Area and Double Craigs summit (375m) which lies approximately 3km to the west. The 'Loup of Fintry' is a waterfall feature on the Endrick Water within 1km to the west of the Development Area. Recreational fishing also takes place on Loch Walton (approximately 0.5km to the west) and the Carron Valley Reservoir, immediately to the south of the Development Area is a destination for fishing.

Tourism

13.29 Tourism is an important source of income for the Stirling area. Statistics produced by VisitScotland[xi] provide an overview of the numbers of trips made and estimated spend. These are listed in **Table 13.5**.

Table 13.5: Visitor Numbers and Estimated Spend in Argyll, Loch Lomond, Stirling and Forth Valley in 2010

UK Tourists	
No. of trips	1.51 million
Spend	£304 million
Overseas Tourists	
No. of trips	290,000
Spend	£1.34 million

13.30 Tourist destinations in the vicinity of the Development Area include Culcreugh Castle, located approximately 3km to the west. The Castle is one of the oldest hotels in Scotland and dates back to the 14th century[xiii].

13.31 Within 10km of the Development Areas is the village of Balfron which, along with the village of Fintry, provides a base for visitors wishing to explore the surrounding countryside including the Gargunnock Hills, Fintry Hills and Campsie Fells.

13.32 The area offers a range of attractions, focusing on outdoor pursuits including hillwalking, horse-riding, cycling, camping, golf and fishing. There are also a number of features of archaeological and historic interest.

13.33 Tourist attractions in the wider area include historical landmarks such as Stirling Castle, the Wallace Monument, and the Bannockburn Heritage Centre. VisitScotland state that Stirling Castle was the second most popular visitor attraction in the Argyll, Loch Lomond, Stirling and Forth Valley area in 2010, attracting an estimated 377,000 visitors. Loch Lomond and The Trossachs National Park, Queen Elizabeth Park, and the West Highland Way are also key visitor destinations in the wider area.

Public Attitudes to Wind Farms

Amenity of Local Residents

13.1 Potential effects on the amenity of local residents are considered to include changes to views, potential noise disturbance and potential effects as a result of increased traffic and heavy goods vehicles on routes. People often have preconceptions about wind farms and how they will affect amenity and these have been the subject of numerous public opinion surveys.

13.2 One of the most comprehensive surveys of the attitudes of the Scottish public towards wind energy is the 2003 MORI survey 'Public Attitudes to Windfarms: A Survey of Local Residents in Scotland' undertaken on behalf of the (then) Scottish Executive[xiv]. In total, 1,810 adults aged over 18 and living within a 20km zone of an operational wind farm were interviewed by telephone between 27th February and 18th March 2003. The survey obtained results that are representative of people living within three proximity zones: residents within a 5km radius; residents between 5km and 10km of the wind farm; and residents between 10 and 20km of the wind farm. This survey found that people were three times more likely to say they felt their local wind farm had a positive effect on the area (20%) as they were to say it had a negative effect (7%). Most people felt the wind farm had neither a positive nor a negative effect. People living within 5km of the local wind farm held the most positive views with 45% saying they thought the overall effect had been positive and only 6% saying they thought it had been negative.

13.3 The survey also noted differences in attitudes before construction and once the wind farm was operational. The proportion of respondents who had anticipated problems prior to the Development (46%) was far higher than the proportion that actually experienced problems after the Development (8%). For example, although 15% of respondents had expected to experience a problem with noise or disturbance during construction, only 4% say that construction caused noise or disturbance.

13.4 More recently (2012) a YouGov study commissioned by Scottish Renewables found that out of 1,000 Scottish people surveyed, 71% were in support of wind power and only 7% were against[xv].

13.5 **Chapter 6: Landscape and Visual Amenity** presents the assessment of the predicted visual effects of the wind farm on key settlements. **Chapter 7: Noise** considers the potential effects on local dwellings of disturbance caused by noise. **Chapter 12: Access, Traffic and Transport** considers the effects of traffic movements generated during both construction and operation of the wind farm. Given this, the effect on local amenity in respect of the above is not considered further in this chapter.

Effects on Tourism

13.6 A MORI poll was commissioned by the Scottish Renewables Forum and the British Wind Energy Association in 2002 to determine public attitudes towards wind farms in Argyll, which had the highest concentration of wind farm developments in Scotland. The survey, which was based on detailed interviews with approximately 300 visitors spanned over two September weekends, found that over 90% of visitors would return to Scotland for a holiday regardless of a wind farm in the area. Only 8% of the tourists who had seen a wind farm during their visit returned with a negative impression. Eight out of ten said that they would go to a wind farm visitor or information centre during their stay[xvi].

13.7 In June 2007, Glasgow Caledonian University was commissioned by the Scottish Government to assess whether Government priorities for wind farms in Scotland are likely to have an economic effect (positive or negative) on Scottish tourism. The overall conclusion of the research was that the Scottish Government should be able to meet commitments to generate at least 50% of Scotland's electricity from

renewable sources by 2020[1] with minimal effect on the tourism industry's ambition to grow revenues by over £2 billion in real terms in the 10 years to 2015. It also found that three quarters of tourists felt wind farms had a positive (39%) or neutral (36%) effect on the landscape[xvii].

13.8 A recent survey commissioned by VisitScotland (2011)[xviii] involved interviewing 3,000 people in order to learn more about consumer attitudes to wind farms and their effect on tourism. The selected sample comprised 2,000 people from a nationally representative UK sample and a Scottish representative sample of 1,000 people. The majority of those interviewed thought that natural scenery and landscape were important to them when taking a short break or holiday. The majority of people had seen a wind farm whilst on a holiday in the UK (Scotland) and indicated, on the most part (80% of UK respondents and 83% of Scottish respondents), that the presence of a wind farm would not affect their decision about where to visit or stay in the UK. According to the survey results, although the majority of people feel that wind farms do not spoil the look of the UK (Scottish) countryside, it was also found that seeing a wind farm would not add to the enjoyment of it. When asked whether they would be interested in visiting a wind farm development if there was a visitor centre, there were more respondents from Scotland (46%) that expressed an interest compared to those from the UK (40%). However, in general, respondents would prefer wind farms not to be in areas popular with tourists. Finally, the survey revealed that the responses from those surveyed indicated that wind farms are not regarded as detrimental to the landscape and neither do they ruin the tourism experience of an area.

13.9 These studies highlight the varying opinions with regards to wind energy development; however, they suggest in all cases that the majority of those surveyed do not have a negative attitude towards wind farms.

Wind Farm Layout Design Considerations

13.10 As detailed in **Chapter 3: Site Selection and Design Strategy**, one of the main objectives of the design process was to design the wind farm in such a way that it relates to the surrounding landscape and minimises effects on landscape and visual amenity. As a result, the visibility of the scheme from the wider landscape has been limited, especially in terms of the main tourist areas.

Effects Assessment

13.11 The assessment of effects is based upon the development description provided in **Chapter 4: Development Description** and is structured as follows:

- construction effects of the Development;
- operational effects of the Development;
- cumulative effects of the Development and other wind farm proposals in the area.

Construction Effects

Predicted Effects

Direct Employment

13.12 It is anticipated that a temporary workforce, varying between 10 and 30 people will be employed during the construction phase. It is standard practice in economic appraisals to convert temporary employment levels into full-time equivalents (FTEs). Therefore, using a conversion factor of ten years of full time employment to one permanent FTE[2] , the total employment generated through construction will be between 1 and 3 FTEs. It is considered that this represents a temporary effect of minor positive significance to the local economy.

Indirect Economic Benefits

13.13 It is likely that there will be some local employment generated as an indirect result of the construction of the Development. This could include supply chain spin-offs for local businesses and sub-contracted work relating to the transportation of construction workers and materials. Any construction workers not living locally may choose to reside in local accommodation which will further benefit the local economy through spending in local hotels, shops, restaurants and other accommodation. It is considered that indirect employment as a result of the Development will have a temporary effect of minor positive significance to the local economy.

Public Access and Recreation

13.14 The Development Area is not currently used for any formal recreation activities and there are no Rights of Way or Core Paths crossing the site. Users of the nearest RoW and Core Path (9078Gg/09), as shown on **Figure 13.1,** may be adversely affected in terms of visual amenity, noise and dust nuisance during construction, however this will be temporary and intermittent in nature.

13.15 There will be no access to the Development Area for informal recreational purposes for the duration of the construction period and the existing Earlsburn Wind Farm access track, from the B818 to the proposed new access track (see **Figure 4.1**) is likely to be closed to pedestrians for extended periods during the construction phase.

13.16 Given the extensive scope for informal recreation in the surrounding area, and informal nature of recreational activity, it is not anticipated that the Development will directly affect public access or recreational activity in the wider area.

13.17 It is anticipated that the Development will result in a temporary effect of minor negative significance in relation to public access and recreation within the Development Area and immediate surrounds, including users of the RoW and Core Path.

Tourism

13.18 It is not considered that construction of the Development will have a significant effect on tourism in the vicinity of the Development Area, or the wider area and as such the effect on tourism is predicted as negligible.

Proposed Mitigation

13.19 During construction of the Development, the following mitigation measures are proposed to reduce potential effects:

- appropriate signage will be displayed to inform users of the temporary closure to the public of the existing Earlsburn Wind Farm access track to accommodate construction traffic;
- measures to control dust and noise emissions from construction activities will be implemented using best practice measures to reduce the effects on users of the nearby RoW and Core Path.

Residual Effects

13.20 The Development will have a temporary effect of minor positive significance both in terms of direct employment opportunities and indirect economic benefits.

13.21 Taking into account the implementation of proposed mitigation, the residual effect of the Development in relation to public access and recreation, within the Development Area and immediate surrounds, will remain a temporary effect of minor negative significance.

13.22 The predicted effect of the Development on tourism will be negligible.

Operational Effects

Predicted Effects

Direct Employment

13.23 Once operational, the Development will require a small team of personnel to service, maintain and operate it. It is predicted that 1 FTE job will be created during the lifetime of the Development (25 years). It is likely that this job should be to undertake routine turbine servicing and wider site

[1] This is now superseded by the increased target of an equivalent of 100% announced by the Scottish Minister in May 2011

[2] Full time equivalent (FTE) is a way to measure a workers involvement in a project. An FTE of 1.0 means that the person is equivalent to a fulltime worker. In this example, 10-30 people employed for 12 months is equivalent to 120-360 months of potential employment. For one year, this is equivalent to 10-30 full time jobs and for 10 years, 1-3 full time jobs.

maintenance. Adopting a precautionary approach, this will result in an effect of negligible positive significance.

Indirect Economic Benefits

13.24 It is likely that there will be some local employment generated as an indirect result of the operation of the Development and this will be associated with induced employment effects resulting from increased household expenditure among those individuals who have gained employment both directly and indirectly as a result of operation of the Development. Adopting a precautionary approach, this will result in an effect of negligible positive significance to the local economy.

Public Access and Recreation

13.25 There will be no restrictions on access to the Development Area during operation of the wind farm and public access via the Earlsburn Wind Farm access track will revert to pre-construction conditions.

13.26 Operation of the Development will not prevent people from visiting the area or from undertaking recreational activities in the area. The change in views from certain areas and routes may, however, influence some individuals in their choice of location to visit or recreational activities to undertake. It should be noted that the effect that changes in views will have on recreational activity will depend on the personal opinion of the viewer which is subjective; some people may be predisposed to dislike wind turbines whilst others may view them as complementary to the landscape. The overall effect of the Development on public access and recreation once operational is considered to be of negligible significance.

Tourism

13.27 The Development will not prevent visitors accessing the identified attractions and popular points of interest. Most surveys undertaken suggest that wind farms do not discourage people from visiting an area and it is considered that effects on tourism whilst the Development is operational are unlikely and represent an effect of negligible significance.

Proposed Mitigation

13.28 No mitigation measures are proposed.

Residual Effects

13.29 Operation and maintenance of the Development will have an effect of negligible positive significance both in terms of direct employment opportunities and indirect economic benefits.

13.30 The significance of the residual effects of the operation of the Development remains as negligible for public access and recreation and also for tourism.

Cumulative Effects Assessment

13.31 This section considers the cumulative effects on direct employment and indirect economic benefits, public access and recreation and tourism which would arise from the construction and operation of the Development in conjunction with schemes within 35km of the site.

Predicted Cumulative Effects

Direct Employment and Indirect Economic Benefits

13.32 Should all of the schemes identified within 35km (which are not yet operational) be constructed and operated, the cumulative effect on direct employment and in terms of indirect economic benefits, particularly during construction, will be positive. Adopting a precautionary approach the contribution of the Development to this positive effect is likely to be of negligible significance.

Public Access and Recreation

13.33 It is considered possible that there may be some positive cumulative effects on public access and recreation in the wider area through the provision of new paths and access routes available to walkers, cyclists and horse riders etc. The contribution of the Development to this positive effect is considered to be of negligible significance.

Tourism

13.34 Recent research, as discussed above, suggests that wind farms do not have a negative effect on tourism. Cumulative effects on tourism, as a result of construction of all the potential wind farm projects within 35km, are therefore considered to be of negligible significance.

Proposed Mitigation

13.35 No further mitigation measures are proposed.

Residual Cumulative Effects

13.36 The residual cumulative effects will remain as identified above.

Further Survey Requirements and Monitoring

13.37 No further surveys or monitoring is proposed.

Summary of Effects

13.38 **Table 13.6** below summarises the predicted effects of the Development on the socio-economic aspects considered.

Table 13.6: Summary of Predicted Effects

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Construction			
Direct Employment	Temporary minor (positive)	None	Temporary minor (positive)
Indirect Economic Benefits	Temporary minor (positive)	None	Temporary minor (positive)
Effects on public access and recreation within the Development Area and immediate surrounds	Temporary minor (negative)	Measures to control dust and noise emissions from construction activities will be implemented using best practice measures to reduce the impact on users of the nearby RoW and Core Path. Signs will be displayed to inform users of the temporary closure to the public of the existing Earlsburn Wind Farm access track during construction.	Temporary minor (negative)
Effects on tourism	Negligible	None	Negligible

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Operation			
Direct Employment	Negligible (positive)	None	Negligible (positive)
Indirect Economic Benefits	Negligible (positive)	None	Negligible (positive)
Effects on public access and recreation within the Development Area and immediate surrounds	Negligible	None	Negligible
Effects on tourism	Negligible	None	Negligible
Cumulative			
Direct Employment	Negligible (positive)	None	Negligible (positive)
Indirect Economic Benefits	Negligible (positive)	None	Negligible (positive)
Effects on public access and recreation	Negligible (positive)	None	Negligible (positive)
Effects on tourism	Negligible	None	Negligible

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14 Other Issues

Introduction

14.1 This chapter assesses the potential effects of the proposed Craigton and Spittalhill Wind Farm ('the Development') relating to:

- aviation and defence;
- telecommunications;
- television;
- dust effects;
- carbon balance (see also **Appendix 14.1** Carbon Balance Assessment Report).

14.2 The initial aviation and defence work was completed by The Wind Consultancy Service (TWCS) and Force 9 Energy LLP (Force 9 Energy). TWCS also undertook the telecommunications and television assessments. LUC completed the assessment of dust effects.

14.3 A number of additional potential effects including those relating to shadow flicker and turbine icing have been scoped out of the assessment (see **Section 14.10** below).

Study Area Description

Aviation and Defence

14.4 An initial aviation assessment was undertaken to identify potential aviation issues. The study assessed the following aviation installation types (and included use of the NATS En Route on-line self-assessment maps):

- Ministry of Defence Air Surveillance and Control System (ASACS) radar sites within 100km of the centre of the Development Area;
- Ministry of Defence Danger Areas (used for bombing and training exercises);
- Military Aerodromes and Military Air Traffic Control (ATC) radar sites within 60km of the centre of the Development Area;
- Military Precision Approach Radar (PAR) sites within 50km of the Development Area;
- Ministry of Defence Tactical Training Areas within 10km of the Development Area;
- Meteorological Radars within 20km of the Development Area;
- NATS En Route radar sites within 100km of the Development Area;
- NATS En Route radio navigation beacons within 10km of the Development Area.

Telecommunications

14.5 Telecommunications operators were consulted and information requested for telecommunications links within 4km of the centre of the Development Area.

Television

14.6 The Development Area is located in the STV Central region and television transmissions for homes near the Development Area are likely to be provided by the Black Hill and Craigkelly transmitter groups.

Dust

14.7 The assessment of dust effects during construction has been undertaken for receptors within 200m of the Development in accordance with accepted good practice using a risk based approach (this is detailed further below).

Carbon Balance

14.8 The assessment of carbon balance focuses on the Development Area. It quantifies the sources of carbon emissions resulting from construction of the Development and balances this against the predicted emissions avoided once the Development is operational.

Effects Assessed in Full

14.9 The following effects associated with the Development have been assessed:

- Potential technical effects on aviation and defence once the Development is operational: wind turbines can affect navigation and surveillance systems (including radar) and can affect the use of aerodromes.
- Operational effects on telecommunications: wind turbines can potentially cause interference through reflection and shadowing to electro-magnetically propagated telecommunications signals including terrestrial fixed microwave links managed by telecommunications operators.
- Operational effects on television reception: wind turbines have the potential to interfere with television broadcasting systems causing receiving viewers to experience degradation in picture quality or loss of reception. Ofcom guidance regarding wind farms and other tall structures[i] states *"Digital terrestrial TV (freeview, or Digital Terrestrial Television) offers a high degree of resistance to some of the signal impairments (particularly delayed image interference) which can spoil analogue TV reception, and may offer an alternative in areas where digital coverage is available."* The digital switchover has already taken place in all UK television regions.
- The effect of dust on sensitive receptors during construction: construction activities can result in temporary effects from dust if unmanaged. This can result in nuisance effects such as soiling of buildings and, if present over a long period of time, can affect human health.
- The main aims of the carbon balance assessment are: to quantify sources of carbon emissions associated with the Development (i.e. from construction, operation and transportation of materials, as well as loss of peat/forestry if relevant); to quantify the carbon emissions which will be saved by constructing the Development; and to calculate the length of time for the Development to become a 'net avoider', rather than a 'net emitter' of carbon dioxide emissions. The length of time, usually expressed in months, is termed the 'payback time'.

Effects Scoped Out

14.10 The following effects associated with the Development have been scoped out of the assessment:

- Construction effects on telecommunications, shadow flicker, television and aviation and defence as these effects solely relate to operational turbines.
- Shadow flicker effects during operation: shadow flicker is an effect that can occur when the shadow of a moving wind turbine blade passes over a small opening (e.g. a window), briefly reducing the intensity of light within the room, and causing a flickering to be perceived. Shadow flicker effects occur only within 130 degrees of north and within ten rotor diameters of a turbine (i.e. 900m in the case of the Development). As there are no properties within 130 degrees of north and within 900m of the development, shadow flicker effects have been scoped out of this assessment.
- NATS En Route Radar and navigation beacons: Review of the NATS self-assessment maps have identified that no issues associated with construction or operation of the Development are likely. There are no navigation beacons located within 10km of the centre of the Development Area and potential effects on these are therefore not considered further in this assessment.
- Effects on Civil Aerodromes and Heliports and Civil Airport Air Traffic Control (ATC) radar during construction or operation: there are no civil aerodromes, heliports, airports or ATC radars located within 30km of the centre of the Development Area. Potential effects on these installations are therefore not considered further.
- Effects on military Air Surveillance and Control Systems (ASACS) Radar, Military Precision Approach Radar (PAR) and Military Aerodromes during construction and operation: There are no ASACS Radar or PAR radars within 50km of the Development Area.

- Effects on Military Low Flying during construction and operation: the Development Area is located within a "*Low priority military low flying area less likely to raise concerns"* [ii] and no effects are predicted.
- Radio broadcasting: it is not considered likely that radio broadcasting signals will be affected by the Development once operational. This is because i) the length of radio broadcast signal wavelengths are such that interference from wind turbines is unlikely and ii) any interference to the radio signal is unlikely to noticeably affect the audio signal.
- Turbine icing: in certain weather conditions, such as still, cold weather, ice may form on turbine blades. This may result in ice fragments being thrown from the blades when operating and in ice falling from the blades when shut down. The Scottish Government web based renewables advice for onshore wind turbines[iii] states *"The build-up of ice on turbine blades is unlikely to present problems on the majority of sites. When icing occurs, the turbines' own vibration sensors are likely to detect the imbalance and inhibit the operation of the machines"*. In addition, the operators would implement measures to ensure the safety of workers and the general public in relation to ice throw and ice fall. These would comprise notices placed at access points alerting members of the public of the possible risk of ice throw and ice fall under certain conditions.
- Dust effects during operation of the Development: during operation there will be limited dust raising maintenance activities being undertaken and transport will be limited.
- Cumulative effects: there are a number of operational and proposed wind farms located in the vicinity of the Development including, Earlsburn, Craigengelt (operational), and Earlsburn North (application approved). No communication links effects are predicted as a result of operation of the Development; therefore, no cumulative effects are considered likely. In relation to television reception, any effects resulting from other schemes are likely to be already mitigated therefore it is considered unlikely that there will be any cumulative effects. Cumulative dust effects during construction and operation of the Development have been scoped out as dust generally settles locally and there would be no cumulative effect with other developments.

Assessment Methodology

Assessment Structure

14.11 The assessment is structured around the consideration of the following:

- effects on aviation and defence during operation of the Development;
- effects on telecommunications during operation of the Development;
- effects on television reception during operation of the Development;
- dust effects during construction;
- carbon balance assessment.

Data Sources and Guidance

14.12 The following guidance documents were referred to in undertaking this assessment:

- Scottish Planning Policy (February 2010)[iv];
- CAA Policy and Guidelines on Wind Turbines (2012)[v];
- PAN 50: Controlling the Environmental Effects of Surface Mineral Working (1996)[vi];
- PAN 51: Planning, Environmental Protection and Regulation (revised 2006)[vii];
- Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1, HA207/07 Air Quality[viii].
- Scottish Government (2011c). *Calculating Potential Carbon Losses & Savings from Wind Farms on Scottish Peatlands, Technical Note – Version 2.0.1.*[ix]*;*
- Scottish Government (2011d). *Carbon Payback Calculator: Guidance on how to use the spreadsheet*[x];
- Scottish Government (2012): Calculating carbon savings from wind farms on Scottish peat lands - A New Approach. Spreadsheet version 2.7.0:[xi];
- Scottish Natural Heritage (2003). Wind Farms and Carbon Savings, SNH Technical Guidance Note[xii].

14.13 The following data sources were used to inform the assessment:

- Department of Energy and Climate Change (DECC) (2013a). *Digest of UK Energy Statistics, DUKES 6.5: Load factors for electricity generated from renewable sources*[xiii]
- Department of Energy and Climate Change (DECC) (2013b). *Digest of UK Energy Statistics, DUKES Chapter 6: Renewable sources of energy*[xiv]
- Department of Energy and Climate Change (DECC) (2013c): *Digest of UK Energy Statistics, (DUKES) Chapter 5: Electricity, Table 5.7 Plant capacity – United Kingdom*[xv]
- Department of Energy and Climate Change (DECC) (2013d): *Digest of UK Energy Statistics, (DUKES) Chapter 5: Electricity, Table 5.1*[xvi]
- Department of Energy and Climate Change (DECC) (2013e): Digest of UK Energy Statistics, DUKES Chapter 5 - Electricity: Table 5C: Estimated carbon dioxide emissions from electricity generation 2010 to 2012[xvii]
- Met Office (2013b). *Regional mapped climate averages – West Scotland*[xviii]

Field Survey

14.14 No field surveys were required to inform the assessment, however peat probing was undertaken within the Development Area to inform the assessments within **Chapter 8: Geology, Hydrology and Hydrogeology** and **Chapter 9: Ecology**, and this information was used to inform the Carbon Balance Assessment.

Consultation

14.15 Consultation has been undertaken to inform the assessment, a summary of which is provided in **Table 14.1** below.

Table 14.1: Consultation Responses

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Civil Aviation Authority (CAA)	Scoping	No concerns raised. Advised consultation with Glasgow Airport.	Consultation with Glasgow Airport undertaken (see below).
Ministry of Defence (MOD)	Scoping	The MOD raised no concerns over the Development in February 2011 in terms of radar or low flying. The MOD requested that turbines be fitted with red or infrared lighting. They further requested to be consulted and notified about progress of planning applications and submissions.	No specific action required.
NATS En Route	Scoping	No conflicts with NATS En Route safeguarding	No action required.

Consultee	Scoping/Other Consultation	Issue Raised	Response/Action Taken
		criteria.	
BAA Glasgow Airport	Other consultation	No response received	A computer model has been used to consider if there is a direct line of sight from the radar position to the proposed turbine locations.
Office of Communications (Ofcom) (operate domestic reception for terrestrial television and radio transmissions)	Scoping	Advised that no communications link is located in the vicinity of the Development. Advised consultation be carried out with Atkins Ltd and Joint Radio Company (JRC).	Consultation with Atkins and JRC undertaken (see below).
Joint Radio Committee (JRC)	Scoping	Advised that the Development will not affect any communications links.	No action required.
Atkins	Other Consultation	No issues identified.	No action required.
British Broadcasting Corporation (BBC) Windfarm Tool (online)	Other consultation	No properties will be affected by the Development.	No action required.
Linesearch (online)	Other consultation	No underground services will be affected by the Development.	No action required.

Assessing Significance

Aviation and Defence, Telecommunications and Television

14.16 For effects on aviation and defence, telecommunications and television, predicted effects are judged as being either significant or non-significant and have been determined through a standard method of assessment based on professional judgement obtained during work relating to a large number of previous wind farm projects. Due to the nature of these effects, levels of significance (e.g. major, moderate, minor or negligible) have not been identified and effects are either 'significant' in the context of the EIA Regulations or 'not significant'.

Dust

14.17 The risk based approach to assessing dust nuisance has been based on the likelihood of dust emissions causing nuisance (such as soiling of buildings) and the potential for effects on human health, with the aim of determining the level of mitigation, if required, to ensure that any potential effects are minimised. The DMRB states that dust generated during construction should be mitigated and that the locations of 'sensitive receptors' within 200m should be identified and mitigation measures to reduce dust effects be applied. As such, all receptors within 200m of potential dust sources have been considered as potential receptors.

14.18 Sensitivity of receptors is determined through professional judgement based on sensitive receptors defined in the DMRB. Effect magnitude has been determined through consideration of the potential dust raising activities during construction. Activities with high dust raising potential include earthworks (e.g. earth moving and excavation,), material handling (e.g. stockpiling and loading/unloading vehicles). Natural causes, e.g. wind blowing on stockpiles and uncovered vehicles can also potentially have a high dust raising potential. Material transport and traffic on unsurfaced roads are considered to have medium dust raising potential and the movement of dirty vehicles have a low dust raising potential.

14.19 Professional judgement is used to consider how receptor sensitivity and effect magnitude combine to affect potential receptors. Effects which are predicted to have an adverse effect on the amenity of the receptor or on human health are considered significant in the context of the EIA Regulations.

Carbon Balance

14.20 The carbon balance assessment was undertaken using the latest Scottish Government guidance. There is no formally established methodology or criteria for determining the significance of carbon sources or sinks in relation to carbon balance. However, the shorter the 'payback time' of CO_2 emissions, the sooner the project becomes a 'net avoider' of CO_2 emissions.

Planning Policy

14.21 Planning policies of relevance to this assessment are identified in **Chapter 5: Planning Policy Context**.

Existing Conditions

Aviation and Defence

14.22 Under the Civil Aviation Act, the CAA is responsible for providing advice about aviation safety. The Authority's Directorate of Airspace Policy (DAP) has the lead responsibility within the CAA for all wind turbine related issues. The Authority's policy on wind turbine development and related guidance to the UK civil aviation community is set out in CAP 764. The CAA changed its policy regarding pre-planning consultations in December 2010, stating that "*it will no longer process pre-planning enquiries unless submitted as a Scoping Opinion through a Local or National Planning Authority. As completion of the pre-planning process is not a statutory requirement, the CAA's decision will not affect the formal planning process.* "

14.23 The initial consultation with the CAA was made immediately before the policy change noted above. The CAA noted the Development and its only comment was to recommended consultation with Glasgow Airport. Glasgow airport was consulted on the proposal on 20th August 2012.

14.24 Data published by the Department of the Environment and Climate Change[xix] has been used to assess the likely effect of the Development on aviation interests. The Development:

- lies outside any consultation zone for safeguarded aerodromes; and
- lies outside the area where there may be effects on any Secondary Surveillance Radar (SSR).

14.25 The Development lies within 20km of the meteorological radar site at Holehead. Consultation for such radars is managed by the MOD. In its response, the MOD raised no objection.

14.26 Planning authorities will consult local aerodromes as follows:

- officially safeguarded aerodromes: Planning authorities must consult aerodromes on all matters relating to safeguarding (DfT / ODPM / NAFW Circular 1/2003 and Scottish Circular 2/2003 refers); and
- non-officially safeguarded aerodromes: Aerodrome Operators are advised to establish a consultation process with local planning authorities.

14.27 The MOD was consulted on the scoping wind farm design (refer to ES **Chapter 3: Site Selection and Design Strategy**) by Force 9 Energy in January 2011. The MOD responded confirming no objections to the project in February 2011. Force 9 Energy consulted again in August 2012 when the final layout was defined. Again, no objection was raised.

Telecommunications and other infrastructure

14.28 An enquiry was entered into the Linesearch facility which "*provides a single point of contact for all initial enquiries relating to the apparatus owned and/or operated by our Members, which now totals some 7,900 kms of pipeline and fibre optic cable ducts".* The results of this enquiry showed that the Development was not in the zone of interest for any of the listed organisations.

14.29 Following consultation with Ofcom and the JRC, no organisations identified telecommunication links which may have had the potential to be affected by the Development.

Television

14.30 The online BBC Windfarm Tool (which provides an estimate of the population numbers potentially affected by the installation of wind turbines) indicated in November 2012 there is unlikely to be interference with local transmitters, with the result that no homes may be affected for which an alternative off-air service may be available.

Dust

14.31 One residential property is located within 200m of the Development infrastructure:

- Todholes (NS 67288 86095).

Carbon Balance

14.32 The results of onsite survey work have confirmed that peat is present across the Development Area. Whilst the final turbine and infrastructure layout of the Development has sought to avoid deeper areas of peat, some peat will be required to be removed during construction and this has been taken into account in the carbon balance assessment.

Wind Farm Layout Design Considerations

14.33 The layout was designed to seek to minimise the loss of peat which is relevant to the carbon balance assessment. No further modifications to the layout were required in relation to the issues considered in this chapter.

Effects Assessment

14.34 The assessment of effects is based upon the development description outlined in **Chapter 4: Development Description** and considers the construction and operational effects of the Development.

Construction Effects

Predicted Effects

Dust

14.35 The types of activities that may cause 'fugitive dust emissions'[1] are detailed above in **Section 14.16**. Given the location of the sensitive receptor identified and proximity to the access track, the movement of vehicles as they transport equipment and goods to site is the most likely source of dust during the construction period. The level and distribution of emissions will vary according to factors such as the duration of dust-generating activity and weather conditions.

14.36 Dust emitting activities generally respond well to appropriate dust control measures such as those outlined in PAN 50: Controlling the Environmental Effects of Surface Mineral Workings, and negative effects can greatly be reduced or eliminated. The developer will commit to adopting good practices for dust management during construction thereby controlling and reducing any potential effects on the potential receptors identified. These measures include:

- ensuring all loads entering and leaving the Development Area are covered where practicable;
- the use of wheel wash facilities prior to exiting the main construction site to ensure mud and/or other wastes are not tracked down the access track and on to the public road;
- enforcing an appropriate speed limit.

[1] Fugitive dust emissions are defined as any solid particulate matter that becomes airborne due to man-made or natural activities such as the movement of soil, vehicles, equipment, blasting and wind.

14.37 With adherence to these good practice measures, the predicted dust effects will be temporary and will not be significant.

Proposed Mitigation

Dust

14.38 No mitigation beyond the adoption of good practice measures for dust management is required.

Residual Effects

14.39 The predicted residual effect of the Development on dust receptors will not be significant with the implementation of the good practice measures proposed.

Operational Effects

Predicted Effects

Aviation and Defence

14.40 The MOD has raised no concerns about the Development.

14.41 The CAA has raised no concerns about the Development.

14.42 Glasgow airport was consulted on the proposal on 20th August 2012. There has been no response to the consultation request from the airport. In lieu of a formal response, computer modelling has been used to establish if there is any line of sight between the Glasgow airport radar and any wind turbines on site. This has confirmed that turbines will not be in the scope of the Glasgow airport radar and should not therefore affect the radar.

14.43 The predicted effect of the operation of the Development on radar is therefore considered not significant.

Telecommunications

14.44 As noted above, consultation with Ofcom identified that there are no communications links within the vicinity of the Development Area.

14.45 The predicted effect of operation of the Development on telecommunications is considered not significant.

Television Reception

14.46 The BBC online tool reported that no properties are likely to be affected by wind turbines in this location. This was reported on the basis of a central grid reference for the Development Area.

Proposed Mitigation

Aviation and Defence

14.47 Given that the MOD and CAA have not raised any concerns about the Development, and computer modelling shows that turbines will not be in the scope of the Glasgow airport radar, no mitigation is considered necessary.

Telecommunications

14.48 Effects on telecommunications are predicted as being not significant therefore no mitigation measures are considered necessary.

Television Reception

14.49 The BBC online tool suggests there are no properties which may experience interference to their television reception once the Development is operational. Effects on television reception would be confirmed following an onsite survey should issues arise. Installation of satellite television or upgrades of the current antenna systems would be the most appropriate and effective form of mitigation at these properties.

Residual Effects

14.50 The predicted residual effect of the Development on civil and military aviation is considered to be not significant.

14.51 The predicted residual effect of the Development on telecommunications is not significant.

14.52 The predicted residual effect of the Development on television reception is not significant.

Carbon Balance

14.53 The carbon balance assessment has calculated the 'payback time' of CO_2 emissions for the Development. A copy of the carbon balance assessment report is provided at **Appendix 14.1** and a summary of the findings is provided below.

14.54 The payback time is defined as the length of time (in months) required for the Development to be considered a net avoider of emissions rather than a net emitter. The calculation of payback time includes consideration of emissions resulting from the construction and operational phases of the Development and includes the quantification of the carbon storage loss as a result of loss of peat within the site (expressed as CO_2 emissions).

14.55 The detailed methodology and assumptions used within the assessment are presented in **Appendix 14.1**. The main aims of the calculation are:

- to quantify sources of carbon emissions associated with the Development;
- to quantify the carbon emissions which will be 'avoided' by operating the Development;
- to calculate the length of time for the Development to become a 'net avoider', rather than a 'net emitter' of carbon dioxide emissions.

14.56 Total carbon losses associated with the Development are shown in **Table 14.2** below.

Table 14.2:Total Carbon Losses Due to Wind Farm

Source of Losses	Carbon losses (tCO_2yr^{-1})		
	Expected Value*	Minimum Value	Maximum Value
Turbine life cycle	16,349	16,349	16,349
Backup generation	14,625 (0)	0	16,097
Reduction in carbon fixing potential	487	123	1,054
Soil organic matter	37,351	4,376	188,546
Dissolved Organic Carbon (DOC) & Particulate Organic Carbon (POC) leaching	0	1	0
Felling of forestry	0	0	0
Total	**68,812 (54,187)**	**20,848**	**222,044**

* Numbers in brackets reflect carbon losses for the scenario where no backup generation capacity is required.

14.57 With the exception of the backup generation (assumed to be from fossil fuel sources), the carbon losses are independent of the generation mix used to calculate the overall carbon balance. Assuming a requirement for backup generation capacity, the calculator model indicates that based on expected values, over 23.8% of the carbon losses are from turbine life cycle, with approximately 54.3% due to losses of soil organic matter. Over 21% of the potential carbon losses are due to the requirement for backup power generation. It is likely that the need for backup power generation will be much smaller, perhaps for 10% or less of the wind farm's proposed operational period of 25 years. Should no backup generation capacity be required, emissions from turbine life cycle and soil organic matter losses account for over 99% of carbon emissions.

14.58 Given that the "Grid-mix" will involve renewable energy developments that are operational, the "Fossil fuel-mix" represents the most likely scenario in terms of the existing capacity to be replaced by electricity generated from the site.

14.59 As shown in **Table 14.3** and assuming a requirement for backup generation capacity of 5%, the expected payback time is calculated to be approximately 2 years or 24 months. With a 25 year operational life, this would mean that this development would save over twelve times the carbon emissions generated. Based on the worst case scenario, represented by the maximum values entered in the calculator, payback time is calculated to be 7.5 years, or 90 months.

14.60 The more likely scenario is that there will be little or no requirement for backup generation capacity, based on predictions for the growth in the contribution of wind energy to the national grid. With no requirement for backup capacity, the carbon payback period is reduced to 1.5 years (18 months) based on the "Fossil Fuel-mix", equating to carbon emission savings of over sixteen times those generated for a 25 year operational period.

Table 14.3 Payback Timetable

Generation Source	Counterfactual emission factors (tCO_2MWh^{-1})[xx]	Carbon Payback time (years)			
		Expected Value		Minimum Value	Maximum Value
		0% Backup	5% Backup		
Coal fired	0.902	1.1	1.4	0.3	5.0
Grid Mix	0.460	2.1	2.7	0.6	10.2
Fossil Fuel Mix	0.636	1.5	2.0	0.4	7.5

Cumulative Effects Assessment

14.61 No cumulative effects have been identified.

Further Survey Requirements and Monitoring

14.62 No further survey requirements or monitoring are proposed.

Summary of Effects

14.63 **Table 14.4** summarises the predicted effects of the Development.

Table 14.3: Summary of Effects

Predicted Effects	Significance	Proposed Mitigation	Residual Effects
Aviation and Defence	Not significant.	No mitigation required	Not significant
Telecommunications	Not significant	No mitigation required	Not significant
Television Reception	Not significant	No mitigation required	Not significant

Predicted Effects	Significance	Proposed Mitigation	Residual Effects
Dust	Not significant	None	Not significant
Carbon Balance	The payback period during which any CO_2 emitted during construction and operation will be offset is 24 months (assuming a requirement for backup generation capacity of 5%). Beyond this period the Development will make a positive net contribution to CO_2 emissions reductions.		

[i] Ofcom (2009), Tall Structures and their impact on broadcast and other wireless services

[ii] Ministry of Defence (2011), Low Flying Consultation Zones

[iii] The Scottish Government (2011) 'Onshore Wind Turbines' Web Based Renewables Advice (updated October 2012)

[iv] The Scottish Government (2010), Scottish Planning Policy (SPP)

[v] Directorate of Airspace Policy (2012), CAP 764 CAA Policy and Guidelines on Wind Turbines 4th edition

[vi] The Scottish Executive (1996), PAN 50: Controlling the Environmental Effects of Surface Mineral Working

[vii] The Scottish Government (2006) PAN 51: Planning, Environmental Protection and Regulation

[viii] Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment Techniques, Part 1, HA207/07 Air Quality

[ix] Scottish Government (2011c). *Calculating Potential Carbon Losses & Savings from Wind Farms on Scottish Peatlands, Technical Note – Version 2.0.1.*: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings/CTN201

[x] Scottish Government (2011d). *Carbon Payback Calculator: Guidance on how to use the spreadsheet*: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings/CCalcGuidance (accessed 24 June 2013)

[xi] Scottish Government (2012): Calculating carbon savings from wind farms on Scottish peat lands - A New Approach. Spreadsheet version 2.7.0: Version dated 27 October 2012

[xii] Scottish Natural Heritage (2003). Wind Farms and Carbon Savings, SNH Technical Guidance Note

[xiii] Department of Energy and Climate Change (DECC) (2013a). *Digest of UK Energy Statistics, DUKES 6.5: Load factors for electricity generated from renewable sources*: https://www.gov.uk/government/publications/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes (Accessed 2nd September 2013)

[xiv] Department of Energy and Climate Change (DECC) (2013b). *Digest of UK Energy Statistics, DUKES Chapter 6: Renewable sources of energy:* https://www.gov.uk/government/publications/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes (Accessed 2nd September 2013)

[xv] Department of Energy and Climate Change (DECC) (2013c): *Digest of UK Energy Statistics, (DUKES) Chapter 5: Electricity, Table 5.7 Plant capacity – United Kingdom*: https://www.gov.uk/government/publications/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes (accessed 2nd September 2013)

[xvi] Department of Energy and Climate Change (DECC) (2013d): *Digest of UK Energy Statistics, (DUKES) Chapter 5: Electricity, Table 5.1*: https://www.gov.uk/government/publications/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes (accessed 2nd September 2013)

[xvii] Department of Energy and Climate Change (DECC) (2013e): Digest of UK Energy Statistics, DUKES Chapter 5 - Electricity: Table 5C: Estimated carbon dioxide emissions from electricity generation 2010 to 2012: https://www.gov.uk/government/publications/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes (accessed 3rd September 2013)

[xviii] Met Office (2013b). *Regional mapped climate averages – West Scotland*: http://www.metoffice.gov.uk/public/weather/climate/lennoxtown#?tab=climateMaps (accessed 25 June 2013)

[xix] https://restats.decc.gov.uk/cms/aviation-safeguarding-maps

[xx] Department of Energy and Climate Change (DECC) (2013e): Digest of UK Energy Statistics, DUKES Chapter 5 - Electricity: Table 5C: Estimated carbon dioxide emissions from electricity generation 2010 to 2012: https://www.gov.uk/government/publications/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes (accessed 3rd September 2013)

15 Summary

Introduction

15.1 Chapters **6 to 14** of the ES report the findings of the assessments of the predicted effects of the proposed Development on a topic-by-topic basis. The significance of these effects has been assessed using criteria defined in the topic chapters. Where appropriate, the significance of effects has been categorised as major, moderate, minor or negligible. In the context of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 ('the EIA Regulations')[i], effects assessed as being of '**major**' or '**moderate**' significance are considered to be significant effects. For some of the assessments, effects are either considered to be **significant** or **not significant** in the context of the EIA Regulations. In line with Planning Circular 3 2011[ii], the Environmental Impact Assessment (Scotland) Regulations 2011, and other relevant EIA guidance, the ES has focused particularly on significant effects and the measures proposed to mitigate them.

15.2 **Table 15.1** summarises the predicted significant effects of the Development prior to, and following, the implementation of committed mitigation measures. Summaries of all significant and non-significant effects can be found at the end of each assessment chapter.

Summary of Significant Effects

15.3 Prior to committed mitigation, significant effects are predicted in relation to:

- Landscape and Visual Amenity;
- Geology, Hydrology and Hydrogeology;
- Ornithology; and
- Archaeology and Cultural Heritage

15.4 No significant effects are predicted in relation to:

- Noise;
- Ecology;
- Access, Traffic and Transport;
- Socio Economics; or
- Other Issues

15.5 Only effects which are considered to be significant prior to mitigation are presented in the summary of predicted significant effects table below (**Table 15.1**). All other effects are considered to be non-significant prior to mitigation and are therefore not presented.

15.6 From the outset, the purpose of the design strategy for the Development was to avoid significant environmental effects through design of the turbines and associated infrastructure. The overall aim of the design strategy was to create a wind farm with a cohesive design that relates to the surrounding landscape, in line with appropriate published guidance.

15.7 The main components of the Development considered in the early design stage were the turbines. Given their form as tall, man-made structures, potentially visible within a wide area, the location and scale of these influenced the design to minimise landscape and visual effects. The design layout was also informed by wind yield and ground condition considerations as information emerged through the EIA process. Informed by the emerging design of the turbine layout, other infrastructure features such as the access tracks were subsequently designed, taking into account environmental constraints data.

15.8 As shown in **Table 15.1**, there is scope to mitigate most of the predicted significant effects and many are therefore not significant following mitigation.

15.9 The landscape and visual assessment has identified that there will be a major landscape and visual effect of construction on the Development Site. This effect will be temporary however, and will be reduced to negligible following the implementation of site reinstatement measures. A residual effect of major significance on the landscape of the Development Site, and moderate effects on localised areas of the Lowland Hills and Flat Valley Floor Landscape Character Types (LCTs) are also predicted during operation. Residual significant effects are also predicted for five viewpoints (all of which are moderate) during operation. Significant residual cumulative effects are also anticipated for the landscape of the Development Site (major) and for the Lowland Hills LCT (moderate). Further mitigation, in addition to that undertaken as part of the design strategy, is not possible due to the inherent nature of wind farm developments.

15.10 The geology, hydrology and hydrogeology assessment has identified the potential for significant effects during the construction of the Development in relation to erosion or loss of soil, sedimentation of surface waters and peat stability failure resulting in sedimentation of surface waters or modifications to surface water drainage. It is proposed that construction activities adjacent to watercourses will be carefully managed and monitored, and it is anticipated that this will result in residual effects of minor significance in terms of erosion/loss of soil and sedimentation of surface waters. In order to mitigate the potential effects associated with peat stability failure, on-going peat stability surveys will identify areas of concern. The adoption of good practice geotechnical techniques in such locations along with routine monitoring will result in a residual effect of minor significance.

15.11 The ornithology assessment has identified that an effect of moderate significance, in relation to black grouse displacement, is likely to occur during construction. It is anticipated that this effect will be reduced to minor significance following mitigation. In addition, during operation of the Development there will be effects of moderate significance in respect of black grouse collision and displacement. Following the implementation of mitigation measures, including the erection of fencing and introduction of a Habitat Management Plan (HMP), these effects are predicted to be reduced to minor significance.

15.12 As identified in the archaeology and cultural heritage assessment, the effect of inadvertent damage to upstanding banked enclosure CH14 is predicted to be of moderate significance during construction. The marking out of this area prior to construction has therefore been proposed to mitigate this effect, and will result in a residual effect of negligible significance.

Interrelated Effects

15.13 The EIA Regulations (Schedule 4, Part 1, paragraph 3) require that Environmental Statements consider the interrelationships between aspects of the environment likely to be significantly affected by a development. It is considered that the following effects are interrelated:

- There is a correlation between recreation and tourism effects and views of the Development from viewpoints within the wider 35km landscape and visual study area. Whilst the assessment of such interrelated effects is presented within **Chapter 13: Socio Economics**, the assessment necessarily relates to the assessment in **Chapter 6: Landscape and Visual Amenity**. No significant effects are predicted on recreation and tourism as a result of the Development.

- There is some correlation between landscape and cultural heritage effects in relation to the change in views resulting from the Development where these are evident from cultural heritage receptors. An assessment of effects on the setting of cultural heritage features is undertaken in **Chapter 11: Archaeology and Cultural Heritage,** which is interrelated to the findings of the assessment in **Chapter 6: Landscape and Visual Amenity** whereby changes to views within the wider area are discussed.

- There is some correlation between likely effects on hydrology and ecology given that changes to hydrology resulting from the Development could result in effects on ecological receptors for example, disruption of the hydrological patterns within groundwater dependent habitats. These interrelated effects are assessed in **Chapter 8: Geology, Hydrology and Hydrogeology** and **Chapter 9: Ecology**.

- There is some correlation between potential effects on local residential amenity resulting from visual effects on settlements; temporary effects from construction noise and traffic, as well as operational

noise. Effects on settlements are considered in **Chapter 6: Landscape and Visual Amenity**, **Chapter 7: Noise** and **Chapter 12: Access, Traffic and Transport**.

Table 15.1: Summary of Predicted Significant Effects

Predicted Effect	Significance of Effect	Mitigation	Significance of Residual Effect
Landscape and Visual Amenity			
Construction			
Landscape and visual effects of construction on the Development Site	Major during construction, Negligible post construction.	The construction of the turbines and associated infrastructure will follow agreed Construction Method Statements, which will include arrangements for implementation of various aspects of the works such as vegetation and soil removal, storage and replacement; vegetation restoration and stream crossings.	Negligible
Operation – Landscape Character			
Effects on the landscape of the Development Site	Major	Measures to reduce effects upon the landscape resource were predominantly achieved through the design of the wind farm. No further mitigation is proposed.	Major
Effects on Landscape Character Types			
Lowland Hills (Central Region LCA: 10 Fintry, Gargunnock and Touch Hills)	Moderate	As above	Moderate
Flat Valley Floor (Stirling SPG: L2, Carse West of Stirling)	Moderate	As above	Moderate
Operation – Visual Amenity			
Visual Effects - Viewpoints			
Viewpoint 1 – Minor Road near Easter Cringate	Moderate	Measures to reduce effects upon views and visual amenity were predominantly achieved through the design of the wind farm. No further mitigation is proposed.	Moderate
Viewpoint 3 - Carleatheran	Moderate	As above	Moderate
Viewpoint 5 - B822 at Kippen Muir	Moderate	As above	Moderate
Viewpoint 6 - Tomtain	Moderate	As above	Moderate
Viewpoint 7 - B8034 nr. Arndale Park and Gardens	Moderate	As above	Moderate
Cumulative Effects			
Cumulative Effects on the landscape of the Development Site	Major	As above	Major
Cumulative landscape effect on the Lowland Hills (Central Region LCA: 10 Fintry, Gargunnock and Touch Hills)	Moderate	As above	Moderate
Geology, Hydrology and Hydrogeology			
Construction			
Erosion or loss of soil	Moderate	Carefully managed and monitored riparian zone construction activities to reduce likelihood of erosion and to minimise soil loss, should it occur	Minor
Sedimentation of surface waters	Moderate	As above	Minor
Peat stability failure; sedimentation of surface waters	Moderate	Good practice geotechnical techniques in areas of concern, including routine monitoring for early evidence of slope failure and remedial action	Minor
Peat stability failure; modification to surface water drainage	Moderate	As above	Minor

Ornithology			
Construction			
Black grouse Displacement	Moderate	Restriction on activity one hour before and after dawn during breeding season. Supplementary feeding using feed hoppers.	Minor
Operation			
Black grouse Collision	Moderate	Chestnut Paling Fencing to reduce collision risk around turbines close to lek sites.	Minor
Black grouse Displacement	Moderate	Habitat Management Plan to create additional foraging habitat.	Minor
Archaeology and Cultural Heritage			
Construction			
Inadvertent damage to upstanding banked enclosure CH14 during construction	Moderate (worst case)	Marking out prior to commencement of works	Negligible

[i] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011
[ii] Planning Circular 3 2011: The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011