Kirkan Wind Farm Limited

Kirkan Wind Farm

Environmental Impact Assessment Report (Volume 1)

661694

MARCH 2019

RSK GENERAL NOTES

Project No.: 661694

Title: Kirkan Wind Farm
Environmental Impact Assessment Report (Volume 1)

Client: Kirkan Wind Farm Ltd

Date: 29th March 2019

Office: Glasgow

Status: Final

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Date:	29/03/2019	Date:	29/03/2019

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Date:	29/03/2019

PREFACE

Kirkan Wind Farm Limited is submitting an application for consent for the Kirkan Wind Farm, located approximately 5.8 km northwest of Garve, Highlands, on the southern side of the A835 trunk road southeast of Loch Glascarnoch dam. The project area currently forms a small part of the Strathvaich Estate. It is proposed that 17 turbines will be constructed in the project area, and that each turbine will have a maximum height to blade tip up to 175 metres. The individual turbine generating capacity is anticipated to be up to 4.8 Megawatts (MW), with the total installed capacity for the development in excess of 50 MW.

RSK Environment Limited has been commissioned by Kirkan Wind Farm Limited to undertake an environmental impact assessment of the proposed development. This Environmental Impact Assessment (EIA) report outlines the findings of environmental assessments undertaken during the evolution of the proposed development.

Information relating to the EIA report and supporting documentation is available in three volumes:

Volume 1 – Environmental Impact Assessment report

Volume 2 – Technical Appendices

Volume 3 – Graphics

A copy of the EIA report, together with a non-technical summary outlining the information provided in the EIA report, has been deposited at each of the locations indicated below and will be available for inspection until at least 12th May 2019 during normal opening hours.

<u>The Highland Council Offices</u>

County Buildings

Dingwall

IV15 9QN

<u>Garve Village Hall</u>

Station Road

Garve

IV23 2PP

Hard copies of the EIA report are available subject to a charge of £500 (plus P&P). Hard copies of the non-technical summary are available free of charge. A digital version of the EIA report on CD-ROM can be obtained for a fee of £10. Copies available on written request from:

Trevor Hunter

Kirkan Wind Farm Ltd

22-24 King Street

Maidenhead

Berkshire

SL6 1EF

Email: info@kirkanwindfarm.co.uk

Expressions of support, representations or opinions should be sent to:

Energy Consents Unit

4th Floor, 5 Atlantic Quay

150 Broomielaw

Glasgow

G2 8LU

Email: representations@gov.scot

Via website: www.energyconsents.scot/Register.aspx

Expressions will be accepted up to 12th May 2019.

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EIA Quality Mark

This Environmental Statement, and the Environmental Impact Assessment (EIA) carried out to identify the significant environmental effects of the proposed development, was undertaken in line with the EIA Quality Mark Commitments.

The EIA Quality Mark is a voluntary scheme, operated by IEMA, through which EIA activity is independently reviewed, on an annual basis, to ensure it delivers excellence in the following areas:

- *EIA Management*
- *EIA Team Capabilities*
- *EIA Regulatory Compliance*
- *EIA Context & Influence*
- *EIA Content*
- *EIA Presentation*
- *Improving EIA practice*

To find out more about the EIA Quality Mark please visit: http://www.iema.net/eia-quality-mark/

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GLOSSARY

alternatives	different design, layout and technological possibilities that could be considered during project development that have potential to fulfil the project objectives
ambient	of or relating to the immediate surroundings of something (e.g. ambient noise level)
ancient woodland	woodland that has existed continuously since at least AD 1600
Annex I project	see ‘Schedule 1 project’
Annex II project	see ‘Schedule 2 project’
appropriate assessment	process whereby projects, either alone or in combination, are considered to see if it can be ascertained that they will not adversely affect the integrity of a European protected site
assessment	process by which information about effects of a proposed plan, project or intervention is collected, assessed and used to inform decision making
baseline conditions	environment as it appears (or would appear) immediately prior to the implementation of the project together with any known or foreseeable future changes that will take place before completion of the project
baseline studies	work done to determine and describe the environmental conditions against which any future changes can be measured or predicted and assessed
biodiversity	variety of life forms; different plants, animals and microorganisms; the genes they contain; and the ecosystems they form
catchment	drainage/basin area within which precipitation drains into a river system and eventually into the sea
Controlled Activities Regulations	Controlled Activities Regulations (CAR), also known as the Water Environment (Controlled Activities) (Scotland) Regulations 2011, apply regulatory controls over activities which may affect Scotland’s water environment. SEPA risk assesses the proposed activities before granting an authorisation if it is appropriate. The type of authorisation depends on the environmental risk, and could be General Binding Rules, registration, or a licence.
committed development	development projects that are either under construction or have valid planning permissions/consents
competent authority	authority responsible for determining the application for consent, permission, licence or other authorisation to proceed with a development
construction phase	period during which the building or assembling of a proposed development and its infrastructure is undertaken
consultation	process by which those organisations or individuals with an interest in the area associated with the proposed development are identified and engaged as part of the EIA process
consultation bodies	organisations that the competent authority is required to consult by virtue of the EIA Regulations
controlled waters	surface waters, ground waters and coastal waters to which UK pollution legislation applies

culvert	pipe or box-type conduit through which water is carried under a structure
cumulative impact	impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. A cumulative impact may arise as the result of (a) the combined impact of a number of different environmental topic-specific impacts from a single environmental impact assessment project on a single receptor/ resource or (b) the combined impact of a number of different projects within the vicinity (in combination with the environmental impact assessment project) on a single receptor/resource.
decommissioning	period during which a development and its associated infrastructure are removed from active operation
design event	event such as a rainstorm or flood of given magnitude and probability (usually derived from previous records)
do-minimum scenario	also known as the 'do-nothing' scenario: the conditions that would persist in the absence of the implementation of a development
effect	term used to express the consequence of an impact (expressed as the 'significance of effect'), which is determined by correlating the magnitude of the impact with the importance (or sensitivity) of the receptor or resource in accordance with defined significance criteria. For example, land clearing during construction results in habitat loss (impact), the effect of which is the significance of the habitat loss on the ecological resource.
EIA Directive	the original European Community Directive 85/337/EEC was amended and then superseded by Directive 2011/92/EU, which in turn was replaced with Directive 2014/52/EU, which was enacted in the UK in 2017 through various Statutory Instruments ('EIA Regulations').
EIA Regulations	collective term for the various statutory instruments through which the Directives on Environmental Assessment have been implemented in the UK
Energy Consents Unit	part of the Scottish Government's Energy Division, the unit processes and administers energy infrastructure applications for Scottish Ministers under the 1989 Electricity Act, The unit is made up of two teams, the Section 36 team and the Section 37 team.
enhancement	measure that is over and above what is required to mitigate the adverse effects of a project
environmental assessment	method and a process by which information about environmental effects is collected, assessed and used to inform decision-making. Assessment processes include strategic environmental assessment, assessment of implications on European sites, and environmental impact assessment.
environmental impact assessment	statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. Involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive, including the publication of an EIA report.
Environmental Impact Assessment Report	otherwise known as an EIA report. Document produced in accordance with the EIA Directive (as transposed into UK law by the EIA Regulations) that reports the outcomes of the EIA process

environmental information	information that must be taken into account by the decision maker (the competent authority) before granting any kind of authorisation in any case where the EIA process applies. It includes the environmental impact assessment report, including any further information, any representations made by any body required by the Regulations to be invited to make representations, and any representations duly made by any other person about the environmental effects of the development
environmental management plan	structured plan that outlines the mitigation, monitoring and management requirements arising from an environmental impact assessment
estuary	downstream part of a river where it widens to enter the sea
European site	sites that make up the European ecological network (also known as Natura 2000 sites). These include sites of community importance (SCIs), special protection areas (SPAs) and potential SPAs (pSPAs), special areas of conservation (SACs) and candidate or possible SACs (cSACs or pSACs), and Ramsar sites.
evaluation	determination of the significance of effects. Evaluation involves making judgements as to the value of the receptor/resource that is being affected and the consequences of the effect on the receptor/resource based on the magnitude of the impact.
existing environment	see ‘baseline conditions’
Gate check	Procedure adopted by the Energy Consents Unit to review work undertaken by the applicant for a Section 36 or Section 37 development prior to submission of their EIA report and consent application.
Habitats Regulations	EC Council Directive 92/43/EEC, known as the Habitats Directive, was translated into legal obligations in Scotland by the Conservation (Natural Habitats) Regulations 1994 (most recently amended in 2012). This legislation is more commonly known as the Habitats Regulations. The Habitats Regulations cover requirements for sites that are internationally important for threatened habitats and species (e.g, Natura sites), species that require strict protection (e.g., European protected species), and other aspects of the Habitats Directive.
Habitats Regulations assessment	assessment of the impacts of implementing a plan or policy on a European site, the purpose being to consider the impacts of a project against conservation objectives of the site and to ascertain whether it would adversely affect the integrity of the site
hydraulics	processes and regimes of water flow (velocities, volumes, duration, frequency etc) in hydrological systems such as surface waters and groundwater
hydrodynamics	mechanical properties of fluids
impact	change that is caused by an action; for example, land clearing (action) during construction that results in habitat loss (impact)
invertebrates	animals without backbones
local development	development type identified as local under the Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009
major development	development type identified as major under the Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009
mean (high/low) water	highest/lowest average level water reaches on an outgoing tide

method statement	document that sets out intended working or survey practices
mitigation	measures intended to avoid, reduce and compensate adverse environmental effects
monitoring	continuing assessment of the performance of the project, including mitigation measures. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted.
national development	development type identified as national under the Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009
non-statutory consultee	organisations and bodies that should be consulted on relevant planning applications
non-technical summary	information for the non-specialist reader to enable them to understand the main predicted environmental effects of the proposal without reference to the main EIA report
operation	functioning of a development on completion of construction
pasture	grassland maintained primarily for and by grazing, and on which grazing stock is kept for a large part of the year
phase 1 habitat survey	Recognised methodology used for collating information on the habitat structure of a particular site.
photomontage	superimposing of an image onto a photograph to create a realistic representation of proposed or potential changes to a view
piling	installation of bored and driven piles into the ground
planning authority	local authority that is empowered by law to exercise planning functions for a particular area of the United Kingdom
pollution	any increase of matter or energy to a level that is harmful to living organisms of their environment (when it becomes a pollutant)
preferred option	chosen design option that most successfully achieves the project objectives and becomes subject to further design and assessment
programme	series of steps that have been identified by the applicant, or series of projects that are linked by dependency
project	One (or more) aspect of a programme or plan that has been identified by the applicant and usually involves a direct physical intervention
project area	refers to everything within the red line boundary of the consent application
project objectives	objectives of the project, set by the applicant
proposed development	the project that the applicant or promoter seeks to implement
Ramsar	areas designated by the UK Government under the International Ramsar Convention (the Convention on Wetlands of International Importance)
receptor	defined individual environmental feature usually associated with population, fauna and flora with the potential to be affected by a project
resource	defined but generally collective environmental feature usually associated with soil, water, air, climatic factors, landscape, material assets, including the architectural and archaeological heritage that has potential to be affected by a project

roosting site (birds)	place where birds rest or sleep
roosting site (bats)	place where bats live (e.g. built structures and trees)
run-off	precipitation that flows as surface water from a site, catchment or region to the sea
Section 36 Application	in Scotland, the construction and operation of power stations of a certain capacity requires an application to be made to Scottish Ministers under section 36 of the Electricity Act 1989. Applications to the Scottish Ministers need to be accompanied by an EIA report. The Energy Consents Unit's Section 36 team will process applications for on-shore power station applications, including wind farms over 50MW and hydro developments over 1MW.
Schedule 1 project	plans or projects listed in Annex I of the EIA Directive and Schedule 1 of the EIA Regulations
Schedule 2 project	plans or projects listed in Annex II of the EIA Directive and Schedule 2 of the EIA Regulations
scoping	process of identifying the issues to be addressed by the environmental impact assessment process. It is a method of ensuring that an assessment focuses on the important issues and avoids those that are considered not significant.
scoping opinion	opinion provided by a competent authority that indicates the issues an environmental impact assessment of a proposed development should consider
screening	formal process undertaken to determine whether it is necessary to carry out a statutory environmental impact assessment and publish an Environmental Impact Assessment Report in accordance with the EIA Regulations
sediment	organic and inorganic material that has precipitated from water to accumulate on the floor of a water body, watercourse or trap
semi-natural	habitat, ecosystem, community, vegetation type or landscape that has been modified by human activity but consists largely of native species and appears to have similar structure and functioning to a natural type
significance	see 'significance of effect'
significance of effect	measure of the importance or gravity of the environmental effect, defined by either generic significance criteria or criteria specific to the environmental topic
significant environmental effect	environmental effect considered material to the decision-making process
sites of special scientific interest	main national conservation site protection measure in Britain designated under the Wildlife and Countryside Act 1981
special area of conservation	international designation implemented under the Habitats Regulations for the protection of habitats and (non bird) species
special protection area	sites designated under EU Directive (79/409/EEC) for the conservation of wild birds
spring tide	spring tides happen just after every full and new moon, when the sun, moon and earth are in line
stakeholder	organisation or individual with a particular interest in the project

study area	spatial area within which environmental effects are assessed (i.e. extending a distance from the project footprint in which significant environmental effects are anticipated to occur). This may vary between the topic areas.
threshold	specified level in grading effects (e.g. the order of significance)
visual amenity	value of a particular view or area in terms of what is seen
wildlife corridor	linear habitats/landscape features such as hedgerows that may increase connectivity by acting as routes between habitat patches
worst case	principle applied where environmental effects may vary (e.g. owing to seasonal variations) to ensure the most severe effect is assessed

ABBREVIATIONS

AA	appropriate assessment
ALARP	as low as reasonably practicable
AOD	above Ordnance Datum
BAP	biodiversity action plan
BAT	best available techniques
bgl	below ground level
BGS	British Geological Survey
BS	British Standard
CA	competent authority
CAR	Controlled Activities Regulations
CCoP	construction code of practice
CD	chart datum
CEA	cumulative effects assessment
CEMP	construction (or contract) environmental management plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CIfA	Chartered Institute for Archaeologists
CIRIA	Construction Industry Research and Information Centre
CLVIA	cumulative landscape and visual impact assessment
COSHH	control of substances hazardous to health
CRTN	calculation of road traffic noise
dB(A)	decibel (A-weighted), a unit of noise measurement
DBA	desk-based assessment
DMRB	Design Manual for Roads and Bridges
EC	European Commission
ECU	Energy Consents Unit
EcIA	ecological impact assessment
EHO	environmental health officer
EIA	environmental impact assessment
EIAR	Environmental impact assessment report or EIA report
EPR	Environmental Permit Regulations
EPS	European protected species

EQS	Environmental Quality Standards
EU	European Union
EUETS	European Union Emissions Trading Scheme
FBA	Freshwater Biological Association
FRA	flood risk assessment
GDL	garden and designed landscapes
GIS	geographic information system
GPS	global positioning system
HAP	habitat action plan
HAZID	hazard identification
HDV	heavy duty vehicle
HER	Historic Environment Record
HBRG	Highland Biological Recording Group
HGV	heavy goods vehicle
HIA	health impact assessment
HRA	Habitats Regulations assessment
HES	Historic Environment Scotland
HIAL	Highlands and Islands Airports Limited
HSE	Health and Safety Executive
IEMA	Institute of Environmental Management and Assessment
ILP	Institute of Lighting Professionals
ISO	International Organization for Standardization
JNCC	Joint Nature Conservation Committee
km	kilometre
LCA	landscape character area
LCT	landscape character types
LAQM	local air quality management
LBAP	local biodiversity action plan
LDP	local development plan
LGV	light goods vehicle
LI	Landscape Institute
LNR	local nature reserve
LTP	local transport plan
LUP	land use planning
LVIA	landscape and visual impact assessment

MAGIC	Multi-Agency Geographic Information for the Countryside
NBN	National Biodiversity Network Database
NID	National Infrastructure Directorate
NNR	national nature reserve
NO_x	oxides of nitrogen
NTS	non-technical summary
NVC	National Vegetation Classification
OS	Ordnance Survey
OWSG	The Highland Council's Onshore Wind Supplementary Guidance
PA	Planning authority
PAC	pre-application consultation
PAN	proposal of application notice
PM_{10}	particulates
PPV	peak particle velocity
PWS	private water supplies
RCS	river corridor survey
RHS	river habitat survey
RIGS	regionally important geological and geomorphological site
RSPB	Royal Society for the Protection of Birds
SAC	special area of conservation
SEPA	Scottish Environment Protection Agency
SINC	site of importance for nature conservation
SLA	sensitive landscape area
SM	scheduled monument
SNH	Scottish Natural Heritage
SoCC	statement of community consultation
SPA	special protection area
SPD	supplementary planning documents
SPG	Supplementary planning guidance
SPP	Scottish Planning Policy
SSSI	site of special scientific interest
SuDS	sustainable drainage system
SWT	Scottish Wildlife Trust
TA	transport assessment
THC	The Highland Council

TIA	traffic impact assessment
TMP	traffic management plan
TPO	tree preservation order
TRICS	Trip Rate Information Computer System
UK	United Kingdom
VEC	valued ecological component
VER	valued ecological receptor
WEBS	Wetland Bird Survey
WFD	Water Framework Directive
ZTV	zone of theoretical visibility

1 INTRODUCTION

1.1 Background to proposed development

1.1.1 Kirkan Wind Farm Limited (hereafter 'the applicant') is submitting an application for consent of the Kirkan Wind Farm (hereafter 'the proposed development'), located approximately 5.8 km northwest of Garve, Highlands, on the southern side of the A835 trunk road southeast of Loch Glascarnoch dam.

1.1.2 The applicant is seeking to secure approval for the proposed development by way of a consent application under Section 36 of the Electricity Act 1989 and the *Electricity Works (Environmental Impact Assessment) (Scotland) (EIA) Regulations 2017* to Scottish Ministers.

1.1.3 The project area is located in Strathvaich Estate, which sits within the Garve District of the Ross and Cromarty region of the Highlands. The project area lies to the south of the A835 trunk road from Garve to Ullapool, to the east of the operational Corriemoillie and Lochluichart wind farms. Kirkan Wind Farm development will be comprised of 17 turbines, with a maximum height to blade tip of 175 m, and associated infrastructure. Infrastructure will include the 17 turbines, 10,835 m of access track, two meteorological masts, two borrow pits, transformers and underground cables, onsite sub-station/control building, and four temporary construction compounds, one of which potentially to be retained permanently to host an energy storage facility. It is assumed that the individual turbine generating capacity will up to 4.8 MW, and therefore the total generating capacity for the development will be in excess of 50 MW.

1.2 Environmental impact assessment (EIA)

1.2.1 EIA is a process for identifying the likely consequences on the existing biological, physical and human environment arising from development progression.

1.2.2 The process is undertaken to ensure that the environmental effects of certain types of development proposal are fully investigated, understood and taken account of in the consenting and authorisation process.

Statutory context

1.2.3 In June 1985 the Council of the European Economic Community determined that an EIA should be prepared by the promoters of certain types of development prior to consent being granted. The requirements for inclusion within EIA, and the process by which an EIA should be undertaken, were detailed accordingly within Council Directive 85/337/EEC (termed the 'EIA Directive').

1.2.4 Several subsequent EIA directives have been published, the latest of which is Directive 2014/52/EU, which was transposed into UK law in May 2017.

1.2.5 *The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations* 2017 (hereafter 'the EIA regulations') transpose the requirements of the EIA Directive into law, and apply where consent is being sought for developments under the Section 36 of the Electricity Act 1989.

1.2.6 Screening procedures exist within the EIA Regulations to assist determination of whether a development proposal qualifies for EIA. However, in this case, in recognition of the proposed development's potential effects, Kirkan Wind Farm Ltd has decided to volunteer to undertake an EIA in support of the application.

Environmental Impact Assessment Report

1.2.7 It is a requirement of the EIA regulations that an EIA report be prepared to describe the likely significant effects of a proposed development on the environment.

1.2.8 This EIA report accompanies the application for consent and reports the formal process and outcomes of the EIA undertaken for the proposed development. Its purpose is to present the proposed development and its predicted environmental effects in a concise, objective and non-promotional manner in order to provide the Scottish Ministers, Local Authority, consultation bodies, interested bodies and the general public with sufficient information to assess its likely environmental effects.

1.2.9 This EIA report has been prepared under the supervision of, and reviewed by, persons having suitable competency in environmental impact assessment, which is also a requirement of RSK's continued registration on IEMA's 'EIA Quality Mark' scheme. Amongst other things, we define 'suitable competency' as sufficient relevant qualifications and experience (e.g. a minimum of 5 years) in working on EIA projects and suitable professional standing.

1.3 Structure of Environmental Impact Assessment Report

1.3.1 The Environmental Impact Assessment Report is presented in three volumes:

- Volume 1: Environmental Impact Assessment Report
- Volume 2: Appendices
- Volume 3: Graphics, as follows:
  - Volume 3a) Graphics
  - Volume 3b) SNH visualisations
  - Volume 3c) THC visualisations

1.3.2 A non-technical summary of the Environmental Impact Assessment Report has been prepared as a separate document, in accordance with the requirements of the EIA Regulations.

Volume 1

1.3.3 Volume 1 comprises 14 sections, which are structured in the following manner.

- **Section 1 Introduction** introduces the proposed development and explains the underlying objectives of the proposals, describes the statutory basis for the EIA, outlines the structure adopted in this Environmental Impact Assessment Report and identifies the team of competent experts responsible for undertaking and reporting the EIA.
- **Section 2 Proposed Development** establishes the need for the proposed development; summarises the reasonable alternatives that have been considered in the development of a preferred design solution; provides a detailed description of the key design components and characteristics of the proposed

development and associated land take; and outlines the planned timescales for construction and implementation.

- **Section 3 Consultation and Environmental Impact Assessment Process** summarises stakeholder consultation undertaken during the EIA and the development of the proposed development. It also summarises the scoping process undertaken to establish the scope of the EIA, the adopted approach to the EIA and format of the individual technical assessments, and modifications made to the EIA scope that have arisen during the development and assessment of the proposed development.
- **Sections 4 to 13 Technical Assessments** report the findings of the detailed environmental assessments and the residual effects on the environment predicted to occur as a result of implementation of the proposed development.
- **Section 14 Summary of Environmental Commitments** provides a schedule of the environmental commitments (i.e. design and mitigation measures that are agreed and deliverable) identified in each technical assessment.
- **References** of documents used or considered during the EIA are provided at the end of each section, where relevant.

Volume 2

1.3.4 Volume 2 comprises technical appendices (referred to in Volume 1) containing detailed reports of the individual environmental assessments and other relevant supporting documentation.

Volume 3

1.3.5 Volume 3 comprises a series of plans, figures and photographs (referenced in Volume 1) that illustrate the relationship between the existing environment and the proposed development. It includes (in Volumes 3b) and 3c) visualisations representing the anticipated appearance of the proposed development, in line with accepted standards

1.4 EIA team

1.4.1 RSK Environment Ltd (RSK) has undertaken the EIA and preparation of this EIA report on behalf of the applicant.

1.4.2 The relevant expertise and qualifications of the experts involved in the preparation of this EIA report are detailed in Table 1.1 below.

Table 1.1 Proposed EIA team

Name	Qualifications	Company	Role and expertise
EIA project management team			
Joe Somerville	MA (Hons), MSc	RSK	EIA Project Manager Member of the Chartered Institute for Archaeologists (MCIfA) Practitioner of the Institute of Environmental Management and Assessment (PIEMA)

Name	Qualifications	Company	Role and expertise
Mike Kelly	BSc (Hons)	RSK	EIA Project Director 22 years of experience of EIA project management
Robert Beck	BA (Hons), MEnvS, PGDip	RSK	EIA Project Support Practitioner of the Institute of Environmental Management and Assessment
Jess McQueen	BSc (Hons), MSc	RSK	EIA Project Support, Carbon Balance/ Climate Change Graduate member of the Institute of Environmental Management and Assessment
EIA technical specialists			
Faye Curtis	BSc (Hons)	RSK	GIS, Graphics Chartered Geographer (CGeog), Member of the Association for Geographic Information, Fellow of the Royal Geographical Society
Andrew Gunning	BSc (Hons), MSc	RSK	Technical Reviewer – Hydrology, Geology and Peat Chartered Geologist, Fellow of the Geological Society of London, Chartered Engineer, Member of the Chartered Institute of Water and Environmental Management, Chartered Director, Member of the Institute of Directors
Catherine Isherwood	MA, MSci, MSc, PhD	RSK	Technical lead – Hydrology, Geology and Peat Chartered Geologist, Fellow of the Geological Society of London, Professional Graduate of the Institute of Materials, Minerals and Mining
Ian Wickett	HNC	RSK	Traffic and Transport Member of the Chartered Institution of Highways and Transportation, Member of the Transport Planning Society
Andy Towle	BA (Hons), MA, PhD	RSK	Technical reviewer – Archaeology Member of the Institute for Archaeologists
Matthew Cand	Dipl Eng, PhD	Hoare Lea	Technical Lead – Noise Member of the Institute of Acoustics

Name	Qualifications	Company	Role and expertise
Bob Bainsfair	BLA, BA (Hons) CMLI	Ramboll Environ	Technical Lead - Landscape
Nicole Robinson	BSc (Hons), MSc ACIEEM	Avian Ecology	Technical Lead - Ornithology and Ecology ACIEEM
Howard Fearn	MSc MCIEEM	Avian Ecology	Project Support - Ornithology and Ecology
Trevor Hunter		Coriolis Energy	Telecoms and EMI Aviation
Roy Dyer	Diploma in Forestry	Adas	Technical lead - Forestry NDF DMS MICFor Chartered Forester

2 PROPOSED DEVELOPMENT

2.1 Need for the scheme

2.1.1 Although significant progress has been made towards achieving the Scottish Government’s 2020 interim target for 100% of national electricity demand to come from renewable energy, alongside the longer-term, legally binding targets set by the UK’s Climate Change Act and the Paris Climate Treaty, substantial efforts are still required to decarbonise the Scottish economy in line with the goal of keeping the global average temperature increase to well below 2°C, with target 1.5 °C.

2.1.2 Looking beyond to 2030, Scottish Energy Strategy target for 50% of total energy demand (including from heat and transport) from renewable sources implies a further substantial increase in delivery required. As such, the Scottish Government looks to encourage all renewable and low carbon solutions for meeting the energy target. With some of the most ambitious targets in Europe, Scotland does however currently risk falling short.

2.1.3 The Scottish Government’s Onshore Wind Policy Statement recognises both the continuing important role of onshore wind and the challenges it now faces in a subsidy-free environment. Further detail relating to the Energy Strategy, Policy Statement and ongoing demand for renewable energy generation is provided in the separate Planning Statement accompanying the application.

2.2 The developer

2.2.1 Kirkan Wind Farm Limited (‘the applicant’) is applying for consent for the Kirkan Wind Farm. Kirkan Wind Farm Limited is a project company owned by Coriolis Energy Limited (‘Coriolis Energy’) and ESB Asset Development Limited (‘ESB’).

2.2.2 ESB is Ireland’s premier energy company and is a leading independent power generator in the UK market. ESB has a track record of over 20 years as a successful investor in the UK since commissioning one of the first independent power generating plants at Corby in Northamptonshire in 1994.

2.2.3 ESB owns and operates wind farms across the UK and Ireland with a total installed capacity of 450 MW.

2.2.4 ESB works in partnership with Coriolis Energy. Coriolis Energy identifies and works on the development of wind farm proposals, and ESB constructs and operates those wind farms.

2.2.5 Coriolis Energy is a specialist independent wind farm development company operating throughout the UK. Its principals have been responsible for successfully developing some 15 onshore wind farms in the UK with a capacity of over 500 MW over a period of 18 years.

2.3 Scheme description and surrounding land use

2.3.1 The area between the A832 and A835 trunk-road north of Garve is proven to have the capacity for delivering a variety of infrastructure including renewable energy generation.

In addition to elements of the Conon hydroelectric power scheme, the area currently hosts the Corriemoillie and Lochluichart wind farms, as well as a range of telecommunication masts, electricity distribution and transmission overhead lines and commercial forestry. The applicant considers the area to have further capacity for wind energy, concentrating and consolidating with existing development.

2.3.2 The Kirkan project area has not formed a part of any previous proposed onshore wind development and has the capacity to make a valuable contribution to national policy aims. In addition, experience in the local community now indicates that the shared benefits of wind energy development can make a valuable contribution towards local community needs through community benefit funds as well as investment and employment during construction.

2.3.3 The proposed development will be made up of 17 wind turbines. It is proposed that each turbine will be able to generate approximately up to 4.8 MW of electricity, meaning that the total installed capacity of the proposed development is predicted to be up to 81.6 MW.

2.3.4 The proposed development will be accessible via the A835, with a total of 10,835 m of access track connecting the proposed development. 9,975 m of this track will be new, with 860 m of existing track being upgraded.

2.3.5 In addition, the proposed development will also include a range of other ancillary infrastructure.

2.3.6 The wider landscape is characterised by rolling moorland, with numerous blocks of forestry plantations also present. The Corriemoillie and Lochluichart wind farms characterise the local landscape to the south of the A835. The Glascarnoch Loch, associated dam and river are located to the north of the A835.

2.3.7 Surrounding land use consists of open moorland deer stalking and rough grazing. There is also an area of mixed plantation within the eastern side of the proposed development area.

2.3.8 There are no in-use built structures within the proposed development area. Desk based assessments and site visits confirm that there are remains of several sheepfolds, enclosures and stells, as well as the small former settlement of Kirkan within the wider Strathvaich estate landholding.

2.3.9 The current settlement pattern around this area is typically characterised by dispersed isolated dwellings and farmsteads. The nearest village of Garve is located a little further away from the proposed development area, 5.8 km to the south east.

2.3.10 Ben Wyvis, a National Nature Reserve, Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC) and Special Protection Area (SPA), is located 5.6 km at closest to the east of the proposed development area. Furthermore, there are 4 other SSSIs, 2 SACs, and 3 other SPAs within 15 km of the proposed development area.

2.3.11 There are no Scheduled Monuments within 1 km of the proposed development area, but 12 within 15km, the closest being 4.6km from the Kirkan site. The project area is not within a conservation area, and the nearest conservation area is Strathpeffer, located 13.9 km to the southeast of the project area. There are 9 listed buildings within 15 km of the proposed development area – the nearest being Loch Glascarnoch Dam, a Category B listed building located 1.1 km north west of the project area. There are three Historic

Garden and Designed Landscapes (HGDLs) located within 15 km of the proposed development area.

2.3.12 The project area located in a largely unsettled and remote location and set within a landscape comprising a number of distinct Landscape character types (LCTs). The proposed development site is not subject to landscape designations. There are a number of landscape designations within the wider study area that would be subject to visibility of the proposed development, as depicted in Figure 4.3. These include:

- Wester Ross National Scenic Area (NSA), which is situated around 25.7 km to the west of the proposed development;
- Ben Wyvis Special Landscape Area (SLA), which, at its closest, is around 5 km to the east of the proposed development;
- Fannichs, Beinn Dearg and Glencalvie SLA, which, at its closest, is around 6 km to the north of the proposed development; and
- Strathconon, Monar and Mullardoch SLA, which is located around is around 13 km to the south west of the proposed development.

2.3.13 There are three Wild Land Areas (WLAs) near the project area, comprising:

- Rhiddorochs, Beinn Dearg and Ben Wyvis WLA, which, at its closest, is around 3.9 km to the north east of the proposed development;
- Central Highlands WLA which is around 11.3 km to the south of the proposed development; and
- Fisherfield, Letterewe, Fannichs WLA, approximately 3.6 km to the west of the proposed development.

2.3.14 Operational wind farms within 15 km of the proposed development are summarised in Table 2.1 below.

Table 2.1 Operational wind farms within 15 km of the proposed development

Wind Farm Name	Location	Number of Turbines	Turbine Height (meters to tip)
Corriemoillie	Near Garve, Highlands	19 consented (of which 17 so far built)	125 m
Lochluichart	Near Garve, Highlands	17	125 m
Lochluichart Extension	Near Garve, Highlands	6	125 m
Fairburn	Near Contin, Highlands	20	100 m

2.4 Site Selection Rationale

2.4.1 Coriolis Energy and ESB, owners of Kirkan Wind Farm Limited, identify potential sites throughout Scotland through a constraints-based approach, with sites being evaluated against the following criteria:

- Avoiding ‘Group 1’ areas from SPP;
- Avoiding ‘Group 2’ national and international designations;
- Local Plan and Structure Plan policy;
- Landscape character;
- Distance from dwellings;
- Cumulative impact with other wind farm developments;
- Exposed sites with good wind speed;
- Feasibility of grid connection;
- Area topography, including gradients, exposure, watercourses and land use;
- Access feasibility; and
- Compatibility with aviation interests.

2.4.2 An essential element of the search for potential sites is the identification of landowners interested in development. In that regard, and taking the criteria above into account, the site at Kirkan initially became a viable proposition for Coriolis Energy following discussions with the landowner, who was interested in exploring the possibility of harnessing wind energy on their estate.

2.4.3 The proposed development area was confirmed as a good site for development following further feasibility assessments.

2.5 Consideration of alternatives

2.5.1 According to the EIA regulations, the EIAR should include: “a description of the reasonable alternatives studied by the developer, which are relevant to the development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment.”

2.5.2 With respect to the proposed development the alternatives considered were as follows:

- different turbine and infrastructure layouts/locations within the Kirkan site,
- different turbine heights/dimensions,
- different access routes to and from the Kirkan site in terms of delivery of abnormal loads, and
- different access routes from the site boundary to and between the development infrastructure within the Kirkan site.

2.5.3 The wind farm design and layout was adapted and altered in response to environmental constraints and consultation feedback. The proposed development went through a series of five broad design iterations. Changes to the layout included decreasing the number of turbines, changing turbine positions, siting of ancillary infrastructure, and routing of access tracks.

2.5.4 A summary of the layout iterations is included within Section 2.6.

2.5.5 In considering turbine heights and dimensions, a maximum turbine tip height and rotor diameter has been selected for the purposes of design and assessment of impacts. However, it should be noted that a single candidate model of the turbine has not been specified. For the purposes of assessment therefore, where relevant for each technical assessment turbine models that adhere to the limits of stated dimensions, and provide the realistic relevant worst-case impact, have been assumed.

2.6 Proposed development

Development of preferred option

2.6.1 The proposed development has gone through five principal iterations of the layout, which have been developed at different stages in the project design process (see Figure 2.2):

- Design 1 – A 24-turbine pre-Scoping layout, representing a view of maximum physical capacity prior to the establishment of detailed constraints.
- Design 2 – A 19-turbine Scoping and public consultation layout, informed by early results of on-site surveys, consultant and consultee inputs.
- Design 3 – A 17-turbine layout responding to Scoping and public consultation responses, alongside further advanced onsite environmental surveys.
- Design 4 - A 17-turbine layout further refining in relation to consultant and consultee comments, with the addition of a first design for access track
- Design 5 – Final layout: a 17-turbine layout informed by detailed multidisciplinary assessment, and including locations of ancillary infrastructure. It is shown in full detail in Figure 2.1.

Design 1 – Pre-EIA

2.6.2 The first design, seen as 'Design Iteration 1' in Figure 2.2, was developed prior to any detailed site-specific surveys being completed and proposed 24 turbines of up to 175 m tip height. The layout was designed taking into account turbine interspacing, approximately 1.5 km separation from nearby properties (with exception of the Estate property at Lubfearn), as well as a minimum 1.0 km setback distance from the A835.

Design 2 – EIA Scoping and Consultation

2.6.3 The second design, seen as 'Design Iteration 2' in Figure 2.2, comprised 19 turbines of up to 175m tip height and was based upon initial feasibility studies. It was prepared for and included in the Scoping Report dated 16th May 2018, as well as for public consultation purposes. The design iteration ensured a 1.5 km buffer to all nearby properties, and included an increased setback distance from the A835 of 1.2 km in response to comments received from SNH at a Pre-Scoping Meeting held 13th April 2017. SEPA comments from the same meeting were also taken on board, with areas of then suspected deepest peat avoided. Watercourses were also buffered in line with SEPA comments.

Design 3 – Post-Consultation Responses

2.6.4 Following the EIA Scoping and public consultations, a number of constructive comments on design had been submitted which were considered. Design 3, comprising 17 turbines of up to 175m tip height, was the result of processing these comments and comments from other stakeholders alongside the findings of by now further advanced environmental surveys. This design is seen as 'Design Iteration 3' in Figure 2.2.

2.6.5 This iteration now achieved a 2.0 km buffer from nearby properties, and further increased the minimum setback distance from the A835 to 1.4 km.

2.6.6 Responding to comments raised by Highland Council in Pre-Application Advice (1st May 2018) in regards containment of wind development within the landscape (a "subtle bowl" in the case of neighbouring Corriemoillie), landscape consultants for the project identified that use of the landform on and around Kirkan can, in effect, provide similar design mitigation, particularly as regards visual effects from the valley of the A835 and from many other key viewpoints, resulting in the definition of the ridgeline of Meallan na Cloiche to Sidhean nan Cearc as a natural 'containment' barrier to the north-west, with the hills of Carn Bad Leabhraidh, Carn na Dubh Choille and Carn Gaineamhach to the south and south-east of the site providing 'containment' from these directions. These features can be seen to provide mitigation of views from locations surrounding the Kirkan site.

2.6.7 Adopting the above "landscape containment" approach in turn acted to largely address the main design issue raised by local communities in consultation, namely views from the A835 at Loch Glascarnoch travelling east (as represented by a photo-visualisation of Design 2 presented in a newsletter and at public exhibitions), with containment here effectively reducing the previous impact of turbines approaching the road with full visibility down to base level at closer range backdropped by and competing with the whole of Little Wvyis (although not Ben Wyvis) .

2.6.8 Potential cumulative effects upon the landscape and visual receptors had been considered when reviewing this layout, ensuring that the design (including turbine dimensions) took account of the surrounding wind farms (Corriemoillie and Lochluichart) and the zone of theoretical visibility. Visual impacts on key receptors such as the Aultguish Inn, properties at Black Bridge, Ben Wyvis, and sequential effects on motorists travelling the A835 were considered. This resulted in a more condensed turbine arrangement, with two fewer turbines than the initial scoping layout. In reducing the number of turbines, the potential impacts of noise on nearby receptors was further reduced.

2.6.9 Correspondence received by the industry body RenewableUK from the Health & Safety Executive's (HSE's) Principal Inspector's (May 2018) stated that the HSE considered positioning transformers in external locations, rather than within wind turbines themselves, to be their strong preference from the perspective of their remit. The applicant acknowledges that internal transformers have the potential to reduce visual "clutter" and impacts (as expressed by Highland Council in pre-application discussions). However, following the advice of the CDM Principal Designer for the project, for the purposes of this project it has assumed that transformers will be external to the turbines.

Design 4 – Refinement and Draft Access Tracks

2.6.10 The fourth design layout, seen as 'Design Iteration 4' in Figure 2.2, represents the final stage of turbine location iteration, whereupon draft internal access tracks could be considered.

2.6.11 By now completed detailed site surveys informed this iteration of the turbine layout, with further information on hydrology, peat, transport, archaeology, ecology and ornithology becoming available. Here the layout was optimised and the position of each turbine was considered based on the environmental and ground conditions at each turbine location.

2.6.12 At this stage the turbine layout was subjected to rigorous testing in photo-visualisations and wirelines from numerous representative viewpoints, routes and other receptors around the area at a range of turbine dimensions up to 175 m to tip height, in reference to the Criteria in Section 4 of Highland Council's Onshore Wind Supplementary Guidance ('OWSG').

2.6.13 It was now considered beneficial to treat the crest of Druim Donn (within the woodland plantation) as a 'containment' limit to the east of the site, affectively represented by the route of the drovers road pathway. In addition, turbines were pulled further back still from the north-west containment barrier (Sidhean nan Cearc to Meallan na Cloiche).

2.6.14 Furthermore, considering key views from Ben Wyvis, it was determined that landscape fit and containment were best achieved by treating the horizontal span of the already operational schemes from the summit as limits. In addition to which, minor changes in the layout of the turbines sought to reduce effects of overlapping/ stacking, and to ensure visual contiguity with the neighbouring schemes, in particular with regards to variation in turbine dimensions.

2.6.15 As a result, the minimum buffer from nearby properties increased to over 2250 m, and setback from the A835 increased to over 1750 m.

2.6.16 At this stage, and in response to SEPA comments, an informal site access options appraisal was undertaken. Further details are given below.

2.6.17 Owing to the dropping of turbines to the east of the drovers road pathway, when it came to drafting access track layouts it was determined, with archaeologists' advice, unnecessary to utilise the whole of the existing route into the woodlands, and instead to make a crossing of the Allt Glac an t-Sìthein a distance further west.

2.6.18 Otherwise, access tracks were initially optimised for construction efficiency and economy, subject to buffering of watercourses and avoidance of deepest areas of peat. This initial layout entailed 10 watercourse crossings in total.

Design 5 - Finalised

2.6.19 Design 5 is the final layout, seen on Figure 2.1.

2.6.20 The final layout incorporated changes to the access track layout, as well as the number and positioning of borrow pits, construction compounds, and substation, following further design workshopping with environmental topic specialists. Construction compounds are located at the site entrance and on the main access road to the project area. Borrow pits were carefully positioned in areas where rock naturally protrudes, limiting the need to remove soil and peat from these areas.

2.6.21 The final turbine and ancillary infrastructure layout had been informed by detailed multidisciplinary assessments and site visits. The location and sensitivity of all identified environmental receptors were mapped, and appropriate buffers around them were agreed between the technical specialists and project engineers. The precise location of infrastructure was then finalised through a joint site visit to all locations by a project engineer and principal hydrogeologist to take account of local ground conditions, peat depth, topography and the presence of bedrock at or near the surface. Turbines locations have been refined with suitable buffers maintained from streams, whilst also ensuring that the visual impact of turbines on key viewpoints in the area is limited.

2.6.22 The access track layout was redesigned to minimise the number of watercourse crossings required, resulting in only five crossings in the final layout. Watercourses in the area are potential habitats for water voles, and therefore the design has been optimised in ecological terms to avoid as many water crossings as possible. Areas of deep peat have also been avoided where possible to preserve the carbon store and ensure stability.

Individual assessment chapters will report their design input in further detail and respond to specific matters, in particular pertaining to the scale of the proposed turbines, the landscape fit of the scheme and Criterion 4 of Highland Council's OWSG.

Site access options

2.6.23 As referred to above, a site access route assessment was undertaken. This used a qualitative multidisciplinary approach to review three potential access routes in terms of the associated environmental constraints, as follows:

- (1) Access direct the A835 via the existing car parking / former borrow pit / telecommunications infrastructure junction approximately 600m east of Aultguish Inn;
- (2) Access through the neighbouring Lochluichart and Corriemoillie wind farms, taking final access between closest connectable turbines; and
- (3) Access via Forestry Commission roads from the south, leading from the A832 north of Garve.

2.6.24 The options were appraised in terms of their technical, ecological and economic feasibility, with the results concluding that option (1) would not lead to significant environmental effects as well as representing the best of the considered options from combined technical, environmental and economic perspectives.

2.6.25 In particular, the minimum distance from the nearest Corriemoillie turbine has increased significantly from around 300 m (per SEPA's letter reference PCS/160110: see the consultation matrix in Appendix 3.3) at the time of the EIA Scoping exercise to being now approximately 950 m, with the shortest technically feasible route to turbine 2 bisecting through a long section of the deepest peat and most sensitive blanket bog habitat on the Kirkan site. By comparison, the final proposed route from the A835 to turbine 3 passes near entirely through peat with depths of less than 50 cm.

Scheme elements

2.6.26 The proposed development will consist of the following elements:

- 17 turbines, of approximately up to 4.8MW each and a maximum tip height of 175 m;
- Hardstanding areas at the base of each turbine, with a maximum total area of 1850 m^2;
- Up to 2 permanent meteorological masts and associated hardstanding areas;
- 10,835 m of access track with associated watercourse crossings – of which 9,975 m are new access tracks, and 860 m are upgrades to existing tracks;
- An operations control building with parking and welfare facilities;
- A substation compound;
- A prospective modular energy storage facility;
- Telecommunications equipment, including masts;
- Up to 3 temporary construction compounds;
- 2 borrow pits, to provide suitable rock for access tracks, turbine bases and hard standings; and
- Underground cabling linking the turbines with the substation;

Wind Turbines

2.6.27 Grid references for the proposed turbine locations are identified in Table 2.2 below, and shown on Figure 2.1.

Table 2.2 Proposed turbine locations

Turbine	Easting	Northing
1	235462	867812
2	235872	868005
3	236288	868428
4	235808	867559
5	236279	867953
6	236776	868364
7	235908	867197
8	236272	867532
9	236692	867870
10	237095	868304
11	236197	867046
12	236642	867329
13	237156	867947
14	236477	866794
15	236864	867151
16	237068	867559
17	236738	866676

2.6.28 The proposed turbine locations and ancillary infrastructure would be subject to a maximum micrositing tolerance of 50 m in any direction. In those places where environmental features may be potentially affected by the micrositing, tolerance would be constrained to less than 50 m, and such changes would be managed in consultation with an Ecological Clerk of Works for the proposed development during its construction phase. The micrositing constraints relevant to the proposed development are set out within each of the technical sections of this EIAR. Any movement of the turbines from the proposed development layout outwith the micrositing tolerance would be agreed with the Highland Council, and would be in accordance with the mitigation set out in this EIAR.

Wind Turbine Structure

2.6.29 It is proposed that there will be 17 turbines within the project area, with a combined capacity of approximately up to 81.6 MW.

2.6.30 The height of the proposed turbines from the ground to the blade tip would measure up to 175 m.

2.6.31 The turbines would have a maximum rotor diameter of 142 m. The model and actual dimensions of the wind turbines ultimately selected would be influenced by the economic market and technological advances at the time of procurement. However, blade tip height would not exceed 175 m. Indicative elevations are shown at Figure 2.3.

2.6.32 The wind turbines would be three bladed, horizontal axis turbines with solid tubular towers. The blades would be made from reinforced composite materials such as fibreglass. The turbine towers would be made of steel.

Colour and Finish

2.6.33 The wind turbines would all be the same basic appearance and colour. It is proposed that the turbines are to be of a matt grey colour finish. Although off-white has been an accepted colour for turbines, more recently constructed wind turbines have been a mid-grey tone, which reduces the distance over which turbines are visible, especially in dull weather or low light conditions. The choice of material and colour for the proposed turbines is important as this has an impact on the visual impact. Finishing would be expected to be agreed by a condition placed on the Section 36 consent.

Turbine foundations

2.6.34 Turbine foundations would be dependent upon site-specific ground conditions at the turbine locations and the type of turbine chosen. However, it is envisaged that installation of the turbines using a steel reinforced concrete base (gravity foundation) would be suitable.

2.6.35 The concrete gravity bases would be located underground. A quantity of earth would therefore need to be removed. The amount of earth to be removed would depend upon site-specific ground investigations at each turbine location. Topsoil, peat and other material would be removed from the foundation area and stored so that it may be used later for reinstatement,

2.6.36 Turbine foundations would be set down to the depth of suitable bearing strata with an approximate diameter of 25 m and octagonal shape (see Indicative Turbine Foundations at Figure 2.4). Should geotechnical investigations demonstrate that the required bearing capacities are not achievable; a piled foundation design would be adopted using the same overall design footprint.

2.6.37 An imbedded tower section would be cast into a central column onto which the turbine tower would be fixed. Concrete for the foundations would either be delivered to the proposed development in a “ready mix” form, or processed in a concrete batching plant located within a construction compound.

2.6.38 For the purposes of this EIAR, a maximum (worst case) scenario of a 2.5 m deep (with no slope from middle to outside edge), 25 m by 25 m octagonal footprint foundation has been assumed. This worse-case scenario would require approximately 650 m^3 of concrete per turbine (assuming a 50:50 ratio of concrete to steel). The concrete bases would be allowed to cure (reach its design strength) before turbines are fitted.

Turbine erection

2.6.39 The turbine components would be delivered to the proposed development area and stored in a temporary construction compound until weather conditions are appropriate for turbine erection. Typically, the bottom turbine tower section would firstly be imbedded into the central column of the foundations, followed by the upper turbine tower sections being crane lifted into place. The cranes would then lift the nacelle into place on the top section of the turbine tower. Blades would then be fitted to the rotor hub, either on the ground before lifting altogether onto the nacelle, or otherwise individually lifted for connection to the rotor hub in situ.

Turbine hard standings

2.6.40 An area of hard standing approximately 1850 m^2 in total would be constructed in the form of one or more separate bases to accommodate two cranes adjacent to each turbine along with blade laid-down areas. An indicative arrangement is shown at Figure 2.5. This is required to allow the safe operation of the cranes during turbine erection. The hard standings would be constructed using suitable surplus material generated from the excavation process elsewhere within the development area and from borrow pits where possible. Topsoil would be excavated and stone laid and compacted to the required depth. The depth of the hard standings would be dependent on the ground conditions at specific locations.

Transformer Houses

2.6.41 Each wind turbine would be expected to have an associated transformer. The electrical transformers would be expected to be located adjacent to the turbines, as illustrated on Figure 2.3. External transformers would be located within houses which would have indicative dimensions of 5.5 m by 3.0 m by 3.0 m. Transformer houses would be colour finished to blend in with the surrounding landscape.

Site Entrance and Access Tracks

2.6.42 The access route to turbines will be made up of approximately 10.8 km of new and upgraded track. Of this, 0.86 km is an existing disturbed pathway through the project area following the route of a former drovers' road. The final access route to and around the development can be seen in Figure 2.1.

2.6.43 The following principles have been applied in the design of the on-site access tracks;

- Tracks make use of existing infrastructure and track/disturbed ground where possible;
- Track length is kept to a minimum to reduce construction time, the requirement for stone, and land-take;
- Gradients are to be kept to acceptable levels to accommodate the requirements of delivery vehicles and also to allow construction plant to move safely around the proposed development area;
- Tracks are routed to avoid sensitive hydrological, ecological and archaeological features as far as practicable; and

- Tracks are routed to avoid areas of deepest peat.

2.6.44 The access track would generally be unpaved (stone surface) and of 5 m running width, with a 1 m shoulder verge to either side and 2:1 side slopes.

2.6.45 Approximately 9.97 km of new access track would require construction. Turning heads of sufficient size to accommodate articulated vehicles would also be provided at several locations. Some further widening would be necessary along the access track route to allow for passing places/temporary lay down areas, approximately every 500 m, with the locations subject to detailed design.

2.6.46 In general terms, the construction method would see topsoil/peat being removed and stored adjacent to the construction area until required for reinstatement. Excavations would continue to expose a suitable horizon or bedrock on which to construct the track.

2.6.47 The tracks would be constructed in layers, with a geo-textile membrane overlain by a base of coarse stone, and subsequent layers of higher graded stone. Each layer of stone would be compacted and shaped to provide a profile and surface finish of a quality suitable for the turbine construction vehicles. The estimated depth of stone would be 750 mm, though the final thickness used would be dependent on local ground conditions and load capacity.

2.6.48 The need for access track drainage would be established on-site during construction. The access tracks would have a suitable cross-fall to drain run-off and, where gradients are present, lateral drains would intercept any flow along the road. The dimensions of the lateral drains would be matched to the estimated water flow and outlets would be suitably located with erosion protection as required.

2.6.49 Where ground conditions are of a permeable nature, swales would be utilised alongside the access tracks to allow natural filtering of surface water into the ground. Where areas are less free draining, land drains or drainage ditches would be installed as topography and ground conditions dictate. Drainage filters would be installed at suitable locations to remove silts from the run-off.

2.6.50 Post construction, the vegetated turf layer will be used for reinstatement. This will allow re-establishment of natural vegetation to the area. Reuse of the turf layer is the preferred option over seeding the edges of the access track, as seeding rarely gives a representative cover and has been known to encourage deer grazing on verges.

Watercourse Crossings

2.6.51 As part of the access track construction and associated hard standing works, 5 new watercourse crossings will be required, locations identified on Figure 8.1.2 in Appendix 8.1. Bridges and bottomless culverts will be used for the main watercourse crossings. Closed culverts may be used for minor drainage channels.

Borrow Pits

2.6.52 The proposed development will require crushed stone to construct new tracks, create hardstanding areas for the cranes and lay the foundations.

2.6.53 The total estimated required quantity of stone is approximately 205,000 cubic metres. However, it is anticipated that approximately 19,500 cubic metres will need to be brought in from off-site sources to build the initial section of access road leading to the first on-site borrow pit. However, for purposes of assessing worst-case, the Traffic & Transport assessment will also consider the scenario where 100% of stone requirement would be brought in from off-site sources.

2.6.54 Location for up to two borrow pits have been carefully sited in areas with rock exposure. As a result, the volume of topsoil/peat that would need to be removed in order to access the stone from borrow pits is limited.

Substation Compound

2.6.55 Cables from the turbine transformers will converge at the substation building, which will be located as shown on Figure 2.1.

2.6.56 The indicative layout of the substation compound is shown in Figure 2.7. It is anticipated that there may be two buildings located within the compound, with one control building belonging to the Applicant and a separate substation building. The requirements by the Network Operator (SSE-N) in relation to the substation, if needed, will be the subject of a separate application.

2.6.57 The substation compound will measure approximately 100 m x 75 m and will contain car parking facilities and a storage yard/laydown area. The substation compound will be surrounded by stock proof fencing, typical of that used elsewhere in the area.

Substation Building

2.6.58 Within the compound, the substation building is likely to comprise a single storey unit measuring approximately 20 m x 10 m with a pitched roof as shown in Figure 2.8. The substation building will contain internal and external transformers and switch-gear, stores and welfare facilities.

2.6.59 The substation will be constructed in keeping with the local built environment. The final designs for the buildings and compound will incorporate sustainable design features and will be agreed with Highland Council.

2.6.60 Lighting will be kept to a minimum and will be limited to working areas only and will comply with health and safety requirements. Lighting will be down lit and linked to timers and movement sensors so that light pollution is kept to a minimum.

Control Building

2.6.61 It is anticipated that the control equipment will be contained within a separate building. This single storey control building will house welfare facilities (toilet, washing and basic food preparation area), site communications (i.e. SCADA), workshop and offices. The 25 m x 8 m building is shown in Figure 2.9. The control building welfare facilities will include a suitably sized holding tank, which would be emptied by tanker and removed from the project area on an appropriate timescale for disposal at a suitably licensed facility or a composting toilet and bottled water or a small water bowser. The details of the system to be put in place will be agreed with Highland Council.

2.6.62 As with the substation, the control building will be constructed in keeping with the local built environment. The final designs for the building and compound will incorporate sustainable design features and will be agreed with Highland Council.

Energy Storage

2.6.63 It is the applicant's intention to retain the construction compound located immediately adjacent to the substation for purpose of potentially hosting a permanent co-located energy storage facility. This is anticipated to comprise a lithium-ion battery technology solution, with modular elements comprising a number of battery housings (either standard ISO containers, electrical-houses ('eHouses') or otherwise) with associated 'heating, ventilation and air-condition' ('HVAC') systems, along with paired power conversion systems ('PCS') comprising bi-directional inverters and transformers, as well as central switchgear, metering and transformer, and space for access and operations.

2.6.64 This area of technology is currently fast-evolving in terms of:

- technological advances in battery energy density and performance,
- the design and existence of various potential service markets for providing revenues, and
- opportunities for time-shifting of wind farm generation.

2.6.65 For this reason indicative designs for the installation have been provided in Figures 2.10 and 2.11 based upon certain parameters, which form the basis of the impact assessment herein. These indicative parameters are considered to represent the realistic worst case scenario in impact assessment terms.

2.6.66 Within the space provided by the substation construction compound (75 m x 45 m), based on the assumed parameters (and as illustrated indicatively on Figures 2.10 and 2.11), it is considered possible to achieve an arrangement comprising 14 x 53-foot ISO containers with top-mounted HVACs, each with a single accompanying PCS, along with a single 40-foot switchgear container, assuming that other electrical elements (including metering and grid-connection transformer) could be either included within or shared with the wind farm substation compound. With reference to NEC's current Grid Battery Storage solution, where a 53-foot container can host between 1.2MW (power): 5.3MWh (energy) at configuration for "maximum energy" (roughly 4.1 hours duration), and 7.2MW:3.8MWh at "maximum power" (roughly 0.5 hours duration), this could relate to a indicative system of anywhere between 21.6 MW:95.4 MWh to 129.6 MW:68.4 MWh.

2.6.67 The number, dimensions, housing type, finish, arrangement, security fencing and landscaping of energy storage elements will be subject to Highland Council consultation and approval prior to construction.

Construction phase

Programme of works

2.6.68 Construction of the wind farm is anticipated to take approximately 18 months from mobilisation to completion.

2.6.69 An indicative construction programme is set out in Table 2.3 below. Many of these construction activities would be carried out concurrently, although predominantly in the order set out below. A more detailed construction plan will be prepared prior to construction.

Table 2.3 Indicative construction programme

Task	Month																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	■	■	■	■	■													
2			■	■	■	■	■	■	■									
3				■	■	■	■	■	■	■								
4				■	■	■	■	■										
5										■	■	■	■	■				
6											■	■	■	■	■	■		
7														■	■	■	■	■

Task:

1. Forestry removal, site establishment/ plant deliveries
2. Borrow pit working, access track construction and hardstanding areas
3. Foundations
4. Substation construction
5. Cabling
6. Erection of turbines
7. Site reinstatement & restoration

Construction Traffic

2.6.70 It is anticipated that the largest volume of traffic will be associated with the construction phase of the project, when vehicles are likely to be travelling from major centres and ports to deliver materials to the proposed project area. The origins of materials and goods are expected to be ports in Inverness and Invergordon, along with Dingwall and Alness.

2.6.71 The main construction traffic access routes will likely comprise the following:

- B817 (Invergordon), A9 (Alness), A835
- A862 (Dingwall), A862, A835
- A9 (Inverness), A835

2.6.72 The roads are predominantly A classified roads, with the A9 and A835 forming part of the primary road network. The main access track to and around the proposed wind farm will join the A835 near the Aultguish Inn.

2.6.73 Further detail is provided in Chapter 11: Traffic and Transport.

Construction Workforce

2.6.74 A detailed construction workforce schedule, i.e. employee numbers throughout the construction programme and likely shift patterns would not be known until the contract for building the wind farm has been granted, however the maximum number of staff likely to be on site at any one time would be 60.

Construction Compounds

2.6.75 During the construction period, a number of construction compounds will be required that will include a laydown area. The location of the construction compounds are shown on Figure 2.1.

2.6.76 The main construction site office and compound will comprise temporary cabins to be used for the site offices, the monitoring of incoming vehicles and welfare facilities for site staff including toilets; parking for construction staff visitors and construction vehicles; secure storage for tools and small parts; a receiving area for incoming vehicles; and security fencing around the compound.

2.6.77 The compounds will be used as storage areas for the various components, fuels and materials required for construction. The major structural components of the turbines would be delivered directly to Site. Temporary lay-down areas will be provided for parking and unloading vehicles and, in particular, abnormal loads.

2.6.78 A first site entrance compound, located roughly in the current (informal) car parking and former borrow pit area, would have dimensions of approximately 30 m by 30 m. A secondary site entrance compound, located within the fenced area hosting the two telecommunication masts, would have dimensions of approximately 100 m x 40 m. A main site compound, located on the approach to turbine 3, would have dimensions of approximately 100 m x 40 m. Finally, a substation construction compound, earmarked to be retained as permanent for a prospective battery energy storage facility, would have dimensions of 75 m x 45 m.

2.6.79 Any lighting would be directional in accordance with ILP guidance, and mounted on the individual portacabins.

2.6.80 The construction compounds and lay down areas would be constructed by first stripping the topsoil/peat, which would be stored in a mound for subsequent reinstatement at the end of the construction period. Care will be taken to maintain separate stockpiles for turf and the different soil/pear types to prevent mixing during storage. A geotextile would then be placed on the sub-stratum, which would be overlain by a working surface of stone to approximately 750 mm thickness.

2.6.81 Reinstatement would involve removing the stone and underlying geotextile before carefully ripping the exposed substrate and replacing the excavated soil/peat.

Construction Hours

2.6.82 It is anticipated that the main construction hours for the development will be between 07.00 and 19.00 from Monday to Friday, and 08.00 and 17.00 on Saturdays and Sundays, unless otherwise agreed with The Highland Council. Construction hours generally also apply to the delivery of materials to the proposed development; however abnormal loads may be delivered out of these hours when the road network is at its quietest to reduce traffic disturbance. Delivery of the nacelles, towers and blades to the proposed development area would require the use of abnormal sized and slow-moving trucks. These trucks would require a police escort and the timing of these deliveries may be dictated by the police.

Operational phase

Turbine Monitoring and Control

2.6.83 Wind turbines have a track record for safety. All turbines are controlled by a Supervisory Control and Data Acquisition (SCADA) system, which would gather data from all the turbines and provide the facility to control them from a remote location. The SCADA system would gather data from all the turbines via communications cables connecting to each turbine (the cables being buried in the electrical cable trenches).

2.6.84 In the case of any fault, including over-speed of the blades, overpower production, or loss of grid connection, the turbines shut down automatically through braking mechanisms. They are also fitted with vibration sensors so that, if, in the unlikely event a blade were damaged, the turbines would again automatically shut down.

Meteorological Effects

2.6.85 Turbines, as with any tall structure, can be susceptible to lightning strike and appropriate measures are included in the turbine design to conduct lightning strike down to earth and minimise the risk of damage to the structure. In the case of a lightning strike on a turbine or blade the turbine would automatically shut down.

2.6.86 In cold weather, ice can build up on blade surfaces when operating. The turbines can continue to operate with a thin accumulation of snow or ice but would shut down automatically when there is a sufficient build up to cause aerodynamic or physical imbalance of the rotor assembly. Many models now include de-icing technology.

2.6.87 Local meteorological conditions would be monitored by up to two anemometer masts, which would be located as shown on Figure 2.1.

Turbine Servicing and Repair

2.6.88 Each manufacturer has specific maintenance requirements; however it is anticipated that routine servicing of the turbines would typically be undertaken twice a year, with a full annual service and a minor service every six months. In the first year, there is also likely to be an initial three-month service post-commissioning. Individual turbines would be switched off as servicing was ongoing. Maintenance and servicing would include activities such as changing of gearbox oils and individual turbine components.

2.6.89 Blade inspections would be likely to be required between every two and five years. These would traditionally be undertaken using a cherry picker or similar, but may also be performed with a 50-tonne crane and a man-basket, or even nowadays using drones. Repairs to blades would use the same equipment. Light winds and warmer, dry conditions are required for any blade repairs hence summer (June, July and August) would be the most appropriate period for this work,

2.6.90 Operational waste would generally be restricted to small volumes of waste generated from machinery repair and maintenance. The maintenance contractors would dispose of any such waste off-site, in line with Scottish waste management regulations and duty of care.

Track Maintenance

2.6.91 Once the wind farm is operational, the volume of traffic using the access tracks would be low (although heavy plant lorries can be particularly wearing on the road). Correspondingly, the need for any track maintenance works is anticipated to be low and infrequent. Any such works required would generally be undertaken during the drier conditions in the summer months.

Operational Workforce

2.6.92 A team of several staff including engineer fitters would supervise the operation of the wind turbine installation, and would visit the proposed development to conduct routine maintenance. The frequency of these visits would depend on the turbine manufacturer,

Decommissioning phase

2.6.93 The proposed development is anticipated to have an operational life of 30 years, after which it would be decommissioned and the turbines dismantled and removed. This is the proposed course of operations which is being applied for and any alternative to this action would require separate consent from the Highland Council, and so is not considered within this EIAR.

2.6.94 During decommissioning the turbines would be dismantled and removed, along with any associated above ground electrical equipment. This decommissioning work would be the responsibility of Kirkan Wind Farm Limited, or any subsequent owners of the proposed development. Underground cables would be left in place and foundations would be removed to a depth of 0.5m below ground level to avoid environmental impacts from deeper removal. Prior to decommissioning of the site, a method statement would be prepared and agreed with the Highland Council.

3 CONSULTATION AND EIA PROCESS

3.1 Consultation

Overview

3.1.1 Consultation has been integral to the design and development of the proposed development, identification of existing environmental constraints and sensitivities, and identification and assessment of the likely environmental effects of the proposed development.

3.1.2 Consultation with consultation bodies commenced in 2017. Consultation with non-statutory bodies and the general public commenced from April 2018. Consultation has taken a number of forms, including

- stakeholder liaison
- public information events
- informal discussions.

Stakeholder liaison

3.1.3 Consultation with statutory consultees and other organisations has been undertaken throughout the EIA process to obtain environmental data, to discuss and agree the scope of individual environmental assessments and the adopted methods of assessment, and to develop appropriate environmental mitigation measures.

3.1.4 EIA topic-specific consultation is summarised in each chapter of this EIA report where relevant. The scoping process allowed the terms of reference of the EIA to be established, in consultation with stakeholders and the determining authority. After this process, discussions and contacts were maintained. Stakeholders associated with this phase were consulted and communicated through site visits and meetings, office-based meetings, and email and telephone contact for general correspondence and delivery of relevant information. The consultation bodies included:

- Energy Consents Unit
- The Highland Council Planning Department as the Planning Authority
    - Planning Department
    - Environmental Health Officer
    - Biodiversity
    - Roads and Transportation
    - Historic Environment Team
- Scottish Environment Protection Agency (SEPA)
- Scottish Natural Heritage (SNH)
- Historic Environment Scotland (HES).

3.1.5 Non-statutory consultees included the following:

- Garve and District Community Council
- Transport Scotland
- Sustrans Scotland

- Arqiva
- Neighbouring Community Councils
- Joint Radio Company (JRC)
- Spectrum Licensing (previously known as Ofcom)
- Ng Wireless
- Ofcom
- BBC
- BT
- Atkins Global
- Civil Aviation Authority
- Ministry of Defence
- Forestry Commission Scotland
- Defence Infrastructure Organisation
- National En-Route Traffic Ltd (NERL)
- Highlands and Islands Airport
- Health and Safety Executive
- Highland and Islands Fire and Rescue Service
- Royal Society for the Protection of Birds (RSPB)
- Scottish Wildlife Trust
- British Trust for Ornithology (BTO)
- West and North Ross Deer Management Group
- Kyle of Sutherland Fisheries Trust
- Cromarty Firth Fisheries Trust
- Scottish Water
- National Trust for Scotland
- VisitScotland
- Rambler's Association
- Scotways
- British Horse Society.

3.1.6 A scoping report was submitted to the Energy Consents Unit on 16 May 2018 (see Appendix 3.1), and a copy of the scoping opinion is contained in Appendix 3.2. A complete consultation matrix summarising all the consultation responses received and how there were addressed is included in Appendix 3.3.

Public information events

3.1.7 Exhibitions and forums were held at key stages in the development process to inform the general public and other interested parties of project alternatives and the emerging findings of the EIA, and to elicit comment and feedback on the proposed development. It is not a statutory requirement to consult with the public in this way. However, it is good practice and was adopted for the proposed development. Further details are provided in the Statement of Community Consultation document submitted alongside the application.

Informal discussions

3.1.8 Discussion was undertaken with affected parties and landowners during the development of the proposed development and the EIA process.

3.1.9 EIA topic-specific consultation is summarised in each chapter of this EIA report where relevant.

3.2 Environmental Impact Assessment Process

Scoping

3.2.1 An underlying principle of the EIA process is that it should concentrate on environmental issues where effects associated with a development proposal are likely to be significant.

3.2.2 The proposed development was subject to a detailed scoping exercise on 16th May 2018, in order to determine issues that should be addressed in the EIA and the form individual assessments should take.

3.2.3 The scoping exercise involved a review of available documentation related to the form and status of the existing environment; consultation with statutory and non-statutory agencies and other environmental bodies with knowledge of the project area and surrounding areas; preliminary desk-based and site-based appraisals and surveys; and knowledge of the potential environmental implications of comparable schemes (based on direct past project experience and other published experience and guidance).

3.2.4 The following considerations were factored into the scoping process:

- The nature of the receiving environment and the type of operations associated with the proposed development are such that environmental effects could arise during construction, operation and decommissioning stages.
- A review of the project area revealed ecological habitats, areas of peat and peatland habitats, and species of potential interest.
- There is a requirement for early liaison with stakeholder and regulatory authorities (e.g. the Scottish Environment Protection Agency and Scottish Natural Heritage) to provide input for the EIA and design development processes.
- Significant cumulative effects could potentially arise through the interaction of the project with other existing and approved development projects in the vicinity.

3.2.5 A tabular scoping matrix was developed to assist identification of potential environmental issues to be scoped into the EIA. This is presented in Appendix 3.3 of this EIA report and takes the form of an initial evaluation of potential interactions between the key development stages of the project and the receptors and resources associated with the receiving human, natural and built environment.

3.2.6 Scoping concluded that the following aspects were relevant for investigation in the EIA owing to the potential for significant environmental effects to arise:

- hydrological and marine interests: surface water and private water supply
- land-based interests: geology, hydrogeology, peat, landscape character and visual assessment (including woodland/forestry), and archaeology and cultural heritage,
- ecological interests: aquatic/terrestrial habitats, vegetation and species, ornithology

- human environment: health and safety, the existing traffic network, transportation, noise and vibrations, telecommunications,
- miscellaneous: carbon balance assessment

3.2.7 The following environmental aspects were reviewed and subsequently scoped out of the EIA based on the limited potential for environmental effects to arise:

- Air quality: The main source of impact on air quality would be increased traffic flows on local roads during construction and emissions from construction activities. It is considered that air emissions associated with these activities will be transient and localised, and highly unlikely to have a significant effect on local air quality. Best practice measures will be applied to construction, forming an integral part of the Environmental Management Plan. There will be no emissions to air during operation. Therefore, Air Quality has been scoped out from further assessment.
- Population and Human Health: This requirement will be covered through the findings of other assessments undertaken as part of the EIA process, and therefore no dedicated EIA chapter will be produced. This includes assessments on: noise, residential amenity, traffic and transportation, telecommunications, aviation and radar, health and safety at work, ide build up on turbine blades and risk of ice throw, lightning strike, risk of turbine failure and consideration of in built emergency procedures and best practice.
- Vulnerability of the development to risks of major accidents and/or disasters (including climate change): None of the following climate trends identified in UKCP0913 could affect the proposed development, with the exception of windstorms: increased temperature, changed in the frequency, intensity and distribution of rainfall events, and sea level rise. Braking mechanisms on turbines allow them only to be operated under specific wind speeds, and given the elevated location flooding will not pose a significant risk. Furthermore, the development will not contribute to flooding elsewhere.
- Shadow Flicker: A buffer to 10 rotor diameters will be maintained between properties and proposed turbines forming part of the proposed development, thereby eliminating shadow flicker impacts on nearby receptors.
- Socio-economic, Land-use and Tourism: In terms of economic impacts, the proposed development would bring the potential for a temporary increase in employment opportunities during construction – which will reduce during operation. Regarding the social implication of the proposed development, there is no evidence to suggest that wind farms have an adverse effect on tourism (Biggar Economics, 2017). Furthermore, the project area is not a notable tourist destination. The surrounding area supports hill walking, fishing and deer stalking as recreational and tourist attractions, however, it is not anticipated that the impacts on these resources will be significant. Therefore, socio-economic, land-use and tourism has been scoped out from further assessment.

3.2.8 It was concluded by the project team that the relationship and compliance of the proposed development to local, regional and national planning policy would be best established in a separate planning statement. Accordingly, Kirkan Wind Farm Ltd has commissioned a standalone planning statement that accompanies the application for consent for the proposed development.

3.2.9 The outcomes of scoping were collated in a scoping report (Appendix 3.1); this accompanied a formal request for a scoping opinion that was issued by RSK to the Energy Consents Unit on 16th May 2018.

3.2.10 The Energy Consents Unit engaged the following parties as part of the scoping process and issued its scoping opinion to Kirkan Wind Farm Ltd on 10th June 2018:

- Community Councils of – Ardgay and District; Contin; Garve and District; Lochbroom; Lochcarron; Marybank, Scatwell and Strathconon; Strathpeffer; Torridon and Kinlochewe
- British Telecommunications plc
- Civil Aviation Authority – Airspace
- Cromarty Firth District Salmon Fisheries Board
- Cromarty Firth Fisheries Trust
- Crown Estate Scotland
- Defence Infrastructure Organisation
- Fisheries Management Scotland
- Forestry Commission Scotland
- Highland Council
- Highlands and Islands Airports Limited
- Historic Environment Scotland
- Joint Radio Company Limited
- Kyle of Sutherland Fisheries Trust
- Mountaineering Scotland
- NATS Safeguarding
- RSPB Scotland
- Scottish Environmental Protection Agency
- Scottish Natural Heritage
- Scottish Rights of Way and Access Society
- Scottish Water
- Scottish Wildlife Trust
- Visit Scotland
- Wester Ross Area Salmon Fisheries Board
- Transport Scotland
- Marine Scotland

3.2.11 A copy of the scoping opinion is contained in Appendix 3.2. Feedback provided in the scoping opinion noted the following, which resulted in the scope of the EIA being modified accordingly.

- Access route: SEPA's response included site-specific comments, one of which related to the access track and use of existing track and infrastructure. Coriolis appointed RSK to address this comment by undertaking a route assessment. The route assessment used a qualitative multidisciplinary approach to review three potential access routes in terms of the associated environmental constraints. The preferred route from this assessment was incorporated into the design as the access route to the wind farm array.
- Viewpoints – Mountaineering Scotland commented, confirming that another viewpoint representing An Teallach should be added if Viewpoint 13 is included. Further discussion was had with SNH and the Highland Council to agree a finalised set of viewpoints.

- Drinking water and private water supplies (PWS) – consideration of the potential for the development to impact on water supplies was made in Chapter 8.

3.2.12 The scope of the individual assessments has been reviewed regularly throughout the EIA process to take account of new published guidance and/or assessment methodologies, stakeholder feedback, new environmental data and ongoing scheme design changes.

3.2.13 Explanations of the methods of assessment adopted and the issues identified are provided in Sections 4 to 13 of this EIA report, which detail the findings in relation to the various environmental aspects considered in the EIA.

EIA delivery

3.2.14 Insofar as practical, a common approach has been adopted in the undertaking and reporting of individual environmental assessments.

EIA guidance

3.2.15 The EIA has been undertaken with regard to the following published best-practice guidance:

- *Planning Circular 1/2017: The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017*, published by the Scottish Government (2017)
- *Planning Advice Note 1/2013: Environmental Impact Assessmen*t, published by the Scottish Government (2013)
- *Guidelines for Environmental Impact Assessment*, published by IEMA (2004)

3.2.16 A common approach has been adopted in the undertaking and reporting of individual environmental assessments.

Establishment of baseline environment

3.2.17 The EIA of scoped-in environmental aspects commenced with the identification and review of information relating to known, or the likely presence of, environmental receptors and resources within a defined study area in order to determine their relative value, importance and/or sensitivity towards change.

3.2.18 Environmental resources were defined as those environmental aspects that support and are essential to natural or human systems. These include areas or elements of population, ecosystems, watercourses, air and climatic factors, landscape, and material assets.

3.2.19 Environmental receptors were defined as people (i.e. occupiers of dwellings and users of recreational areas, places of employment and community facilities) and elements within the environment (e.g. flora and fauna) that rely on environmental resources.

3.2.20 Desk-based data sources comprised consultation responses; published literature; databases, records and schedules relating to environmental designations; national, regional and local policy documentation; historic and current mapping; aerial photography; and data gathered from previous environmental studies.

3.2.21 Site surveys were undertaken to verify and consolidate information gathered during the desk-based review, and to evaluate the relationships between specific environmental interests and their wider environmental value.

3.2.22 Study area extents vary in accordance with the environmental aspect being considered. For some topics, a study area has been defined as being relatively localised to the proposed development, while for others it has extended outward to capture the surrounding road network, distant communities, and environmentally sensitive areas. The definition of each study area has been informed by a review of the relationship between the proposed development and the receiving environment, the outcomes of scoping, and reference to thresholds stipulated in topic-specific EIA guidance.

Impact prediction and assessment

3.2.23 Impacts comprise identifiable changes to the baseline environment. These can be either beneficial (e.g. introduction of planting to screen visually detracting elements) or adverse (e.g. loss of an attractive environmental component), and can take the following forms:

- direct [primary] (e.g. loss of habitat to accommodate the proposed development)
- indirect [secondary] (e.g. pollution downstream arising from silt deposition during earthworks)
- transboundary
- short-term/temporary (e.g. dust generated during construction)
- medium-term (e.g. cutting back of planting which is subsequently allowed to regenerate)
- long-term/permanent (e.g. improvement in air quality)
- cumulative (e.g. incremental changes caused by other past, present or reasonably foreseeable actions together with those associated with the proposed development, or where a receptor or resource is subject to a combination of individual impacts such as air pollution, noise and visual impact associated with the proposed development in isolation).

3.2.24 Impact assessments have been both quantitative and qualitative in nature, and based on comparisons between the environmental conditions immediately prior to the assumed construction of the proposed development and the predicted environment conditions resulting from its implementation.

3.2.25 Impacts have been defined in accordance with accepted terminology and standardised methodologies to predict the magnitude of impact (or change) resulting from the proposed development.

3.2.26 Assessments have been undertaken for the year of construction and in the year when the proposed development would become operational. Some environmental aspects have required further assessment beyond the operational year to take account of factors such as predicted traffic growth or activities associated with decommissioning of the proposed development.

Environmental effects

3.2.27 Effects are defined as the consequence of impacts. They are formulated as a function of the receptor/resource value and sensitivity, and the predicted magnitude of impact.

3.2.28 Professional judgement, defined thresholds, established criteria and standards have been used to report the environmental effects of impacts, which can be referred to as either being prior to, or following establishment of, environmental mitigation.

Environmental mitigation

3.2.29 Environmental mitigation measures have been developed to address potentially significant adverse environmental effects.

3.2.30 Mitigation can take the form of agreed measures incorporated into the evolving design of the proposed development (e.g. environmental treatments), standard measures (e.g. best practice construction management to control dust emissions) that are enforceable through planning conditions, and measures proposed in outline (e.g. off-site planting to provide visual screening to nearby residential dwellings) that may require further development and formal agreement to ensure their implementation.

3.2.31 The principles adopted in the identification and development of environmental mitigation for the proposed development are avoidance (wherever possible), reduction (where avoidance cannot be achieved) and compensation (where reduction is unachievable or would not achieve the required level of mitigation).

Significance of environmental effects

3.2.32 The significance of an environmental effect has been established by way of reference to the importance/value of affected resources; the number and sensitivity of affected receptors; impact magnitude; duration, frequency and extent of effect; and the reversibility of effect.

3.2.33 The following generic significance criteria have been applied across the environmental aspects to ensure identified environmental effects are assessed in a comparable manner, except where such criteria are not applicable due to other prevailing topic-specific guidance (e.g. ecological impact assessment) and/or established standards and thresholds (e.g. EU limit values for air emissions):

- **Very large** effects are key factors in the decision-making process generally (but not exclusively) associated with sites and features of national importance and resources/features that are unique and, if lost, cannot be replaced or relocated.
- **Large** effects are important considerations at a regional or district scale but, if adverse, are potential concerns to the project depending upon the relative importance attached to the issue during the decision-making process.
- **Moderate** effects, if adverse, while important at a local scale, are not likely to be key decision-making issues.
- **Slight** effects may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in the detailed design of the project.
- **Neutral** effects are beneath levels of perception, within normal bounds of variation, or within the margin of forecasting error.

3.2.34 Significance assumes only incorporated and standard mitigation measures are in place, these being the measures for which delivery and implementation can be secured.

3.2.35 The competent authority determining the planning application considers the residual effects (i.e. the post-mitigation effects) as part of the decision-making process.

Assessment reporting

3.2.36 Each individual assessment follows a comparable format to ensure consistency in reporting the existing environmental conditions and the potential effects on them arising from implementation of the proposed development.

- **Introduction** introduces the assessment topic under consideration.
- **Scope and Methodology** identifies and describes the scope of the assessment, the methods and criteria adopted, relevant guidance followed, and any assessment limitations, assumptions or difficulties encountered.
- **Statutory and Planning Context** outlines statutes, guidance, policies and plans relevant to the environmental interests forming the focus of the assessment.
- **Existing Environment** describes the features and characteristics associated with the baseline environment.
- **Predicted Impacts** reports the predicted impacts on the baseline environment during the construction, operational and decommissioning phases. It will also indicate the potential cumulative effects that may arise.
- **Mitigation** details all measures that have been incorporated into the design of the project and/or agreed as deliverable.
- **Summary of Effects** summarises the nature and significance of residual environmental effects that are predicted to remain, post-implementation of mitigation measures.

Assumptions, uncertainties and limitations

3.2.37 The EIA was undertaken and the resulting EIA report has been compiled using the material made available to the EIA team by the client and members of their project team, together with other readily available and publicly accessible material including existing literature and studies, as well as personal communication with local experts. To the best of our knowledge, the information used as a basis for the assessment is accurate and up to date. The team is not aware of any limitations of the underlying information or of any constraints that would materially affect the evaluations.

3.2.38 We have also carried out our own site visits, surveys and investigations at or in the vicinity of the project area to provide more information for the assessments and to fill data gaps. This has resulted in a more complete and up to date set of baseline data to use as the basis for the impact assessment. Although the data have been collected over a period of time, we are of the opinion that the data is relevant and valid at the time of reporting. It should be noted that the surveys and investigations are conducted on a sampling basis and this places a limit on the certainty of the data set.

3.2.39 This EIA report has been based on the best available information at the time of publication. However, further information may become available during the detailed design phase that will be used to inform the project if relevant.

3.2.40 Assumptions adopted in the evaluation of impacts are reported in each of the relevant sections. However, these assumptions are often implicit and rely on expert judgement. Any assumptions and known technical deficiencies have been documented.

3.2.41 The EIA has been undertaken during the initial design phase of the project and therefore some of the technical aspects of the construction and operation have yet to be determined. Where an alternative option could cause additional impacts, these are discussed within the relevant sections. In addition, the EIA has taken a precautionary approach to adopt conservatism in the assumptions made and any scenarios assumed, so that a reasonable ‘worst-case’ scenario was assessed. Therefore, inherent uncertainties are accounted for and subsequent modifications to the project during the detailed design phase are less likely to fall outside of the assumed envelope of the assessment parameters.

3.3 References

Biggar Economics (2017). Wind Farms and Tourism Trends in Scotland: A Research Report. Report published October 2017.

IEMA (2004). Guidelines for Environmental Impact Assessment.

Scottish Government (2017). Planning Circular 1/2017: The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017, published by the Scottish Government (2017)

Scottish Government (2013). Planning Advice Note 1/2013: Environmental Impact Assessment, published by the Scottish Government (2013)

4 LANDSCAPE AND VISUAL ASSESSMENT

4.1 Introduction

4.1.1 This chapter considers the likely significant effects on the landscape and visual resource of the area arising from the proposed development. The chapter comprises:

- a description of the methodology utilised in completing the assessment;
- a description of the existing landscape and visual baseline context and cumulative context;
- a description of impact generators associated with the type of development proposed and their potential effects on landscape and visual receptors;
- a description of design priorities and any mitigation measures proposed to address likely significant landscape and visual effects; and
- an assessment of residual landscape and visual effects, including cumulative effects taking into account the influence of design responses and mitigation measures.

4.1.2 This chapter is supported by the following technical appendices (TAs) which are presented in EIAR Volume 4: Technical Appendices:

- TA 4.1: Glossary;
- TA 4.2: Landscape Character Types;
- TA 4.3: Designated Landscapes and Classified Landscapes;
- TA 4.4: Assessment of Residual Effects on Landscape Character Types;
- TA 4.5: Assessment of Residual Effects on Designated Landscapes and Classified Landscapes;
- TA 4.6: Wild Land Impact Assessment (WLIA);
- TA 4.7: Viewpoint Assessment;
- TA 4.8: Route Analysis; and
- TA 4.9: Lighting Assessment.

4.1.3 The chapter is also accompanied by the following figures which are presented in EIAR Volume 3: Figures:

- Figure 4.1: Topography;
- Figure 4.2a: Landscape Character;
- Figure 4.2b: Landscape Character with Zone of theoretical Visibility (ZTV);
- Figure 4.3a: Landscape Designations and Classified Landscapes;
- Figure 4.3b: Landscape Designations and Classified Landscapes with ZTV;
- Figure 4.4: Transportation Routes, Recreational Routes and Summits;
- Figure 4.5a: Blade Tip ZTV drawing;
- Figure 4.5b: Blade Tip/Hub Height ZTV;
- Figure 4.6: Cumulative Context;
- Figure 4.6a: Cumulative ZTV - Kirkan, Corriemoillie, and Lochluichart/Lochluichart Extension;
- Figure 4.6b: Cumulative ZTV - Kirkan, Novar/Novar Extension, and Yellow Wells WF;
- Figure 4.6c: Cumulative ZTV - Kirkan, Rosehall & Achany and Braemore WFs;
- Figure 4.6d: Cumulative ZTV - Kirkan, Beinn nan Oighrean & Beinn Tharsuinn, and Coire na Cloiche WFs;

- Figure 4.6e: Cumulative ZTV - Kirkan, Fairburn and Auchmore WFs;
- Figure 4.6f: Cumulative ZTV - Kirkan, Lairg, Belladrum Kiltalarity WFs;
- Figure 4.6g: Cumulative ZTV -Kirkan, Corrimony and Bhlaraidh WFs;
- Figure 4.7: Viewpoint Location Map;
- Figures 4.8a - 4.8o: Visualisations - Viewpoint 1: Aultguish Inn, A835;
- Figures 4.9a - 4.9o: Visualisations - Viewpoint 2: Old Drovers Road;
- Figures 4.10a - 4.10o: Visualisations - Viewpoint 3: A835, Near Tarvie;
- Figures 4.11a to 4.11o: Visualisations - Viewpoint 4: A832 Gorstan;
- Figures 4.12a to 4.12o: Visualisations - Viewpoint 5: Summit of Sgurr Marcasaidh;
- Figures 4.13a to 4.13o: Visualisations - Viewpoint 6: Summit of Ben Wyvis;
- Figures 4.14a to 4.14o: Visualisations - Viewpoint 7: Avenue of Fairburn Estate;
- Figures 4.15a to 4.15o: Visualisations - Viewpoint 8: Summit of Sgurr a'Muillin;
- Figures 4.16a to 4.16o: Visualisations - Viewpoint 9: Summit of Beinn a'Bha'ach Ard;
- Figures 4.17a to 4.17o: Visualisations - Viewpoint 10: Sgurr a' Choire Ghlais;
- Figures 4.18a to 4.18o: Visualisations - Viewpoint 11: Summit of Moruisg;
- Figures 4.19a to 4.19o: Visualisations - Viewpoint 12: Leathad Buidhe, Beinn Eighe;
- Figures 4.20a to 4.20o: Visualisations - Viewpoint 13: Summit of An Coileachan, Fannich range;
- Figures 4.21a to 4.21o: Visualisations - Viewpoint 14: Summit of Beinn Dearg;
- Figures 4.22a to 4.22o: Visualisations - Viewpoint 15: Summit of Meall a' Ghrianain;
- Figures 4.23a to 4.23o: Visualisations - Viewpoint 16: Summit of Meall Mor;
- Figures 4.24a to 4.24o: Visualisations - Viewpoint 17: Layby, Loch Glascarnoch
- Figures 4.25a to 4.25o: Visualisations - Viewpoint 18: Summit of Meall Mor;
- Figures 4.26a to 4.26o: Visualisations - Viewpoint 18: Little Wyvis
- Figure 4.6.1: Relative wildness and Visibility
- Figure TA4.8.1: Route Analysis; and
- Figure TA4.9.1: Lighting Intensity.

Figures and TAs are referenced in the text where relevant.

4.2 Scope and Methodology

Study Area

4.2.1 The study area for the LVIA comprises a 45 km radius area extending from the outermost turbines of the proposed developments turbines. This study area is presented on Figures 4.1 - 4.7 (EIAR Volume 3). The extent of the study area was agreed following production of a preliminary ZTV based on an initial layout for the turbines and in consultations with the Energy Consents Unit (ECU), The Highland Council (THC), Scottish Natural Heritage (SNH) and is consistent with current SNH guidance, as set out in SNHs guidance on the visual representation of wind farm developments.

Scope of Assessment

4.2.2 This chapter assesses the landscape and visual effects of the proposed development as described in Chapter 2 of the EIAR. This chapter considers effects on:

- Landscape fabric;

- Landscape character;
- Designated Landscapes and Classified landscapes; and
- Visual amenity.

4.2.3 Effects on landscape fabric occur when there is physical change to components of the landscape such as the landform, land use or land cover. Effects on landscape character arise when there is change to the key characteristics of the landscape and its associated distinct and recognisable pattern of elements. Visual effects are a subset of landscape effects and comprise changes in views of the landscape and the overall effects on visual amenity.

4.2.4 Landscape and visual effects may have effects on cultural heritage facets of the landscape, specifically on the setting of Gardens and Designed Landscapes (GDLs) and on listed buildings and ancient monuments. The landscape and visual assessment (LVIA) considers potential effects on GDLs, whilst effects on other cultural heritage receptors are considered in EIAR Chapter 5: Archaeology and Cultural Heritage.

4.2.5 Landscape and visual considerations have influenced the design of the proposed development and these are explained in EIAR Volume 2: Chapter 2: Proposed Development.

4.2.6 The scope of the assessment has been informed by consultation responses, published guidance and planning policy.

Guidance

4.2.7 The landscape and visual assessment was based on guidelines provided in:

- Guidelines for Landscape and Visual Impact Assessment (GLVIA);
- Landscape Character Assessment;
- Techniques for Judging Capacity and Sensitivity;
- Siting and Designing Wind Farms in the Landscape;
- Assessing Effects on Wild Land; and
- Guidance: Cumulative Effects of Wind Farms.

Consultations

4.2.8 Table 4.1 summarises the consultation responses received that are of relevance to the preparation of the LVIA and provides information on where and/or how they have been addressed in this assessment.

4.2.9 Full details on the consultation responses can be reviewed in EIAR Technical Appendix 3.2: Consultation Matrix.

Table 4.1: Consultation Responses - LVIA

Consultee and Date	Scoping/Other Consultation	Issued Raised	Response/ Action Taken
THC 1st May 2018	Pre-application advice (Ref No. 18/00618/PREAPP)	A Landscape and Visual Impact Assessment will be required to demonstrate how the surrounding landscape and visual amenity of the area will be affected; how the proposal	The LVIA identifies the residual effect of the proposed development on the landscape and visual amenity of a study area equivalent to 45 km radius from the outermost turbines.

Consultee and Date	Scoping/Other Consultation	Issued Raised	Response/ Action Taken
		will integrate with the Lochluichart and Corriemoillie schemes; and how the layout, height difference and rotation speed will affect views and the landscape will be a key consideration. The containment of the adjacent schemes within a subtle bowl in the landscape was pursued as part of their design mitigation. The case to expand development beyond those bounds will need to be robustly justified including the deployment of significantly larger turbines when compared to existing turbines in the locality. The pre-application advice also contains advice from THCs Landscape Officer with regard to addressing of the Criteria in Section 4 of the THC Onshore Wind Energy Supplementary Guidance as well as some detailed advice in respect of the focus and scope of the LVIA.	Section 4.5 of the LVIA discusses key mitigation and matters pertaining to landscape fit and relationship to the adjoining existing turbines at Corriemoillie and Lochluichart. An assessment of the degree to which the proposed development would be consistent with the Criteria in Section 4 of the SG is presented in the Planning Statement. The scope and detailed content of the LVIA is considered to reflect the wider advice from THC's Landscape Officer.
THC 18th June 2018	Response to the Scottish Government on Scoping Opinion	An Assessment of the impact on the WLA, and a LVIA will be required. Viewpoints for the LVIA must be discussed and agreed with the Highland Council in consultation with Scottish Natural Heritage. The Council has Visualisation Standards which the applicant will be expected to adopt when presenting information on the expected visual impact of the development. THC argued that the proposal will have significant landscape implications, both individually and cumulatively with other operational and proposed wind farms. THC requested that considerable attention should be given to possible designs and layout. Cumulative landscape and visual impacts of this proposal in association with Lochluichart (and its extension) and	TA4.6 contains a Wild Land Impact Assessment for Wild Land Areas in the vicinity of the proposed development. This was undertaken in accordance with the draft technical guidance as requested. Viewpoint utilised in the assessment were agreed with THC and SNH. Visualisations were prepared in accordance with both the current SNH guidance as well as THCs standards. The iterative design approach adopted for the proposed development is described in Chapter 2 of the EIAR. The relationship between the proposed development and the adjacent Corriemoillie and Lochluichart wind farms is discussed in both Chapter 2 of the EIAR and in Section 4.5 of the LVIA.

Consultee and Date	Scoping/Other Consultation	Issued Raised	Response/ Action Taken
		Corriemoillie are likely to be a key issue. The landscape and visual impact of the scheme will be a key consideration. This should include look at how the proposal will integrate with the existing adjacent schemes and how the layout, height difference and rotation speed will affect views compared with the adjacent schemes. It should also consider the impact on the A835 as a 'gateway' road, with changing views unfolding as you travel north and west.	Implicit in the LVIA is the cumulative effects arising from the proposed development in conjunction with the existing cumulative baseline. Section 4.7 of the LVIA contains an assessment of effects on the A835, and the Planning Statement contains an analysis of the effect on this key route.
SNH 1st May 2018	Pre-application advice (Ref No. 18/00618/PREAPP)	SNH consider that the landscape and visual impact of the scheme will be a key consideration and requested that consideration should be given to how the proposal will integrate with the existing adjacent schemes and how the layout, height difference and rotation speed will affect views compared with the adjacent schemes. It should also consider the impact on the A835 as a ‘gateway’ road, with changing views unfolding as you travel north and west. The wild land assessment should follow the new draft technical guidance. The existing windfarms in the area will include a number of mitigation measures to offset impacts on the landscape, habitats and species. The design and layout should be such that it does not compromise these measures or negate their impact.	Section 4.5 of the LVIA and Chapter 2 of the EIAR consider the relationship between the proposed development and adjoining Corriemoillie and Lochluichart developments and whether the proposed development is likely to compromise the mitigation established for these existing schemes. TA4.6 contains a Wild Land Impact Assessment for Wild Land Areas in the vicinity of the proposed development. This was undertaken in accordance with the draft technical guidance as requested.
SNH 18th June 2018	Scoping Opinion	SNHs scoping response outlines a number of matters that they recommend for consideration in the LVIA, including: The design of the proposed development and its relationship between the proposed development and adjoining Corriemoillie and Lochluichart developments.	The design of the proposed development is described in Chapter 2 of the EIAR and its relationship with the adjoining Corriemoillie and Lochluichart wind farms is discussed in Section 4.5 of the LVIA. Section 4.7 of the LVIA assesses effects on the amenity of the A835, and TA4.6 contains a Wild Land Impact

Consultee and Date	Scoping/Other Consultation	Issued Raised	Response/ Action Taken
		SNH recommended reduction of the proposed turbine size to reflect that of Corriemoillie and Lochluichart. Landscape effects, including effects on the A835. Wild Land Assessment for the Rhiddorochis, Beinn Dearg and Ben Wyvis WLA 29 and the Fisherfield, Letterewe, Fannichs WLA 28. SNH also requested the inclusion of a viewpoint at An Cabar.	Assessment in respect of the WLAs identified. The proposed viewpoint at An Cabar was omitted as, during the details assessment, no view of the proposed development was identified from this summit.
Mountaineering Scotland 15th June 2018	Scoping Opinion	Mountaineering Scotland suggested a number of alterations to viewpoints for use in the LVIA, including: Replacement of preliminary Viewpoint 9 (Creag Ruadh) by viewpoint at Sgurr a'Muillin (NH2655); Inclusion of An Teallach if Viewpoint 13 (Leathad Buidhe, Beinn Eighe NNR) is included.	Both of Mountaineering Scotland's suggestions were accepted and incorporated into the Viewpoint Assessment in TA 4.7.

Legislation and Policy Context

NATIONAL LEGISLATION AND POLICY

4.2.10 A desk study of the relevant national, regional and local planning guidance and landscape planning policy context was carried out and the findings summarised below. Broader policy deliberations are covered in the accompanying Planning Statement.

4.2.11 The Scottish Government's Planning Guidance on renewable developments is set out in the National Planning Framework (NPF3) and in the Scottish Planning Policy (SPP) published in 2014.

4.2.12 Much of the relevant material in the SPP in regard to onshore wind farm development relates to the development of spatial frameworks. Paragraph 161 of the SPP states that:

"Planning authorities should set out in the development plan a spatial framework identifying those areas that are likely to be most appropriate for onshore wind farms as a guide for developers and communities, following the approach set out below in Table 1 (page 39 of the SPP). Development plans should indicate the minimum scale of onshore wind development that their spatial framework is intended to apply to. Development plans should also set out the criteria that will be considered in deciding all applications for wind farms of different scales - including extensions and re-powering - taking account of the considerations set out at paragraph 169 of the SPP."

4.2.13 These criteria refer to a number of environmental factors. Those of relevance to the LVIA include:

- cumulative impacts;
- impacts on communities and individual dwellings;
- landscape and visual impacts, including effects on Wild Land;
- impacts on long distance walking and cycle routes and scenic routes identified in NPF3; and
- impacts on tourism and recreation.

4.2.14 The categories proposed for use in spatial frameworks comprise the following:

- Group 1 Areas: Where wind farms will not be acceptable such as in National Parks (NPs) or National Scenic Areas (NSAs).
- Group 2 Areas: Areas designated/classified for their international or national heritage value, outwith National Parks and National Scenic Areas including:
- National and international designations including (principally those relating to cultural heritage and/or ecological value);
- Sites included in the inventory of Gardens and Designed Landscapes (GDLs);
- Other nationally important classified landscapes such as Wild Land Areas (WLAs); and
- Community separation for consideration of visual impact (i.e. an area not exceeding 2 km around cities, towns and villages identified on the local plan.
- Group 3 Areas: Areas with potential for wind farm development, subject to detailed consideration against policy criteria.

4.2.15 In addition to matters pertaining to spatial frameworks, the SPP provides guidance on the preparation of development plans. Paragraph 196 of the SPP states that:

"International, national and locally designated areas and sites should be identified and afforded the appropriate level of protection in development plans. Reasons for local designation should be clearly explained and their function and continuing relevance considered when preparing plans. Buffer zones should not be established around areas designated for their natural heritage importance. Plans should set out the factors which will be taken into account in development management. The level of protection given to local designations should not be as high as that given to international or national designations."

4.2.16 The outline of the extent and reason for local designations (Special Landscape Areas) are described in The Highland Councils (THCs) Assessment of Highland Special Landscape Areas.

4.2.17 In respect to non-designated sensitive landscape classifications, paragraph 200 of the SPP states that:

"Wild land character is displayed in some of Scotland's remoter upland, mountain and coastal areas, which are very sensitive to any form of intrusive human activity and have little or no capacity to accept new development. Plans should identify and safeguard the character of areas of wild land as identified on the 2014 SNH map of wild land areas."

4.2.18 The proposed wind farm is not located within a Wild Land Area (WLA). The nearest WLA to the proposed development is the Rhiddoroch - Beinn Dearg - Ben Wyvis WLA, located approximately 3 km north east of the nearest turbine. Fisherfield - Letterewe - Fannichs WLA is located approximately 3.5 km to the west. The Central Highlands WLA is located approximately 11.5 km south. An assessment of the potential effect of the proposed wind farm on the Rhiddoroch - Beinn Dearg - Ben Wyvis WLA and the Fisherfield - Letterewe - Fannichs WLA was undertaken as requested by SNH. This was undertaken in accordance with SNHs guidance on assessing impacts on wild land.

4.2.19 Paragraph 202 of the SPP provides guidance regarding the siting and design of wind farms and states that:

"The siting and design of development should take account of local landscape character. Development management decisions should take account of potential effects on landscape and the natural and water environment, including cumulative effects. Developers should seek to minimise adverse impacts through careful planning and design, considering the services that the natural environment is providing and maximising the potential for enhancement."

4.2.20 Paragraph 203 states:

"Planning permission should be refused where the nature or scale of proposed development would have an unacceptable impact on the natural environment. Direct or indirect effects on statutorily protected sites will be an important consideration, but designation does not impose an automatic prohibition on development."

4.2.21 Paragraph 203 goes on to state that:

"Planning authorities should apply the precautionary principle where the impacts of a proposed development on nationally or internationally significant landscape or natural heritage resources are uncertain but there is sound evidence indicating that significant irreversible damage could occur. The precautionary principle should not be used to impede development without justification. If there is any likelihood that significant irreversible damage could occur, modifications to the proposal to eliminate the risk of such damage should be considered. If there is uncertainty, the potential for research, surveys or assessments to remove or reduce uncertainty should be considered."

REGIONAL AND LOCAL POLICY

4.2.22 The proposed Kirkan Wind Farm would be wholly located within the Highland Council (THC) administrative area, the relevant planning context for which is contained in:

- Highland Wide Local Development Plan (HwLDP), adopted in April 2012;
- Highland Wide Local Development Plan, Supplementary Guidance (SG): Onshore Wind Energy, November 2016; and
- Highland Wide Local Development Plan, Addendum Supplementary Guidance (ASG): Part 2B, December 2017.

4.2.23 The HwLDP was adopted by THC on 5th April 2012. The Plan sets out the overarching vision, spatial strategy and general planning policies for THC area, with the exception of the area covered by the Cairngorms National Park Local Plan. Landscape policy of relevance to the proposed wind farm includes:

- Policy 28 Sustainable Design, including provisions regarding residential amenity, design, impacts on landscape resource and designations;
- Policy 57 Natural, Built and Cultural Heritage, including provision for nationally, regionally and locally important landscape and heritage resource, including Wild Land areas;

- Policy 61 Landscape, which covers the design of new development to ensure that they reflect the landscape characteristics and special qualities identified in the Landscape Character Assessment for the area in which they are proposed; and
- Policy 67 Renewable Energy Developments, which relates to the location, siting and design of developments so that they will not be significantly detrimental overall, either individually or cumulatively with other developments.

4.2.24 The SG provides a spatial framework to guide the location of all wind farms through the identification of spatial constraints. In line with SPP, the guidance has identified three 'groups' which set out the requirements for safeguarding with regards to wind energy development. These are:

- Group 1: Areas where wind farms will not be acceptable.
- Group 2: Areas of significant protection; and
- Group 3: Areas with potential for wind farm development.

4.2.25 The proposed development is located across a mixture of landscape identified as Group 2 and Group 3. However, justification of the Group 2 classification at the site concerns the presence of carbon rich soils rather than landscape matters.

4.2.26 Whilst recognising the need for significant protection in areas identified as 'Group 2', the guidance identifies that in certain circumstances, wind farms may be appropriate in these locations and a set of criteria is presented in Table 1 of the guidance. The site is not located within an area designated for its landscape or scenic quality. The site is not located within an area of Wild Land. The closest settlement to the proposed development is Garve, which is a small village situated around 5.8 km south of the proposed development. The nearest large settlement affording theoretical visibility is Muir of Ord, which is located approximately 21 km south east of the proposed development.

4.2.27 Proposals located within 'Group 3' are likely to be supported, subject to detailed consideration of the relevant policies of the HwLDP.

4.2.28 Section 4 of the guidance sets out how important features and assets identified in HwLDP are expected to be safeguarded in relation to onshore wind energy development. With regards to impacts on the landscape resource and visual amenity, this includes narrative on:

- the siting and design of wind turbines and wind farms; and
- landscape and visual effects.

4.2.29 Criteria is set out as key landscape and visual aspects that the Council will use as a framework and focus for assessing proposals, including discussions with applicants.

4.2.30 The guidance also presents landscape sensitivity appraisals for a number of areas within the Highland administrative area:

- Loch Ness;
- Black Isle, Surrounding Hills and Moray Firth Coast; and
- Caithness.

4.2.31 The proposed development is not located within these areas. The Black Isle, Surrounding Hills and Moray Firth Coast appraisal boundary is located approximately 5 km east of the proposed development.

4.2.32 Additional appraisals are in progress for East and Central Sutherland, and for West Highlands and Islands and will be subject to public consultation prior to inclusion in the guidance. The proposed development would be located within the West Highlands and Islands study area.

4.2.33 This LVIA has therefore used the sensitivity appraisals insofar as applicable to the proposed development. Information contained within the Landscape Sensitivity report commissioned by THC to inform the sensitivity appraisals has also informed the LVIA.

Matters Scoped Out

4.2.34 Effects related to the decommissioning of the proposed development were not assessed within the LVIA as such effects are anticipated to be equivalent or possibly less than those expected to occur during its construction.

Desk Study

4.2.35 Initially, a desk study was undertaken to establish the baseline context of the proposed development, this considered physical components of the landscape (i.e. landscape fabric) as well as the distinctive recognisable patterns of elements that form the landscape character of the area and of designated and classified landscapes. Visual elements and receptors/receptor locations were also identified including settlements, transportation corridors and recreational trails and summits, as well as specific landscape character types and designated areas.

4.2.36 Landscape character types (LCTs) considered in the baseline and subsequent assessment are derived from the following SNH Landscape Character Assessments (LCAs) listed below:

- SNH (1999) Ross and Cromarty Landscape Character Assessment No. 119;
- SNH (1998) Caithness and Sutherland Landscape Character Assessment No. 103;
- SNH (1998) Inverness District Landscape Character Assessment No. 114; and
- SNH (1998) Moray and Nairn Landscape Character Assessment No. 101; and
- THC (2017) Onshore Wind Energy Supplementary Guidance: Landscape Sensitivity Appraisal for Black Isle, Surrounding Hills and Moray Firth Coast Caithness.

4.2.37 The description of landscape designations and classifications contained in the LVIA were derived from the following publications:

- SNH (2010) The Special Qualities of the National Scenic Areas;
- THC (2011) Assessment of Highland Special Landscape Areas (THC, 2011); and
- SNH Wild Land Area descriptions.

4.2.38 Other datasets utilised in the preparation of the LVIA included:

- Ordnance Survey 1:50,000 and 1: 250,000 mapping;
- Ordnance Survey 50 - 5 m Digital Terrain Model;
- Scottish Landscape Character Assessment data - SNH data sets;
- Gardens and Designed Landscapes - Historic Environment Scotland datasets;
- National Scenic Areas - Scottish Government data sets;
- Special Landscape Areas - The Highland Councils data sets;
- Wild Land Areas - SNH data sets;
- Road network - Meridian 2 data; and

- Cumulative data - THC dataset.

Field Survey

4.2.39 Desktop findings were verified and augmented by targeted field reconnaissance during which all key sensitive receptor locations were visited. During the field reconnaissance draft wireline images, mapping, GIS/GPS data collection systems and augmented reality tools such as *Ventus AR*[1] were utilised to verify theoretical visibility (including cumulative visibility).

4.2.40 Extended, detailed field reconnaissance within Wild Land Areas was undertaken by two Landscape Architects as part of the Wild Land Impact Assessments in EIAR Volume 2: Technical Appendix 4.6.

Illustrative Materials

4.2.41 The LVIA is illustrated by a range of tools including Zone of Theoretical Visibility (ZTV) plans, photographs, wirelines, and photomontages. All outputs have been prepared in accordance with current best practice comprising:

- SNH (2017) Visual Representation of Wind Farm - Guidance Version 2.2;
- Landscape Institute (2018) Technical Guidance Note - Photography and Photomontage in Landscape and Visual Impact Assessment - Public Consultation Draft; and
- THC (2016) Visualisation Standards for Wind Energy Developments

4.2.42 ZTVs have been prepared to assist in the identification of areas from where there is potential visibility of the proposed development, illustrated on EIAR Volume 3: Figure 4.5a. ZTVs are based on Ordnance Survey (OS) digital terrain data supplied as gridded height data at 50 m interval resolution. This data does not reflect the screening effect of vegetation or built structures and so the visibility shown on the ZTVs is more extensive than actual visibility on the ground. Where the ZTV shows no visibility, it is predicted that no turbines can be seen.

4.2.43 The blade tip ZTV (Figure 4.5a) illustrates the extent of the proposed developments viewshed based on the visibility of turbines from base to maximum blade tip, whilst the blade tip/hub height comparison drawing in Figure 4.5b contains comparison of blade tip visibility and hub height visibility. This makes it possible to identify locations from where the proposed development would be seen as blade tips only and would therefore be less prominent.

4.2.44 In order to establish the cumulative theoretical visibility, ZTVs were prepared for all operational, under construction, consented and application stage wind farm projects within 45 km of the proposed development (EIAR Volume 3: Figure 4.6). The cumulative ZTVs are included in EIAR Volume 3: Figures 4.6a to 4.6g.

Assessment of Effects

4.2.45 The aim of the landscape and visual impact assessment is to identify, predict and evaluate potential significant effects arising from the proposed development. Wherever possible, identified effects are quantified, but the nature of landscape and visual

[1] A computer based tool for field visualisation using on-board tablet cameras and a referenced terrain model an incorporating a model of the proposed development and cumulative wind farms.

assessment requires interpretation by professional judgement. In order to provide a level of consistency to the assessment, landscape sensitivity to change, the prediction of magnitude of impact and assessment of significance of the residual effects has been based on pre-defined criteria, the level of effects being determined by a comparison of the sensitivity of receptors and the magnitude of impact arising from the proposed development.

4.2.46 The LVIA considers landscape and visual effects on designated landscapes in the study area, including National Scenic Areas (NSAs), Special Landscape Areas (SLAs). Additionally, whilst not landscape designations, a number of sensitive landscape classifications have been assessed, including Wild Land Areas (WLAs). Whilst there are numerous Gardens and Designed Landscapes (GDLs) located within the study area, most would not be subject to views of the proposed development and these have therefore been omitted from the LVIA.

4.2.47 In order to assist in evaluating the potential landscape and visual effects arising from the proposed wind farm, ZTVs were generated to identify the potential extent of the proposed development's visibility over the study area (EIAR Volume 3: Figure 4.5a and 4.5b). An assessment of the predicted visibility of the proposed development from each of the landscape character types, designated and sensitive non-designated landscapes in the study area has been carried out by analysing the ZTVs and verifying the findings during field reconnaissance. The visibility assessment has concentrated on the publicly accessible areas including outdoor recreational areas, cycle routes, roads, and the public footpath network.

4.2.48 Mitigation measures which have been incorporated into the final design and layout of the proposed development are described, together with a summary of the design optimisation process carried out in parallel with the LVIA. Further details of the constraints which were identified, and the design process are described in EIAR Volume 1: Chapter 2: Proposed Development.

4.2.49 Representative viewpoints were chosen in consultation with THC, SNH and non-statutory consultees in respect of this application. These viewpoints are considered to be representative of the main sensitive receptors in the study area. The viewpoints have also been checked against the cumulative ZTVs for existing/consented and proposed wind farms within the study area in order to ensure that they provide representative coverage of potential cumulative visibility and related effects. Viewpoint locations are detailed in EIAR Volume 2: Technical Appendix 4.7 and are included in EIAR Volume 3: Figures 4.7 to 4.15o.

4.2.50 Analysis of the potential effects on landscape and visual amenity arising from the proposed development at each of these viewpoints has been carried out. This analysis has involved the production of computer-generated wirelines and/or photomontages to predict the operational views of the proposed development from each of the agreed viewpoints. The existing and predicted views from each of these viewpoints have been analysed to identify the magnitude of impact and the residual effects on landscape character and visual amenity at each viewpoint location.

Criteria for Assessing the Sensitivity of Receptors

4.2.51 The sensitivity of the landscape to change is defined as high, medium or low based on professional interpretation of a combination of its susceptibility to change associated with the type of development proposed, and the value attributed to the landscape. The following parameters were therefore applied in determining the susceptibility of the landscapes within the study area:

- Landscape quality;
- Existing land-use;
- The pattern and scale of the landscape;
- Visual enclosure/openness of views and distribution of visual receptors;
- The scope for mitigation, which would be in character with the existing landscape; and
- The degree to which the particular element or characteristic contribution to the landscape character and can be replaced or substituted.

4.2.52 In determining value, the LVIA uses, as its primary indicator, formal landscape designations. Where other clearly defined indicators were identified, these have also been referred to.

4.2.53 Visual receptor sensitivity is also defined as high, medium or low based on an interpretation of a combination of parameters, and also relates to the susceptibility and value ascribed to visual receptors or receptor locations. The following criteria were utilised in determining viewpoint sensitivity:

- The land use or main activity at the viewpoint/receptor location;
- The frequency and duration of use of receptor location; and
- The landscape character and quality of the intervening landscape.

4.2.54 In relation to land use at the viewpoint, visual sensitivity is defined in Table 4.2, below.

Table 4.2: Sensitivity in Relation to Receptor Type and Activity

Sensitivity	Receptor Type and Activity
High	• Tourists and those engaged in outdoor recreational activities for which the landscape and views form a key part of their experience, including hill walkers and visitors to formal vantage points, • Passengers and Tourist travelling on key routes; • Passengers on trains and ferries where visual amenity and scenic qualities form an integral part of receptors experience and expectations; • Walkers on strategic recreational footpaths or on hills, cycle routes or rights of way; • Visitors to landscapes/sites that have a strong physical, cultural or historic connection with the landscape or a particular view; and • Residential receptors at individual dwellings and within settlements.
Medium	• Local road users/commuters whose are generally travelling alone and/or are focused on the road rather than the adjoining landscape.
Low	• People engaged in outdoor sports or recreation (other than appreciation of the landscape); and

Sensitivity	Receptor Type and Activity
	• Receptors located in commercial and retail buildings, industrial complexes, and other locations where people's attention may be focused on their work or activity.

Criteria for Assessing the Magnitude of Impacts

4.2.55 The magnitude of impact arising from the proposed development may be described as substantial, moderate, slight, negligible or none based on the interpretation of a combination of largely quantifiable parameters, as follows:

- The distance of receptors from the proposed development;
- The duration of the predicted change and whether it is reversible;
- The size and scale of the change anticipated;
- The geographical extent of the study area, landscape character unit, designation or route that would be affected;
- The angle of view in relation to main receptor activity;
- The degree of contrast;
- The background context to the proposed development; and
- The extent and nature of other built development visible, including vertical elements.

4.2.56 The assessment of effects at viewpoints in EIAR Volume 2: Technical Appendix 4.7 quantifies the horizontal angle occupied by the proposed development in each view

4.2.57 Table 4.3, below, provides a brief definition for different magnitudes of impact.

Table 4.3: Magnitude of Impact

Magnitude	Definition
Substantial	Total loss or considerable alteration/interruption of key elements, features or characteristics of the landscape character and/or composition of views resulting in a substantial change to baseline conditions.
Moderate	Notable partial loss or alteration to one or more key features or characteristics of the baseline, resulting in a prominent, but localised change within a broader unaltered context.
Slight	Discernible loss or alteration to one or more key elements, features or characteristics of the baseline conditions. Change arising from the loss/alteration would be discernible but underlying landscape character or view composition would be broadly consistent with baseline.
Negligible	Very limited or imperceptible loss or alteration to one or more key elements/characteristics of the baseline. Change may be barely discernible.
None	No aspect of the proposed development would be discernible. The proposed development would result in no appreciable change to the landscape resource or view.

Criteria for Assessing the Magnitude of Cumulative Impacts

4.2.58 Table 4.3, below, provides a brief definition for different magnitudes of cumulative impact.

Table 4.4: Magnitude of Cumulative Impact

Magnitude	Definition
Substantial	The proposed development would represent a considerable or possibly fundamental increase in the influence of wind energy development on the character of the landscape and/or the composition of views.
Moderate	The proposed development would represent a notable and possibly considerable increase in the influence of wind energy development on the character of the landscape and/or the composition of views. Moderate cumulative impacts may, however, equate to a localised change within an otherwise unaltered context.
Slight	The proposed development would represent a minor addition to the influence of wind energy development on the character of the landscape and/or the composition of views. The change would be discernible, but the original baseline conditions would be largely unaltered.
Negligible	The proposed development would represent a barely discernible addition to influence of wind energy development on the character of the landscape and/or the composition of views. The baseline condition of the landscape or view would, for all intents and purposes, be unaffected.
None	No other cumulative development would be apparent.

4.2.59 In assessing potential cumulative landscape and visual effects, consideration has been given to cumulative effects arising from combined and/ or consecutive (concurrent) visibility (where the observer is able to see two or more developments from one viewpoint location), and sequential effects (where a number of similar developments would be visible individually or simultaneously over a sequence of connected viewpoints, such as would be found along a road or footpath). This is in accordance with current SNH guidance.

4.2.60 Consideration has also been given to the additional effects attributable specifically to the proposed development, as well as its 'in combination' effect, where the combined effect of the proposed development and other cumulative schemes are taken into account.

4.2.61 In accordance with current SNH and Scottish Government policy, projects which are at scoping stage have not been included in the detailed assessment as they may undergo substantial change before a formal planning application is submitted and may not progress to an application at all. The final list of cumulative developments for consideration was derived from THCs online data base (EIAR Volume 3: Figure 4.6), and is summarised in Table 4.6, below. No consideration has been given to turbines less than 50 m to maximum blade tip height above ground level.

Criteria for Assessing Significance

4.2.62 Table 4.5 below, illustrates how residual effects are determined by comparison of the sensitivity of receptors with the magnitude of predicted change. For the purposes of this assessment significant landscape or visual effects are **major** or **major/moderate**.

Table 4.5 Residual Effects

	Magnitude of Change				
Landscape and Visual Sensitivity	Substantial	Moderate	Slight	Negligible	None
High	**Major**	**Major/moderate**	Moderate	Moderate/ minor	None
Medium	**Major/moderate**	Moderate	Moderate/minor	Minor	None
Low	Moderate	Moderate/minor	Minor	Minor/none	None

4.2.63 In line with the recommendations in the GLVIA the matrix is not used as a prescriptive tool or arithmetically, and the methodology and analysis of potential effects at any particular location must allow for the exercise of professional judgement. Descriptions of residual effects, especially those considered significant, are described in narrative text.

4.2.64 Landscape and visual effects can be adverse (i.e. having a detrimental effect on the physical elements, character and visual amenity of the area) or beneficial (i.e. having a positive effect on the landscape and visual amenity of the area through strengthening or augmentation of baseline conditions and/or improvement of the existing landscape or views). For the purposes of this assessment residual effects are assumed to be adverse, unless stated otherwise.

Limitations and Assumptions

4.2.65 The assessment considers receptors in publicly accessible locations. Where assessment of individual residential properties has been undertaken this was completed from publicly accessible locations. In general, no assessment has been undertaken for individual residential or private properties as this is considered a matter of private, as opposed to public interest. There are, however, circumstances where development of the type proposed can be subject to effects that could be material to the determination of a planning application. Such a circumstance was defined in Inspector Lavenders Appeal Decision in respect of Enifer Downs (2009) (Appeal Ref: APP/X22201/A/08/2071880) in which he concludes that: *"when turbines are present in such number, size and proximity that they represent an unpleasantly overwhelming and unavoidable presence in the main views from a house or garden, there is every likelihood that the property concerned would be come to be widely regarded as an unattractive and thus unsatisfactory (but not necessarily uninhabitable) place in which to live. It is not in the public interest to create such living conditions where they did not exist before."* Consequently, an assessment of effects on the amenity of three residential properties that are located within 3 km of the proposed development has been undertaken. An assessment has not been included for residential amenity at Aultguish Inn as this is a commercial property first and foremost.

4.2.66 The data utilised in completion of the LVIA has a number of inherent limitations related to data tolerances and levels of accuracy. However, these have been taken into account in the assessment.

Measurement

4.2.67 Unless stated otherwise, all measurements pertaining to the distance of receptors from the proposed development are based upon the nearest turbine rather than the nearest visible turbine or any other ancillary element of the proposed development. Where measurements pertain to Landscape Character Types (LCTs), designations and classifications, the measurement given relates to the nearest section of the LCT or designated/classified area boundary to the proposed development turbines, which may not be subject to potential views of the proposed development. This is important because effects experienced within such areas may occur at a considerably greater distance, with corresponding consequences for the level of residual effect.

4.3 Existing Landscape and Visual Context

Current Baseline

Landform and Hydrological Features

4.3.1 Figure 4.1 illustrates the topography within the study area. The proposed development is located on a series of shallow hills at an elevation of between 291 m AOD and 392 m AOD and is enclosed to the east, south and west by elevated topography. To the east this includes Carn na Dubh Choile and Gaineamhach (479 and 450 m AOD, respectively)., whilst to the south, the elevated landform comprises Carn Bad Leabhraidh (409 m AOD). To the west the site is enclosed by Beinn nan Cabag (474 m AOD) and more distantly, by the hills west of the Corriemoillie Forest where elevations regularly exceed 500 m AOD.

4.3.2 The topographic of the study area is typified by of mountains ranges, hills, and upland plateau. Elevations in the study area vary between sea level (adjoining the Moray Firth and Cromarty Firth) and 1,127 m AOD (at An Riabhachan) in the Northwest Highland Mountains, at the south extents of the study area.

4.3.3 To the west and north-west of the proposed development the prominent mountain ranges of Sgurr Mor (up to 1109 m AOD), Beinn Eighe (1010 m AOD), Slioch (980 m AOD) and An Teallach (1062 m AOD) rise sharply from areas of rocky moorland, which at its westernmost extents is bisected by Loch Broom and Little Loch Broom.

4.3.4 To the north-east and east of the proposed development the landscape rises to a series of ranges at elevations of between 650 m AOD and 1050 m AOD, the highest summits occurring at Ben Wyvis. In contrast, the landscape is lower lying and flatter where it adjoins the Cromarty and Beauly Firths and the northern extends of the Great Glen, south of Inverness. The coastal edges are characterised by broad, gently undulating planes.

4.3.5 To the south of the proposed development, the landscape comprises dramatic and rugged mountains up to 1083 m AOD (Sgurr a Choire Ghlais).

4.3.6 A notable characteristic of the landscape, and a basis for concentration of settlement and transportation networks, is the network of glens, straths, and lochs that link to the western and eastern coasts of Scotland. The most notable of which include

- Strath Vaich, which extends northwards from the A835 corridor to Tollomuik Forest and which contains Loch Vaich;
- Strath More which corresponds with the alignment of the A835 between the application site and Loch Broom;
- Strath Beag, which is associated with the open waters of Little Loch Broom;
- Strath Bran which extends westwards from Lochluichart to Glen Docherty and the southern extents of Loch Maree, and the eastern extents of Glen Torridon; and

- Strathconnon, which connects Lochluichart and low-lying land at the western ends of the Cromarty Firth and Beauly Firth.

4.3.7 Throughout the study area, micro-topographical features such as the remains of chambered cairns, henges, fort and duns are evident.

Landcover, Land-Use and Landscape Elements

VEGETATION

4.3.8 Vegetation within the application site comprises a mixed commercial forestry, and areas of open moorland grassland.

4.3.9 Vegetation cover within the wider study area varies considerably depending partly upon topography. On elevated slopes and summits a mixture of heather, moorland grasslands and mosses predominate. In contrast, commercial coniferous and native woodlands are present across some of the rounded hills and rocky moorland while in the lower lying straths and farmland areas estate copses, shelterbelts, hedgerows and agricultural grasslands are characteristic features.

ROADS

4.3.10 The road network within the study area is concentrated on the base of glens and straths and along the flatter coastal plains adjoining the Cromarty and Beauly Firths.

4.3.11 The key roads affording potential views of the proposed development include:

- A832 which forms a loop between Braemore and the A835 by Gorstans. At its closest, this route is situated 3.2 km to the south of the proposed development. This route is identified as a 'key route' in THC Onshore Wind Energy SG;
- A835 which is a key tourist route between Ullapool and the A9 carriageway at Tore. At its closest, this route is situated around 1.7 km to the north of the proposed development. This route is identified as a 'key route' in THC Onshore Wind Energy SG;
- A862 which, at its closest, is situated over 13 km to the south-east of the proposed development;
- A9 which connects the central belt of Scotland to northern Caithness, via Inverness. At its closest, this route is located around 13 km to the south-east of the proposed development.

4.3.12 In accordance with Table 4.2, the sensitivity of receptors on key transportation routes varies from medium in respect of general commuters who may be travelling alone and concentrating on the road rather than the adjoining landscape, and high in respect of tourists who are more likely to carry passengers, and who are likely to focus on the landscape.

RAIL

4.3.13 The only public railway liable to theoretical views of the proposed development is the Kyle Line which runs between Inverness and the Kyle of Lochalsh via Strath Bran. At its closest, this route is located around 3.5 km to the south of the proposed development.

4.3.14 In accordance with Table 4.2, the sensitivity of passengers on trains on this route would be high.

RECREATIONAL ROUTES AND SUMMITS

4.3.15 There are a number of long-distance routes, cycleways and core paths within the 45 km study area. However, few of these have theoretical visibility of the proposed development.

4.3.16 Figure 4.4 shows the location of recreational routes and summits which have been considered in this LVIA.

4.3.17 The only long distance or nationally recognised recreational route within the study area with theoretical views of the proposed development is the Great Glen Way. However, predicted visibility is limited to less than 3 km of this route sections to the south west of Inverness, approximately 33.5 km from the proposed development. Consequently, significant visual effects on users of this path are considered unlikely and have therefore not been considered further in the LVIA.

4.3.18 The Highland Council Adopted Core Paths Plan identifies a number of Core Paths within 10 km of the proposed development. Those with potential visibility of the proposed development comprise:

- Core Path RC20.01 and RC20.02 – Tor Breac, located approximately 5 km south east of the proposed development;
- Core Path RC20.03 – Kinellan to Strathgarve, located approximately 6.5 km south east of the proposed development; and
- Core Path RC20.04 – Village River Path, located approximately 6 km south east of the proposed development.

4.3.19 Two heritage paths were identified by Scotways within 10 km of the proposed development. These are:

- The Fish Road/Drovers Road – which commences at Little Garve, ascends the southern flank of Creagan an Eich Ghlais, before progressing northward along the edge of Carn na Dubh and thereafter descending to the A835 by Aultguish Inn; and
- Croick to Black Bridge Track - commencing in Croick and following the eastern side of Strath Vaich and ending at Black Bridge.

4.3.20 The Walk Highlands web site identifies 14 routes within the study area which pass through areas where there is theoretical visibility of the proposed development, including:

- Little Wyvis, near Garve;
- Ben Wyvis, near Garve;
- Beinn a' Chaisteil, via Strath Vaich;
- Carn Ban via Strath Vaich;
- Carn Ban via Alladale;
- Beinn Liath Mhor a'Ghiubhais Li, Loch Glascarnoch;
- Sgurr Mor & the eastern Fannichs;
- Am Faochagach;
- Cnoc Croit na Maoile (Ord Hill), Muir of Ord;
- Sgurr a' Mhuilinn and Meallan nan Uan;
- Glen Strathfarrar Munros circuit;
- Beinn a' Bha'ach Ard;
- Toll an Lochain; and

- Ruadh-stac Beag.

4.3.21 In addition to the above routes, the study area contains substantial opportunities for access to the countryside of the Highlands under the terms of the Land Reform (Scotland) Act 20013. A key part of this access is mountain walking and the study area contains numerous notable summits, including Munros (i.e. selected summits with an elevation exceeding 3,000 feet, or 914 m AOD) and Corbetts (which have summits between 760 m AOD and 914 m AOD), and Grahams (which have elevations of between 609 m AOD and 760 m AOD).

4.3.22 The study area contains 47 Munros, 27 Corbetts, and 30 Grahams. Of these, 21 Munros, 11 Corbetts, and 11 Grahams have theoretical visibility of the proposed development.

4.3.23 For the purposes of this LVIA, a number of summits have been included in the LVIA in both TA4.7: Viewpoint Assessment, and in the assessment of effects on recreational routes in TA4.8: Route Analysis. Whilst not comprehensive, these summits are considered to provide a reasonable and proportionate coverage with which to assess effects on the amenity of hill walkers and the character of the hills.

SETTLEMENT

4.3.24 Settlement within the study area is generally confined to the interior of incised glens and straths, along low lying flatter coastal locations and along principal communication corridors and transportation routes. Examination of the ZTV in Figure 4.5a indicates that the proposed development would be screened from the majority of such settlements, the viewshed of the proposed development mainly coinciding with elevated slopes and summits. However, there are a number of exceptions to this, including:

- Inverness - a key coastal city located at the transition between the Beauly and Moray Firths, which is located over 37 km to the south-east of the proposed development.
- Kirkhill, which is a village in north Inverness-shire, close to the south opening of the Beauly Firth, and 16 km west of Inverness. This settlement is located over 28 km to the south-east of the proposed development.
- Muir of Ord which is a village near the western boundary of the Black Isle, about 14.4 km west of the city of Inverness and is located around22 km to the south-east of the proposed development.

4.3.25 Within 5 km of the proposed development, residential properties are limited to a small number of scattered houses along the A835, including:

- Lubfearn (approximate location – 238469, 870237): A croft consisting of a single storey dwelling and connecting outbuildings with informal gardens and adjacent fields. This property is situated around 2.4 km to the north-east of the proposed development;

- Black Bridge (approximate location – 23171, 871031): A two-storey detached property with no apparent defined garden space. Situated around 2.7 km to the north of the proposed development;

- Hydro House – (approximate location – 237326, 871082): A two-storey detached property with no apparent formal and informal gardens. Situated around 2.77 km to the north of the proposed development.

4.3.26 The community of Garve, located approximately 5.8 km south east of the application site, is the nearest small settlement with potential visibility of the proposed development. Garve is located on the A835, just south of the junction with the A832. Properties within Garve comprise a mix of detached and semidetached bungalows with dormer windows, with a small number of double storey properties. Houses are largely oriented north - south to the south of the settlement, and east - west to the north. The Black Water defines the settlement boundary to the east.

4.3.27 In accordance with the criteria in Table 4.2, residential receptors (including those at scattered dwellings and within larger settlements) are generally assumed to have a high sensitivity to the type of development proposed.

Landscape Character Types

4.3.28 Figure 4.2a shows the location and extent of landscape character types found within the study area. The findings of these studies were verified during field reconnaissance and have been taken to represent a suitable baseline context for the assessment.

4.3.29 LCTs and constituent Units within the study area which, according to Figure 4.2b are subject to theoretical views of the proposed development include the following:

- Undulating Moorland LCT (RCY 2) - which partially contains the proposed development;
- Rocky Moorland LCT (RCY 4) - which partially contains the proposed development;
- Rounded Hills LCT (RCY 7) - which partially contains the proposed development;
- Narrow Farmed Strath (LCT RCY 8) - 3 km south east;
- Rugged Mountain Massif (LCT RCY6) - 8.8 km west;
- Smooth Moorland (RCY1) - 8.9 km north west;
- Irregular Massif (LCT CSL6) - 14.8 km north;
- Forest Edge Farming (LCT RCY10 and MYF7) - 14.5 km south east and;
- Sloping Terrace Moorland (LCT RCY3) - 15.8 km south south-east;
- Rugged Massif (LCT INV1) - 18 km south; and
- Rocky Moorland Plateau with Woodland (INV4) - 30 km south east

4.3.30 Technical Appendix (TA) 4.2 provides descriptions of these LCTs, along with an assessment of their sensitivity to the type of development proposed based on pre-defined criteria. The assessment of potential residual effects on these LCTs is summarised in TA 4.4.

4.3.31 Other LCTs which fall within the theoretical viewshed of the proposed development, but that have been omitted from the assessment, are listed in TA 4.2, along with the justification for their omission.

4.3.32 The application site is situated at the confluence of three LCTs:

- RCY2: Undulating Moorland - Glascarnoch Unit;
- RCY4: Rocky Moorland – Lochluichart Unit; and
- RCY7: Rounded Hills - Dornoch Firth/Loch Fannich unit.

4.3.33 It is apparent from the description of these landscape in TA 4.2, that these units are not typical of their wider character type, being of a comparatively smaller scale than the vast uplands found elsewhere in these LCTs. It is also the case that the units listed are subject to greater influence of human artefacts, including wind turbines, grid infrastructure and forest cover.

4.3.34 The units are generally experienced from key receptor locations within incised glens and straths including the A832/Strath Bran and the A835 corridor, from where only two of the LCTs are visible from any given location. RCY2 – Glascarnoch Unit, is only evident from the A835 corridor, whilst RCY4 – Lochluichart Unit is only evident from the A832.

4.3.35 From much of the A835 route the RCY7: Rounded Hills - Dornoch Firth/Loch Fannich unit.is principal landscape context, RCY 2 and RCY4 being screened by intervening topography. As this route approaches the Glascarnoch Dam and Aultguish Inn, however, RCY2 emerges in oblique and perpendicular views from the road. Its slacker slopes providing a sense of increased scale in respect of views from the road. RCY4 is not apparent in this view as it is obscured by intervening topography.

4.3.36 Viewed from remote elevated summits distinctions in topographical form and landcover are less immediately evident, the existing Corriemoillie and Lochluichart developments provide a conspicuous developed context.

Landscape Designations

4.3.37 The location and geographical extent of landscape designations and classifications within the study area are shown on Figure 4.3a.

4.3.38 The site itself is not subject to landscape designation. Those designated landscapes within the study area which, according to Figure 4.3b have theoretical visibility of the proposed development, and are therefore taken account of in this assessment are:

- Wester Ross National Scenic Area (NSA), which is located approximately 25 km west of the proposed development;
- Three of the Highland Council Special Landscape Areas (SLAs), consisting of:
- Ben Wyvis SLA, located approximately 5.1 km east of the proposed development;
- Fannichs, Beinn Dearg and Glencalvie SLA, located approximately 5.5 km north west of the proposed development; and
- Strathconnon, Monar and Mullardoch SLA, located approximately 12 km south west of the proposed development.

4.3.39 There are also 20 Inventory Gardens and Designed Landscapes (GDLs) located within the LVIA study area. Those with potential visibility of the proposed development comprise:

- Fairburn GDL - located approximately 15.3 km to the south east of the proposed development; and
- Leys Castle GDL - approximately 40 km to the south east of the proposed development.

Classified Landscapes

4.3.40 There are seven Wild Land Areas (WLAs) located within the study area. Of these, five are subject to theoretical visibility of the proposed development, including:

- WLA 29 - Rhiddorochis, Beinn Dearg and Ben Wyvis, which, at its closest, is around 2.5 km to the north east of the proposed development;
- WLA 28 - Fisherfield, Letterewe, Fannichs, located approximately 3 km to the west of the proposed development;

- WLA 24 - Central Highlands, which is around 11 km to the south of the proposed development;
- WLA 26 - Coulin and Ledgowan Forest, which lies approximately 27 km to the south west of the proposed development; and
- WLA 27 - Flowerdale-Sheildaig-Torridon, approximately 32 km west of the proposed development.

4.3.41 Given the distance between the proposed development and WLA 24 - Central Highlands, the WLA 26 - Coulin and Ledgowan Forest, and WLA 27 - Flowerdale-Sheildaig-Torridon, the potential for significant effects as a result of the proposed development were considered unlikely. Therefore, these WLA were scoped out of the assessment.

4.3.42 A Wild Land Assessment has been prepared for the Rhiddoroch - Beinn Dearg - Ben Wyvis WLA (WLA 29), and the Fisherfield - Letterewe - Fannichs WLA (WLA 28). This was agreed with SNH during consultations.

Cumulative Context

4.3.43 Table 4.5 summarises the cumulative context at the time of the LVIA. The location of these developments is indicated in Figure 4.6.

Table 4.6: Cumulative Wind Farms

Status	Wind Farm	No of Turbines	Max Height of Turbines to Blade Tip (m)	Direction from the Proposed development	Approx. Distance from the Proposed Development	Landscape Character Type
Operational	Corriemoillie	19	126.25	west	380 m	Rounded Hills
	Lochluichart	17	125	west	2.3 km	Rounded Hills
	Lochluichart Extension	6	125	west	2.4 km	Rounded Hills
	Fairburn	20	100	south	14.5 km	Rocky Moorland (19 turbines); Sloping Terrace Moorland (1 turbine)
	Novar	34	60	east	16 km	Rounded Hills (13 turbines); Rocky Moorland (21 turbines)
	Novar Extension	16	106	east	15.5 km	Rounded Hills (1 turbine);

Status	Wind Farm	No of Turbines	Max Height of Turbines to Blade Tip (m)	Direction from the Proposed development	Approx. Distance from the Proposed Development	Landscape Character Type
						Rocky Moorland (15 turbines)
	Auchmore	1	79	South-east	20.8 km	Sloping Terrace Moorland
	Auchmore Extension	1	79	South-east	21.8 km	Sloping Terrace Moorland
	Coire na Cloiche	13	99.5	North-east	23 km	Rounded Hills
	Corrimony	5	100	south	42 km	Rocky Moorland Plateau
	Achany	19	100	north north-east	37.5 km	Moorland Slopes and Hills (17 turbines); Sweeping Moorland (1 turbine)
	Rosehall	19	90	north north-east	36.8	Forest Slopes and Moorland Mosaic (15 turbines); Moorland Slopes and Hills (4 turbines)
	Lairg	3	100	north north-east	41.8	Moorland Slopes and Hills
	Bienn nan Oighrean	2	80	North-east	26.7	Rounded Hills
	Beinn Tharsuinn	17	80	North-east	26.4	Rounded Hills
	Bhlaraidh	32	135	south	44.7	Rocky Moorland Plateau
	Yellow Wells	1	78	east	20.8	Rounded Hills

Status	Wind Farm	No of Turbines	Max Height of Turbines to Blade Tip (m)	Direction from the Proposed development	Approx. Distance from the Proposed Development	Landscape Character Type
Consented	Braemore	18	126	North north-east	35.7	Coniferous Woodland Plantation (15 turbines); Moorland Slopes and Hills (3 turbines)
	Belladrum Kiltarlity	1	61	south east	30 km	Enclosed Farmland

4.3.44 In general terms, the emergent pattern of development is for clusters of turbines with a spacing of greater than 8 km, up to 12 km in the case of the separation between the Lochluichart/Corriemoillie cluster and the adjacent Fairburn and Novar clusters. Lochluichart/Corriemoillie turbines combine to form a concentration of turbines in the rounded hills which has avoided the dispersal of development and associated cumulative effects.

4.3.45 Lochluichart Wind Farm (and extension) is based on ground levels of between 333 m AOD and 472 m AOD with maximum blade heights of 597 m AOD, whilst Corriemoillie turbines are located at between 317 and 395 m AOD and its turbines have a maximum tip height of 520 m AOD.

4.3.46 The Lochluichart turbines are based on spacing of between 300 and 500 m. The Lochluichart array arranged in a series of parallel rows oriented broadly north-south along the southern flank of Meall Mhic Lomhair. In contrast, Corriemoillie turbines are arranged with spacings of between 430 and 600 m and are configured as a more irregular cluster of turbines, reflecting the more irregular form of the underlying topography in which it is located.

Future Baseline

4.3.47 With the exception of distant historical events, the landscape within the centre study area where there is visibility of the proposed development exhibits a relatively limited trend of change. This, in part, reflects the difficulties in development of the mountainous terrain and relatively low population level.

4.3.48 The greatest changes apparent in the study area relate to the ebb and flow of settlement, improvements to road infrastructure, and expansion of power transmission infrastructure within straths and glens where access and terrain are more accommodating.

4.3.49 Commercial forestry and associated felling and forest infrastructure constitute a cause of change in the landscape historically but are largely confined to the elevated drier sides of straths and glens, leaving the more elevated open tops of hills and plateaus that contain the greatest peat resource as open moorland.

4.3.50 In the absence of the proposed development and without dramatic changes to policy or economic drivers in the area, the established trends in respect of land use/landcover and the baseline landscape and visual context will remain largely unaltered.

4.4 Predicted Impacts

Potential Construction Impacts

4.4.1 The construction phase would be approximately 18 months in duration. The methods that would be utilised during the construction stage are described in Chapter 2: Proposed Development.

4.4.2 The following elements and activities associated with the construction phase of the proposed development have the potential to result in effects on the landscape and visual amenity of the study area:

- Construction of a new site access tracks and bell mouth entrance on the side of the A835;
- Construction of temporary site compounds incorporating site offices;
- Construction of site infrastructure, including tracks between turbine locations;
- Construction of laydown areas and crane pads;
- Construction of substation and compound, incorporating control room;
- Construction of energy storage facility;
- Excavation and construction of turbine foundations;
- Erection of turbines;
- Excavations of ditches for underground cables;
- Excavation temporary mineral extraction areas;
- Creation of a possible temporary batching plant;
- HGV and abnormal load deliveries to site and movement of vehicles on site; and
- Reinstatement work, including restoration of borrow pits and removal of temporary accommodation works.

4.4.3 The majority of effects occurring during this phase would concern disturbance of existing landcover at the site and potential for long term change or loss of characteristic vegetation with consequent effects on the character and amenity of the site and the adjoining area. However, a large proportion of the construction effects would be managed through adoption of good practice and careful construction management and monitoring regimes (such as those presented in the schedule of environmental commitments in Chapter 13). Given the relatively localised, short duration and partially reversible nature of such effects, they are considered unlikely to result in significant effects on landscape fabric.

Potential Operational Impacts

4.4.4 The operational life of the proposed development would be 30 years. The operational elements with the potential to affect the landscape and visual amenity of the study area are:

- Wind turbine generators and external transformers;
- En-route lighting on turbine towers/nacelles;
- On-site access tracks and hardstanding areas;
- Restored temporary mineral extraction areas;

- Any retained off-site highway improvements and any new roads for HGV deliveries established during the construction phase of the proposed development;
- Sub-station/ site control building; and
- Potential energy storage facility.

Potential Decommissioning Impacts

4.4.5 Decommissioning of the proposed development could have effects similar to that of the construction period with temporary disturbance of landscape fabric and effects on landscape character and visual amenity, both within the site and in the wider study area. Detailed decommissioning proposals would be devised in conjunction with THC, SNH and other statutory consultees prior to the commencement of this phase, the emphasis being upon minimising landscape and visual effects.

4.5 Mitigation

4.5.1 The siting and design of the proposed development has been influenced by a number of national and regional sources of guidance, including:

- SNH's current guidance on the siting and design of wind farms;
- Scottish Planning Policy; and
- THC's 2016 Adopted Onshore Wind Energy Supplementary Guidance (SG)

SNH Guidance

4.5.2 Paragraph 1.15 of the SNH guidance (guidance) states that "Wind farms should be sited and designed so that adverse effects on landscape and visual amenity are minimised and so that landscapes which are highly valued are given due protection."

4.5.3 Paragraph 2.15 states that "Choice of turbine size is an integral part of the design process. Identification of the key landscape characteristics, their sensitivity and capacity to accommodate change will inform this. Generally speaking, large wind turbines will appear out of scale and visually dominant in lowland, settled, or smaller-scale landscapes, which are often characterised by the relatively 'human scale' of buildings and features. They are best suited to more extensive, upland areas, and set back from more sensitive upland fringes. This can reduce effects on settled and smaller-scale valleys and lowland landscapes."

4.5.4 Paragraph 2.16 states that "turbine size is also a key issue in upland landscapes, where they are viewed against, or from, landscapes of a more intricate scale and pattern; or where it is otherwise difficult to discern the landscape scale and distance. By illustrating the scale of an upland landscape, wind turbines may seem to conflict with the expansive nature of these areas."

4.5.5 Paragraph 2.20 goes on to propose that "ancillary elements for a wind farm development should be designed so they relate to the key characteristics of a landscape. It is important that these elements do not confuse the simplicity of the wind farm design, or act as a scale indicator for the turbines themselves. Undergrounding power lines within the wind farm, using transformers contained within tower bases (where possible), and careful siting of substations, transmission lines, access tracks, control buildings and anemometer masts will all help to achieve a coherent wind farm design. Simplicity of appearance and use of local, high quality materials will further enhance this."

4.5.6 Paragraph 2.25 addresses the layout of turbines and suggests that "turbines can be arranged in many different layouts. The layout should relate to the specific characteristics of the landscape - this means that the most suitable layout for every development will be different."

4.5.7 Paragraph 3.23 discusses design responses to terrain, stating that "landform is a key landscape characteristic, whether it is rugged, flat, undulating or rolling, upland or lowland. In flat landscapes, any undulations tend to become accentuated so that even low hills appear substantial."

4.5.8 Paragraph 3.24 goes on to state that "it is generally preferable for wind turbines to be grouped on the most level part of a site, so the development appears more cohesive, rather than as a poorly related group of turbines."

4.5.9 The guidance identifies skylines to be of critical importance and posits that the design should avoid detracting from, or overwhelming the character of distinctive skylines, as well as avoiding variable heights or overlapping turbines.

4.5.10 A further design objective discussed in the guidance is the appropriate scale for the wind farm that is in keeping with that of the landscape. SNH suggests that the proposed development should form an element of:

- Minor vertical scale in relation to the other key features of the landscape;
- Minor horizontal scale in relation to the key features of the landscape (where the wind farm is surrounded by a much larger proportion of open space than occupied by the development); and
- Minor size compared to other key features and foci within the landscape; or separated from these by a sufficiently large area of open space (either horizontally or vertically) so that direct scale comparison does not occur.

4.5.11 The guidance also discusses the relationship between wind farms. A key factor determining the cumulative impact of wind farms is the distinct identity of each development. This relates to their degree of separation and similarity of design between wind farms. This applies whether they are part of a single development, a wind farm extension, or a separate wind farm in a wider group. A wind farm, if located close to another of similar design, may appear as an extension. However, if it appears at least slightly separate and of different design, it may conflict with the other development.

THC Guidance

4.5.12 According to THC's SG and spatial framework (EIAR Volume 3: Figure 3.2) the proposed development would predominantly be located largely in a Group 2 area which is defined by SPP as locations where wind farms may be appropriate in some circumstances, given further consideration to demonstrate that any significant effects on their classifying qualities can be substantially overcome by siting, design or other mitigation. The mapped presence of carbon rich soils forms the sole reason for the proposed development not be entirely classed as Group 3, where wind farms are likely to be acceptable, subject to detailed consideration against identified policy criteria.

4.5.13 Section 4 of THC's Adopted Onshore Wind Energy Supplementary Guidance (2016) contains a series of criteria relating to potential landscape and visual effects of developments. It should be noted that these criteria are not policy tests but are intended as a framework and focus against which the THC can assess proposals. The Planning Statement to be submitted alongside the EIA-R contains an evaluation of the proposed development against these criteria and is based, to a large degree, on the findings in Section 4.6 and 4.7 of this LVIA.

Siting and Design Priorities

4.5.14 The design of any on-shore wind farm is a matter of balance between commercial, technical and environmental constraints and opportunities. EIAR Chapter 2: Proposed Development [Design Evolution and Alternatives] provides a summary of the key design drivers and decisions made during the course of the design of the proposed development.

4.5.15 It is clear from the description of the design process that landscape and visual considerations, such as the existing landscape and visual baseline context as well as the published guidance and recommendations made by SNH and THC (as summarised in Table 4.1, above) were key to the design development. In landscape and visual terms, the siting and design priorities applied included:

- Location of the proposed development outwith areas classified as Group 1, and outwith areas defined as Group 2 on landscape and visual grounds in the 2016 spatial framework for onshore wind energy.
- Location of proposed development outwith areas subject to landscape designations or classifications, and away from settlements and other concentrations of receptors.
- Positioning of the proposed development in larger scale upland moorland and forested locations that are more capable of accommodating wind turbines than smaller scale landscapes.
- Location of the proposed development away from distinctive landscape features the scale and form of which could be compromised
- Avoidance of the interruption of views of key landmark landscape features such as Ben Wyvis.
- Positioning of turbines to take advantage of topographical enclosure formed by elevated summits and ridgelines around the site to reduce the visibility and prominence of the proposed development from key receptor locations to the west, south and east, including settled straths and glens and the key transportation and tourist/scenic routes.
- Positioning of the proposed development so that it appears in close association with the adjacent cluster of existing Lochluichart and Corriemoillie wind turbines, thereby adding to an existing cluster of wind farms rather than contributing to a more dispersed pattern of development that would have a greater and wider geographical spread of cumulative effects.
- Location of the proposed development on topography that is broadly consistent with that of the adjoining Corriemoillie site, but marginally lower in elevation (i.e. at between 291 m AOD and 392 m AOD, in contrast with the levels of the Corriemoillie site which are between 317 and 395 m AOD), thereby providing a suitable basis for the accommodation of the proposed developments taller turbines without significantly exceeding the maximum blade tip elevation of the Corriemoillie and Lochluichart turbines.
- Adoption of turbine spacings that are broadly consistent with those of the neighbouring Corriemoillie Wind Farm.
- Minimisation of extent to which the proposed development would be seen without the context of the Corriemoillie and Lochluichart wind farms.
- Preferential use of existing tracks on site to minimise effects associated with this aspect of the proposed development;
- Minimisation of the amount of site infrastructure and ancillary elements required, and careful positioning and design to ensure that such elements are screened from the majority of external receptor locations; and

- Careful siting and design of proposed substation and control room along with potential associated energy storage facility to minimise visibility from external receptor locations.

4.5.16 Turbine type, relative size and geometry of turbines was also considered during the design of the proposed development. Whilst it is generally desirable to match the specification of the turbine type and geometry for new development with that of existing established developments immediately adjacent, this is proving impractical in many cases, either on commercial or technical grounds. In landscape terms differences in turbine type and geometry are often cited as exacerbating residual landscape and visual effects. However, the subject is more nuanced and complex than this and depends, upon a range of circumstances, including:

- the relative rotor size of turbines (as this is often the main element that is visible and intervisible between schemes);
- the proximity, relative visibility and prominence of neighbouring wind farms, larger turbines may be less obviously different when seen more distantly and less prominently (as in views from oblique angles to the south-west of the proposed development;
- the degree to which contrasting schemes overlap and whether larger turbines are seen behind or in front of adjacent developments. Seen at distance and substantially overlapped by smaller turbines the contrast between existing and proposed turbines can be lessened. Conversely, when seen in front of small turbines, larger models do not distort the perspective of receptors, as in the case in views from locations to the east of the proposed development, including the Ben Wyvis summit (Viewpoint 6);
- Whilst rotor size differences can result in variations in rotor speed between neighbouring schemes, this can also be the case in respect of different models of turbines with the same geometry. It is also the case that some differences in rotor speed occur within individual wind farms as a result of differing wind conditions associated with topography, elevation, land cover.

4.5.17 The efficacy of the siting and design measures is evidenced by the relatively constrained viewshed indicated in the ZTV in Figure in EIAR Volume 3: Figure 4.5a. Matters pertaining to the design and appearance of the proposed development, including matters pertaining to appreciable turbine size differences, are discussed in relation specific viewpoint locations in EIAR Volume 2: Technical Appendix 4.7: Viewpoint Analysis.

Mitigation during Construction

Substation and Energy Storage Facility

4.5.18 The control building and substation, along with potential associated energy storage facility, would be located within the undulating elevated large-scale forested landscape within the site and away from exposed slopes and the A835 corridor. The buildings and housings would be positioned on a slight break of slope, in order to avoid the necessity for extensive ground modelling or excavations that could form scarring on the hillside. Its forested position provides some scope for screening this aspect of the proposed development from external receptor locations.

4.5.19 Owing to current rapid market evolution (as addressed in EIAR Chapter 2: Proposed Development), technical design for an optimal energy storage facility would need be agreed via planning condition prior to start of construction for this element (being located upon the base of the otherwise temporary construction compound related to the adjacent substation). For the purposes of the LVIA, it has been assumed that the energy storage facility would comprise a number of modular steel containers along with associated electrical components and smaller GRP housings, enclosed by palisade fencing within a maximum 75m by 45m area, as indicatively portrayed at Figures 2.10 and 2.11.

General Construction Mitigation Measures

4.5.20 The location and management of construction elements has been carefully considered to minimise environmental effects including potential landscape and visual effects during the construction stage. Additionally, the following general precautionary measures would be adopted in order to minimise landscape and visual effects:

4.5.21 All working areas would be restricted as far as practicable to the specified areas and demarcated to prevent incursion of site plant into non-construction locations:

- Material storage/temporary stockpiles would be retained for the shortest duration practicable and would be sited to avoid visual intrusion to neighbouring receptor locations, with particular regard to avoidance of sky-lining such features in views from the A835 carriageway.
- Peat materials would be placed directly wherever practicable to avoid double handling, reduce vehicle movements, and to reduce potential drying and oxidisation of the peat. Where this is not possible the peat shall be stored in accordance with the EIAR Volume 2: Technical Appendix 9.4: Peat Management Plan;
- temporary site compounds and temporary mineral extraction areas would be reinstated prior to the commencement of the operational phase of the site to avoid the necessity of retaining restoration materials on site over the operational period and to avoid sustained effects on landscape fabric character and visual amenity;
- The surface of lay-down areas would be reinstated to replicate the appearance of adjoining moorland, but retaining and
- Excavations for turbines foundations, laydown areas and underground cables, would be reinstated prior to commencement of the operational phase of the proposed development and all track sides would be reinstated with translocated turves to ensure they would blend in with the adjoining (undisturbed) ground in the site.

Temporary Construction Compounds

4.5.22 A total of up to four temporary construction compounds are proposed: two close to the main site entrance off the A835 (‘initial’ and ‘main’); one to the north of turbine 3; and one adjacent to the substation, providing a potential location for a permanent battery energy storage facility (as addressed above).

4.5.23 The use of four compounds is intended to limit the necessary overall size of compound and reduce length and frequency of on-site vehicle movements. It is also intended that all temporary compounds would be returned to a condition consistent with that of the adjoining moorland during final construction works at the site.

Concrete for Turbine Bases

4.5.24 It is the intention that concrete required for the construction of turbine foundations will be produced at a batching plant to be established within the temporary construction compound north of Turbine 3. This would be screened from a large proportion of external receptor locations along key transportation routes and settlements. In any event, this is a temporary element and would be removed and restored during final construction works at the site.

Mineral Extraction Areas

4.5.25 It is proposed that the majority of aggregate for new tracks would be won from mineral extraction areas at the site. Currently two temporary mineral extraction areas are proposed (EIAR Volume 3: Figure 2.1a and b). Of the mineral extraction areas, one is positioned immediately west of Turbine 3, and the other proposed at the centre of the site between Turbines 8 and 12. These locations were selected to minimise the visibility of these elements form external receptor locations, including view from Ben Wyvis, as well as minimising their effect on the Drovers Road. Their position was also selected to avoid prominent exposed slopes or ridgelines or highly distinctive topographical forms that might make sympathetic restoration difficult. The distribution of the mineral extraction areas is intended to reduce the length of site haulage of stone and its consequent effects on the character and amenity of the adjoining landscape.

4.5.26 It is intended that the size of any excavation would be limited as far as possible to avoid formation of large-scale unsightly excavations that might prove onerous to restore. Detailed designs and restoration proposals for the mineral extraction areas would be provided to THC and SNH prior to commencement of construction works at the site but are anticipated to comprise a partially backfilled void topped with selected soils/peat materials and translocated turf (as set out in EIAR Volume 2: Technical Appendix 9.3). Additionally, in order to avoid the establishment of anomalous cut faces on the upper part of the excavation the softening of sharp edges of the mineral extraction areas by restoration blasting are proposed, the resultant slopes to be covered in restoration substrate and turf to ensure that the pit blends in with the adjoining landscape.

Crane Pads and Laydown Areas

4.5.27 These elements of the proposed development would be kept to a minimum size and would be surfaced to match the track construction. Laydown areas not potentially required for future maintenance could be removed at the end of the construction phase of the proposed development and the ground reinstated to match adjoining undisturbed ground. Alternatively, the surface of the laydown areas could be reinstated to match adjoining moorland whilst a form sub base is retained for future use if required. The final option in this regard would be confirmed prior to construction operations commencing at the site.

Mitigation during Operation

4.5.28 Mitigation measures relating to the operational phase of the proposed development have been incorporated into the design of the proposed development, as described in paragraph 4.5.15, above, and in Chapter 2: Description of the Development of the EIAR.

Mitigation during Decommissioning

4.5.29 The decommissioning phase of the proposed development would be of a shorter duration to that of the construction phase, with the dismantling of all above ground structures and reinstatement of disturbed ground, subject to a hydrological assessment. Below ground structures would be left in place to avoid further disturbance. There would therefore be a temporary impact from the activities on site to remove structures, but this would be of relatively short duration. Accordingly, the decommissioning phase is considered to be likely to have a minimal effect on the landscape and visual amenity of the locality.

Mitigation measures associated with decommissioning would be agreed during the preparation of the final decommissioning plan, that would require approval of statutory consultees and ECU.

4.6 Residual Effects during Construction

4.6.1 The following section summarises the identification of residual effects (taking into account the efficacy of mitigation/design) relating to landscape fabric, character designations and visual amenity.

Residual Effects on Landscape Fabric during Construction

4.6.2 Chapter 2: Proposed Development [Development Description] details the landtake associated with the construction of the proposed development. This indicates that, including temporary disturbance, the proposed development would cause disturbance of, or change to around 25.5 hectares (ha) of the site. However, of that, 15.4 ha would comprise temporary disturbance associated with the establishment of temporary compounds and laydown areas. The remaining 10.0 ha of the proposed development site would be subject to long term alteration associated with turbine bases, crane pads, communications mast, the control room and compound, the substation and compound, the potential energy storage facility, and site access tracks.

4.6.3 The key change to the fabric of the landscape within the site would relate to some minor localised changes to site topography and losses to characteristic landcover. This is considered to represent a non-significant effect, and one which would be largely reversible upon decommissioning of the proposed development.

Residual Effects on Landscape Character Types during Construction

4.6.4 The effect of construction operations at the development site would be localised to construction locations and would be of relatively short duration and much of the disturbance associated with construction would be ameliorated or removed during subsequent reinstatement activities. Consequently, they are not considered to represent significant residual effects on landscape character either within or in the adjacent landscape.

Residual Effects on Designated Landscapes during Construction

4.6.5 As with predicted effects on landscape character types, effects on designated landscapes within the study area are also not anticipated to be significant. The proposed development would occur outwith designated areas and would therefore have no direct effect on designated landscapes. Whilst indirect effects are likely, primarily as a result of the operation of cranes and erection of turbines, such effects would be localised and would be of a short duration. Consequently, such effects are not considered to represent significant residual effects on adjacent designated landscapes.

Residual Effects on Visual Amenity during Construction

4.6.6 Construction operations at the site would be confined to locations within the site that are screened from the majority of external receptor locations, including settlements, transportation routes and the majority of recreational routes, the exception to this being the operation of site cranes and erection of turbines. However, even these aspects of the construction operations would be of relatively short duration. In this context, residual construction effects on visual amenity are considered unlikely to be significant.

4.7 Residual Operational Effects

Operational Effects on Landscape Character

4.7.1 The study area for the LVIA contains a total of 46 distinct LCTs. A total of eleven would be subject to views of the proposed development and were therefore included in the assessment. These are listed and described in TA4.2 and assessed in TA4.4, and where there is variance in the character or the level of effects from the proposed development in different units of the LCT this is identified.

4.7.2 Based on the assessment undertaken significant residual effects were predicted within the following LCTs:

- RCY2: Undulating Moorland – Strath Bran unit and within the site, where the proposed development would introduce a prominent addition to the established cumulative wind farm context and reduce the remoteness of the landscape. The proposed development is partially located within the Glascarnoch unit of RCY2 and would therefore have direct, albeit non-significant effects on the topography and landcover of this unit but would result in **major** (significant) effects on its character introducing additional movement and man-made elements to a mostly still landscape of moorland and forestry.
- RCY4: Rocky Moorland – Loch Luichart unit, which would be subject to **major/moderate** significant effects within the application site, and at the summits Creag nan Corrachan, Sgurrachd Ire and Sgurr Marcasaidh and little Wyvis summits. Significant effects in this unit would arise from the proximity of the development to receptor locations and its role in extending the lateral extent and influence of wind energy development, thereby impacting upon views to the north, lessening the perceived remoteness of the landscape and increasing the influence of human artefacts.
- RCY7: Rounded Hills - Dornoch Firth/Loch Fannich unit. **Major/moderate** significant indirect effects within this unit would be confined to:

- the summits of Meall na Speiraig, Beinn Liath Beag and Meallan Caoruinn;
- low lying positions along the A835 corridor;
- the southern extents of Strath Vaich; and
- the summit of Little Wyvis.

The proposed development's visual prominence, which is partially derived from its scale but more critically its horizontal spread relative to the existing Corriemoillie wind farms in views would result in effects on the perceived scale and form of the landscape in this LCT (most notably the A835 corridor and southern extents of Strath Vaich).

4.7.3 With regard to the effect of the proposed development upon the distinctiveness of these LCT units it is noted that the units are generally experienced from key receptor locations within incised glens and straths including the A832/Strath Bran and the A835 corridor, from where only two of the LCTs are visible from any given location. RCY2 – Glascarnoch Unit, is only evident from the A835 corridor, whilst RCY4 – Lochluichart Unit is only evident from the A832.

4.7.4 From much of the A835 route the RCY7: Rounded Hills - Dornoch Firth/Loch Fannich unit is principal landscape context, RCY 2 and RCY4 being screened by intervening topography. As this route approaches the Glascarnoch Dam and Aultguish Inn, however, RCY2 emerges in oblique and perpendicular views from the road. Its slacker slopes providing a sense of increased scale in respect of views from the road. RCY4 is not apparent in this view as it is obscured by intervening topography. The proposed development would appear almost entirely in the context.of the RCY2 unit and cannot therefore be considered to affect the distinctiveness of the other two landscape types.

4.7.5 Views of the proposed development from the A832 are substantially restricted by a combination of intervening topography and vegetation. Consequently, the effect of the proposed development on the distinctiveness of landscapes would not be significant.

4.7.6 Viewed from a large proportion of remote elevated summits the distinction between LCTs is less immediately evident, the site often being seen partially obscured by intervening receding ridgelines and summits. Where the interior of the site is more evident distinctions in topographical form and landcover are less immediately evident, the existing Corriemoillie and Lochluichart developments provide an existing developed context. Key distinctions in landscape are associate with the more elevated and distinctive summits of the Rugged Mountain Massifs of the Fannichs, which are seen distantly to the west.

4.7.7 Viewed from the site itself (e.g. on the Drovers Road at Viewpoint 2), views are largely contained to within the immediate confines of the site which is characteristic of the RCY4: Rocky Moorland – Lochluichart Unit. Views into the neighbouring RCY7: Rounded Hills - Dornoch Firth/Loch Fannich unit, to the west, are restricted by intervening topography, the LCT appearing largely as a series of more distant hills, thereby avoiding effects on the distinction between these two LCTs.

Operational Effects on Landscape Designations

4.7.8 In total there are five NSAs, five SLAs and twenty GDLs within the study area. Those with potential views of the proposed development are assessed in detail in TA4.5, and the findings summarised below.

Wester Ross NSA

4.7.9 The proposed development would affect a limited geographical extent of the NSA, and where it is visible, would be seen distantly and would be partially screened by intervening topography. The proposed development would also appear behind and overlapping with the existing/consented Corriemoillie and Lochluichart wind farms and represent a barely discernible change to existing long-range panoramic views from this designated landscape. Consequently, the influence and prominence of the proposed development would be negligible and not constitute a significant effect on the scenic quality or wildness of the NSA or its key characteristic related to the dominance of spectacular and magnificent mountains; large sweeps of open, expansive moorland superb coast and coastal views, or the many layered landscape, with visual continuity of coastal, moorland and mountain.

Ben Wyvis SLA

4.7.10 Generally, no significant indirect effects are anticipated as, viewed from elevated summits of Ben Wyvis, the proposed development would occupy a small proportion of what are vast panoramic views, would occupy a low-lying position, and would overlap with the existing developed context of the Corriemoillie and Lochluichart developments.

4.7.11 Viewed from the popular walk that descends from Ben Wyvis, to the A835, the proposed development would be closer and more prominent, but would be subject to increased screening as a result of the intervening topography of Carn na Dubh Choille and Carn Gaineamhach which encloses the application site on its eastern side. It is also the case that the key special qualities of the SLA are not evident from the lower sections of this route where views reduce in scale and there is increased influence of human activities and artefacts. Views from this route when ascending the side of Ben Wyvis are oriented away from the proposed development.

4.7.12 No significant effects on the “dominant” landmark quality of Ben Wyvis are anticipated, but significant effects on the landmark quality (“locally prominent”) of Little Wyvis are predicted. These would affect eastbound road users on the A835 between Loch Droma and the Loch Glascarnoch dam from where the proposed development turbines would be interposed between receptors and Little Wyvis. However, it is important to note that the A835 lies outwith the SLA.

Fannichs, Beinn Dearg and Glencalvie SLA

4.7.13 Residual effects on the SLA would range from none (in locations with no visibility of the proposed development), to moderate at Inchbae Forest, Strathvaich Forest and Strath Vaich, and Tollomuik Forest.

Strathconnon, Monar and Mullardoch SLA

4.7.14 No significant effects are anticipated within this designated area.

4.7.15 Residual effects on the SLA would range from moderate/minor to moderate in respect of potential effects on the composition of compositional contrasting mountain ridges, long glens and wide strath landscapes and their perceived form and scale.

4.7.16 Effects on the wildness and remoteness of the SLA would generally range from moderate/minor to moderate, the greatest effects occurring at the Sgurr a’ Ghlas Leathad, Sgurr a’ Mhuilinn, Meallan nan Uan and Creag Ruadh summits where the proposed development would result in the greatest increase in the influence of wind farm development.

Operational Effects on Gardens and Designed Landscapes

4.7.17 Of the twenty GDLs present within the study area, there are only two that fall within the viewshed of the proposed development, Fairburn House and Leys Castle GDLs.

4.7.18 No significant effects are predicted in respect of the Fairburn GDL. The proposed development would be screened from a large proportion of the GDL, including Fairburn House and gardens by intervening topography, forest and tree cover. However, views of the proposed development would be provided from the more open and elevated sections of the main estate tracks by Tower Mains and between the Muir of Fairburn and Fairburn

House. The proposed development would be seen distantly to the north-west and would be seen in conjunction with the existing/consented Corriemoillie and Lochluichart turbines, as illustrated in Viewpoint 7. Whilst the proposed development could be more prominent than these developments, it would appear consistent with the established pattern of development and represent a barely discernible addition to the cumulative baseline.

4.7.19 Whilst there is theoretical visibility of the proposed development from parts of the Leys Castle GDL, the proposed development would be seen at a considerable distance and would therefore be unlikely to represent a significant effect on the character or amenity of this landscape.

Operational Effects on Wild Land

4.7.20 TA4.6: Wild Land Impact Assessment (WLIA), assesses the effect of the proposed development on the following Wild land Areas (WLAs):

- the Rhiddorochis, Beinn Dearg and Ben Wyvis Wild Land Area (WLA No.29); and
- the Fisherfield, Letterewe, Fannichs Wild Land Area (WLA No.28).

4.7.21 The WLIA follows the methodology set out in SNH's 2017 consultation draft Assessing impacts on Wild Land Areas – technical guidance and utilises their published Wild Land Area descriptions in determining the likely impact upon key aspect and characteristics of each WLA.

Rhiddorochis, Beinn Dearg and Ben Wyvis Wild Land Area (WLA No.29)

4.7.22 Comparison of the viewshed of the proposed development, SNH's mapping of Jenks Classification and Map 5 of SNH's mapping of relative wildness suggests that the majority of the proposed developments visibility occurs within 10 km of the proposed turbines and would coincide with areas of lower degrees of wildness (i.e. below Class 5 in the composite Jenks Classification, as indicated in Figure TA4.6.1). These areas are largely concentrated along the southern edges of the WLA and already subject to the influence of human activity and artefacts in adjoining straths and glens, as well as existing wind energy development such as Corriemoillie and Lochluichart which represent a prominent facet of views out of the WLA.

4.7.23 Whilst some visibility occurs within areas of higher degrees of relative wildness (up to Class 8) this is generally located at distances over between 10 and 20 km and confined to elevated summits and slopes. At such locations, mitigation is provided by the vast scale of the landscape and panoramic views, the distance at which the proposed development would be seen, and its juxtaposition with existing wind farm developments.

4.7.24 Turning to the wild land characteristics of this WLA, the key aspects of relevance, as described in SNH's Wild Land Descriptions of 2017, include its:

- range of awe-inspiring massive, high rounded hills and plateaux, as well as steep rocky peaks and ridges, and elevated panoramas;
- long and deep penetrating glens with steep, arresting side slopes that limit views, some containing access routes and clearly influenced by estate management; and
- very large interior with a strong sense of remoteness and sanctuary that seems even more extensive where appearing to continue into neighbouring wild land areas.

4.7.25 The proposed development would generally constitute no effect or moderate/minor effects within this WLA but increasing to moderate at summits in the vicinity of Beinn Dearg and at elevated summits between Gleann Beag and the Freewater Forest due to the proposed developments contribution to the increased prominence and influence of wind energy development in the panoramic views to the south of the WLA. Such effects are not considered significant.

4.7.26 The awe-inspiring massive, high rounded hills and plateaux, as well as steep rocky peaks and ridges that form key aspect of this WLA would not be significantly affected as the key exemplars of this aspect are largely concentrated in views away from the proposed development or area mainly experienced from lower lying locations within the WLA from where the scale and form of the topography is most apparent. Views of the proposed development from such locations would, however, be constrained.

4.7.27 The naturalness and remoteness of the long and deep penetrating glens within the WLA would not be significantly affected as views of the proposed development would be substantially obscured from such locations and would mainly be concentrated at the southern extents of Strath Vaich, on the boundary of the WLA, and experienced in views to the south, away from the WLA interior.

4.7.28 The proposed development would be visible from a relatively limited proportion of the interior of the WLA and focused on elevated summits and slopes that are located distantly from the proposed development and from where the proposed development would be seen distantly to the south, would occupy a small proportion of what are vast panoramic views, and would be seen in conjunction with existing wind energy developments. Consequently, no significant effects on the remoteness or sanctuary of the WLA interior are anticipated.

Fisherfield, Letterewe, Fannichs Wild Land Area (WLA No.28).

4.7.29 As in WLA29, a comparison of the viewshed of the proposed development, SNH's mapping of Jenks Classification and Map 5 of SNH's mapping of relative wildness for WLA 28 indicates that the majority of the proposed developments visibility occurs within 10 km of the proposed turbines and would coincide with areas of lower degrees of wildness. These areas are largely concentrated within the easternmost part of the WLA and already subject to the influence of human activity and artefacts in adjoining straths and glens, as well as existing wind energy development such as Corriemoillie and Lochluichart which are located immediately to the east of the WAL and would be interposed between the WLA and the proposed development.

4.7.30 Whilst some visibility occurs within areas of higher degrees of relative wildness (up to Class 8) this is generally located at distances over between 10 and 20 km and confined to elevated summits and slopes which are typified by vast scale landscapes and panoramic views. The proposed development would be seen distantly and overlapped by existing wind farm developments that create a developed context. The proposed development would be seen to the east away from the interior of the WLA and also away from the neighbouring Rhiddorochis, Beinn Dearg and Ben Wyvis WLA.

4.7.31 The key aspects of relevance to the proposed development include its:

- awe-inspiring range of colossal, steep, rocky and rugged mountains interlinked around deep and arresting corries, glens and lochs;
- very large mountain interior with a strong sense of remoteness and sanctuary; and

- wide open lochs that highlight the profile of surrounding mountains and offer contrast of experience in relation to access, human elements and activity.

4.7.32 No significant effects on this WLA or any of its key aspects are anticipated. Visibility would be relatively constrained, and where the proposed development is visible, it would be seen relatively distantly and remote from the WLA and in the opposite direction to the key exemplars of these aspects, would occupy a relatively small proportion of what is an expansive outlook from summits, and would be seen behind, and overlapping with, the existing Corriemoillie and Lochluichart developments. Consequently, the proposed development would not represent a significant lateral extension to wind farm developments, the drawing of development closer to the WLA or increase in the influence of wind farms on the WLA.

Operational Effects on the Amenity of Settlements

Inverness

4.7.33 The ZTV in Figure 4.5a indicates theoretical visibility of up to three of the proposed developments turbines from locations at Milton of Leys, Inshes and parts of Westhill. However, only the very tips of the turbines would be visible and would be seen at distances in excess of over 38 km. Consequently, the proposed development would not be readily discernible in actuality. Given the substantially restricted nature of visibility, the distance at which the proposed is from prospective receptor locations, the magnitude of impact on the amenity of Inverness would be negligible and the residual effect would be minor.

Kirkhill

4.7.34 Kirkhill is a village in north Inverness-shire, close to the south opening of the Beauly Firth, and 16 km west of Inverness. This village is situated within an enclosed farmland landscape which is typified by a patchwork of coniferous forest plantations, woodland blocks and shelter belts which restrict intervisibility and restricts views out from the interior of the settlement. Glimpses of the proposed development would be provided, however, from locations at the north-western fringe of the village (e.g. Wardlaw Mausoleum) from where up to six of the proposed developments turbines would be visible on the skyline around 26 km to the north-west and would occupy a small portion of the view. The proposed development would be seen to the east of the existing Corriemoillie and Lochluichart wind farms and would therefore not represent a wholly new feature in the view. Given the restricted visibility of the proposed development, its distance and developed context, the magnitude of impact on this settlement would be negligible, equating to a moderate/minor effect, which is not significant.

Muir of Ord

4.7.35 The Muir of Ord comprises a low-lying settlement, generally below 40 m AOD, and is arranged in a cluster centred around the intersection of the A832 and extending in a linear assemblage of buildings to the south. Views out from the settlement are partly restricted by extensive tree cover and built forms, but an open aspect is provided at the southern end of the settlement by the Muir of Ord golf club, from where theoretical visibility of up to six blade tips of the proposed developments turbines would be possible. However, field reconnaissance suggests that the turbines would not be discernible in actuality due to the screening effects of intervening topography and vegetation. Consequently, there would be no effect on this settlement.

Garve

4.7.36 Garve is a small village situated in the floor of Strath Garve, between the A835 carriageway and the Black Water and consists of two main housing areas, one along Stirling Drive, and another along Matheson Road. Stirling Drive properties are located on the eastern side of the road and consist of two-storey terraced and semi-detached dwellings oriented in a westerly direction. These properties have small front gardens and longer rear gardens that are enclosed by a tree line that marks the western bank of the Black Water. In contrast, properties on Matheson Road are arranged on both sides of the road and oriented in a north-south direction. The principal views to the north (towards the proposed development) are provided from the rear of properties on the northern side of the road but are partially restricted by intervening vegetation both within private gardens, along field boundaries and the sides of Strath Garve.

4.7.37 The clearest views of the proposed development would be provided from sections of Stirling Drive where it is aligned in a northerly direction. In this location up to six of the proposed turbines would be visible on the skyline at a distance of around 6 kms and would appear mainly as blade tips and would be partially obscured by intervening vegetation within the village and Strath Garve. Given the limited visibility of the proposed development and its distance from this village, the magnitude of impact on the amenity of the village would be slight and the residual effect would be moderate and not significant.

Operational Effects on the Amenity of Individual Residential Properties

4.7.38 The planning system does not provide any specific protection to private views and in general the outlook from each individual property is a matter of private interest and not a public one, which is the primary concern of the planning system. However, where a development may result in impacts on the outlook of a property being overwhelming or oppressive so as to affect residents to the extent to make everyday living conditions unsatisfactory, this can be a material consideration in determination of the planning application.

4.7.39 There is no formal or statutory guidance available as to how to assess the visual component of living conditions. However, the following assessment is based on tried and tested methodology and relies upon professional judgement. This is consistent with the approach advocated by the Reporter in the Baillie decision who stated that *"any assessment of acceptability in these circumstances relies on judgement rather than measurement."*

4.7.40 The matter of judgement of potential impacts on living conditions has been considered at a number of public inquiries to determine whether the potential impacts upon the visual amenity of residential properties is so unsatisfactory that the development in question should be refused planning permission in the public interest.

4.7.41 Inspector Woolcock in the Langham Appeal Decision of September 2011 stated that:

"The planning system controls development in the public interest, and not in the private interest. The preservation of open views is a private interest, which the planning regime

is not intended to protect. But public and private interests may overlap. The issue is whether the number, size, layout and proximity of wind turbines would have such an overwhelming and oppressive visual impact on a dwelling and its amenity space that they would result in unsatisfactory living conditions, and so unacceptably affect amenities and the use of land and buildings which ought to be protected in the public interest".

4.7.42 It is clear from such an approach that the incidence of significant visual impacts in environmental impact assessment terms are, in themselves, not evidence of unacceptable effects on amenity. Consequently, in reaching conclusions regarding the effect of the proposed development on the amenity of the small number of dispersed dwellings in the vicinity of the site, the potential for significant effects has been established, along with whether such effects meet the criteria set out in Inspector Woolcock's decision.

Lubfearn

4.7.43 Lubfearn, a currently uninhabited property, but subject to possible regeneration by the Strathvaich estate if the proposed development is consented (see the separate Planning Statement). The property is located approximately 2.4 km to the north-east of the proposed development on land immediately west of the A835 carriageway. It is a single storey dwelling and adjoining outbuildings with informal gardens on three sides. The property frontage and main porched entrance is oriented to the north-east, towards the A835, whilst the rear aspect is oriented to the south-west towards the proposed development. Views from each aspect are considerably different. Those from the front of the property are enclosed by elevated topography in the middle ground and the foreground is dominated by vehicles moving close by on the A835. In contrast, views from the rear of the property have a more open aspect and are characterised by open agricultural fields in the foreground and middle ground, beyond which the adjacent elevated moorland and forested slopes east of the proposed development. The existing Corriemoillie and Lochluichart turbines are evident on the skyline in the distance.

4.7.44 The proposed development would be seen directly and in views to the rear of the property. All of the proposed turbines (rotor and upper towers) would be visible on the skyline and occupy around 25 horizontal degrees of the view. Whilst the proposed development would overlap with the Corriemoillie array it would represent a substantial increase in the prominence and influence of wind energy development and constitute a major effect on views from the rear of this property. However, the proposed development would not be seen in views from the front of the property (the main façade and access) and would be seen in the middle distance of the view, to the rear of the property, and clearly associated with the moorland landscape, rather than the agricultural land that forms the immediate context of the property. On this basis the proposed development would represent a prominent feature within the broader view and landscape, rather than an overwhelming or oppressive influence.

Black Bridge

4.7.45 Black Bridge is located approximately 2.7 km to the north of the proposed development., close to the banks of the Black Water. The property is oriented in a north-east and south-west direction, its main façade and porched entrance being located on the north-eastern side of the dwelling. Views from the interior of the dwelling are provided from windows on the southern side of the dwelling. The property has an open aspect rural, but views to the north and north-east are enclosed by the elevated topography of Creag Rais and Druim Buidhe. To the south-west, views from this property extend along the line of the Glascarnoch River and up to the large-scale undulating moorland that forms the horizon in this direction. The existing Corriemoillie and Lochluichart turbines are clearly evident on the skyline of the view in this direction, occupying approximately 33 horizontal degrees of the view. The incised form of Strath Vaich provides a key context to the north of this property.

4.7.46 The proposed development would form a prominent lateral extension to the existing concentration of wind turbines on the skyline in views to the south, equivalent to around an additional 28 horizontal degrees of the view occupied by wind farm development. Given the extent of the view it would occupy, its proximity to this property and consequent prominence, the residual visual effect at locations at the rear of this property and on its approach would be substantial, equating to a major effect. However, the proposed development would not be seen in views from the front of the property (the main façade and access) and would not affect the key context of the property which is Strath Vaich. Moreover, the proposed development would be seen in the background of the view, and clearly associated with the elevated moorland landscape, rather than the enclosed interior of the valley landscape adjoining Loch Glascarnoch forms the immediate context of the property. On this basis the proposed development would represent a substantial addition to the developed skyline in one aspect of this property and would be seen as a prominent feature within the broader view and landscape, rather than an overwhelming or oppressive influence.

Hydro House

4.7.47 Hydro House is located around 2.77 km to the north of the proposed development and its main façade and entrance is oriented broadly towards the south-west, but not directly towards the proposed development and is partially restricted by a mixed tree belt. Views from other aspects include views from windows in the southern end of the dwelling and from the driveway that bisects the southern part of the property’s curtilage. Views to the north and east are foreshortened by the elevated topography of Creag Rais and Druim Buidhe.

4.7.48 The proposed development would be seen obliquely from the interior of the property but would form a prominent lateral extension to the existing concentration of wind turbines on the skyline in views to the south, equivalent to around an additional 28 horizontal degrees of the view occupied by wind farm development. Given the extent of the view it would occupy, its proximity to this property and consequent prominence, the residual visual effect at locations at the front of the property, including its driveway would be substantial, equating to a major effect. The proposed development would be seen in the background of the view, and clearly associated with the elevated moorland landscape, rather than the enclosed interior of the valley landscape adjoining Loch Glascarnoch that forms the main context of the property. On this basis the proposed development would represent a substantial addition to the developed skyline in one aspect of this property and would be seen as a prominent feature within the broader view and landscape, rather than an overwhelming or oppressive influence.

4.7.49 Based on the preceding assessment of the effects on the amenity of the three properties, none are predicted to be liable to effects that are so severe as to lead to unsatisfactory living conditions or effects that are prejudicial to public intertest.

Operational Effects on the Amenity of Transportation Routes

4.7.50 The transportation routes assessed are mapped on Figure 4.8.1, and TA4.8: Route Analysis contains a statistical analysis of visibility of the proposed development as well as other wind farm developments in the study area from key transportation routes. The analysis also provides details of the relative distance and direction of visible wind farms to allow for comparison and determination of potential cumulative effects, including sequential effects.

A832 - Cromarty to Junction with the A835(T)

4.7.51 According to the statistical analysis in TA4.8, glimpsed views of the blade tips of up to five of the proposed turbines would be experienced by north-bound road users in the vicinity of the Muir of Ord and Marybank, the proposed development being seen at distances of between 17 km and 21 km. The extent of the route affected would be around 1.77 linear km of what is a 45.71 km route within the study area. However, field reconnaissance suggests that actual visibility would be barely discernible due to the screening effect of intervening topography and vegetation. Consequently, the magnitude of impact on this route would be negligible and the residual effect would be minor.

A832 - Talladale to A835(T)

4.7.52 Of this 56.37 km long section of the A832, between Talladale and the A835(T) junction, the ZTV indicates intermittent visibility of up to three turbines would be provided along a total of 5 km of the route, at its eastern extent, as the road passes to the north of Loch Luichart. Field reconnaissance, however, indicates that visibility would be substantially restricted by intervening topography and vegetation along the northern side of the road so as to effectively remove all visibility of the proposed development from this route. On this basis, no effects on the amenity of this route are anticipated.

A835(T) - Ullapool to Tore

4.7.53 Of the 78.76 km of this route within the study area, views of the proposed development would theoretically be provided from a total of 21.8 km of this route. However, actual visibility would be less than this due, as described below.

4.7.54 For eastbound road users, visibility would commence as the road approaches Loch Droma, where four wind turbines would be visible at a distance of more than 12.6 km and would be backclothed by Little Wyvis. Progressing eastwards, along the side of Loch Glascarnoch the proposed developments visibility and prominence would gradually increase. On this stretch of the route up to thirteen of the proposed turbines would be visible on the skyline to the south of the route, away from the main focal point of Ben Wyvis, which is seen to the east. The turbines whilst prominent would be partially screened by intervening topography, thereby lessening their perceived scale. As eastbound road users approach Glascarnoch Dam and the Aultguish Inn the proposed development would be seen relatively briefly and obliquely, and in conjunction with

Corriemoillie and Lochluichart turbines. Beyond this, the route turns north-eastwards away from the proposed development.

4.7.55 For north and westbound road users, views of the proposed development would commence as the A835(T) approaches Loch Garve from the south. At this location, fleeting oblique views of up to nine turbines would be seen on the skyline around 9 km to the north. The turbines would be seen adjacent to the existing Lochluichart and Corriemoillie wind farms.

4.7.56 Progressing northwards along the side of Loch Garve, views of the proposed development would be restricted by roadside and lochside vegetation, and as the route approaches Garve views of the proposed development would be obscured by intervening topography. Whilst further theoretical visibility of the proposed development is indicated in the vicinity of Garve Hotel, such views would be restricted by roadside vegetation. Similarly, as the route approaches Gorstans, views of the proposed development would remain obscured by intervening topography and vegetation.

4.7.57 As the route approaches Inchbae views of the proposed development would be restricted by a combination of roadside vegetation, topography and forest cover. However, as the route passes northwards from Inchbae intermittent transient views of the proposed development would occur, the proposed development forming an increasingly prominent feature on the skyline emerging through commercial forestry around 2.5 km to the south-west but would be seen obliquely. In the vicinity of Lubfearn the proposed development would be prominent in views perpendicular to the route and seen in conjunction with the existing Corriemoillie and Lochluichart turbines.

4.7.58 Following screening by topography (Carn an t-Sneachda) at the bend in the road at Black Bridge, first Lochluichart and then Corriemoillie turbines would reappear directly ahead of drivers becoming closer as the proposed development appears passing progressively obliquely to the passenger's side. Whilst the proposed development would remain prominent in certain views from this section of the route, Corriemoillie and Lochluichart turbines would be seen first more distantly, beyond the proposed development, before appearing alongside and at similar distance from the road at Aultguish, the proposed development contained beyond the intervening ridge and at lower elevation.

4.7.59 Based on the preceding analysis the impact of the proposed development upon the amenity of this route for eastbound road users would range from none (in location where no visibility would occur) to slight by Loch Droma and substantial in the vicinity of Aultguish Inn. This means that effects would be moderate and not significant in the vicinity of Loch Droma, but increasing to **major/moderate** as the route progresses eastwards along the side of Loch Glascarnoch, and major in the vicinity of the Aultguish Inn.

4.7.60 North and westbound road users would be largely unaffected by the proposed development, with the exception of slight impacts as receptors approach Loch Garve and moderate just north of Inchbae and intermittently substantial between Lubfearn and Aultguish Inn. Consequently, short duration **major/moderate** (significant) effects would occur north of Inchbae, increasing to **major** between Lubfearn and Aultguish Inn.

Operational Effects on the Amenity of Recreational Routes

4.7.61 The recreational routes assessed are mapped on Figure 4.8.1, and TA4.8: Route Analysis contains a statistical analysis of visibility of the proposed development as well as other wind farm developments in the study area from key transportation routes. The analysis also provides details of the relative distance and direction of visible wind farms to allow for comparison and determination of potential cumulative effects, including sequential effects.

Core Path RC20.01/RC20.02

4.7.62 The statistical analysis in TA4.6 predicts views of the development from a 600 m section of this route, at its northernmost extent. Theoretically, only blade tips of three turbines would be visible from this section of path. However, this section of the route is located in an area of coniferous plantation and so views of the proposed development would be obscured by intervening vegetation. Consequently, this route would be subject to no effects on its visual amenity.

Core Path RC20.03

4.7.63 The statistical analysis in TA4.6 predicts views of the development from locations north of Loch Garve. Theoretically, only blade tips of the proposed development would be visible from this section of path. However, this section of the route is located in an area of coniferous plantation and so views of the proposed development would be obscured by intervening vegetation. Consequently, this route would be subject to no effects on its visual amenity.

Core Path RC20.04

4.7.64 Whilst north-westbound path users are predicted to have theoretical visibility of the proposed development from around 0.45 km of this 1 km route, field reconnaissance suggests that the proposed development would be almost completely obscured in views by intervening vegetation and localised topographical features that are not reflected in the DTM and ZTV calculations. Consequently, the magnitude of impact would be negligible, and the residual effects on the amenity of this route would be minor.

Scotways - Croick to Black Bridge

4.7.65 Of this 28.31 km path, the proposed development would theoretically be visible for a total of 7.85 km at the southern extent of this path. Progressing along the base of Meall a' Ghrianain to the east of Loch Vaich, the proposed development would come in to view, appearing as a series of blade tips on the skyline to the south, at a distance of over 8 km.

4.7.66 As the path progresses southwards, past Loch Vaich dam into the lower reaches of Strath Vaich, the proposed development becomes more prominent, occupying a growing proportion of the view around 2.57 km to the south of receptors. As the path approaches the A835 the proposed development would be seen in conjunction with the Corriemoillie and Lochluichart wind farms, forming a lateral extension to these existing developments.

4.7.67 The magnitude of impact on the affected sections of this route would range from slight by Meall a' Ghrianain to substantial at the southern reaches of this route. Consequently, significant effects would be confined to locations approaching the Loch Vaich dam and between the dam and the A835.

Scotways - Old Drovers Road (The Fish Track)

4.7.68 The Old Drovers Road is around 10 km in length and routes from the A835 at Gorstan, through forestry across the slopes of Creagan an Eich Ghlais and across moorland to meet the A835 to the east of the Aultguish Inn. Of this, theoretical visibility of the proposed development is predicted from around 8 km of the route.

4.7.69 For northbound walkers, the forestry on the slopes of Creagan an Eich Ghlais would effectively screen views for the ascent from the A835. However, as walkers exit the forestry and crosses the brow of the hill, up to 12 turbines would extend across a large proportion of the view and would be experienced at close proximity. Corriemoillie and Lochluichart Wind Farms would be visible in the background, along the skyline. The proposed development would remain prominent in views as walkers round the base of Carn na Dubh Choille and passes directly beside the wind farm. Once north of the proposed development, the path begins to descend to the A835 and views of the turbines would be behind receptors, with views of Glascarnoch Dam, the A835 and Aultguish Inn ahead.

4.7.70 Walkers progressing in a southerly direction from the A835 by Aultguish Inn would have clear views of the proposed development, the turbines seen along the skyline, but partially obscured by intervening convex topography in the middle-ground, and seen in conjunction with the existing Corriemoillie and Lochluichart arrays that form a prominent concentration of turbines. It is noted from responses to public consultation (as reported in the separate Statement of Community Consultation) that at present a significant proportion of the identified route between the A835 and essentially where new wind farm tracks are to be constructed is in generally difficult to impassable condition due to boggy ground conditions and absence of signage, which might at present deter some users.

4.7.71 Further south, the route skirts the eastern side of the turbine development area of the proposed development where the proposed turbines would be seen at their full height to the west, along with aspects of site infrastructure. The Corriemoillie and Lochluichart development would be seen extending into the background behind the proposed development.

4.7.72 Once the path user has passed to the south of the development, at the southern toe of Carn na Dubh Choille, the proposed development would be behind receptors.

4.7.73 The proposed development would be seen in conjunction with the operational Corriemoillie and Lochluichart turbines from the majority of this route. Distant views to Fairburn Wind Farm would also be provided.

4.7.74 In this context the magnitude of impact would be substantial for users of the path, travelling in both directions, and the effect would be **major** (significant).

Walk Highland Paths - Am Faochagach

4.7.75 Of the 6.75 km of this route within the study area the proposed development would be visible for just over 4 km of this. From the summit of Am Faochagach, the full extent of the proposed development would be visible adjacent to Corriemoillie, Lochluichart and Lochluichart wind farms. Fairburn Wind Farm is visible in the background of the view, along the skyline. As hill walkers descend the hill, views to the proposed development would be intermittent. The proposed development would appear within an existing cluster of wind farm development.

4.7.76 Lower down the hillside, views of the proposed development would be screened completely by topography from nearly 3 km of the route. However, the proposed development would be revealed upon reaching flatter and more open position at the head of Loch Glascarnoch, from where the proposed development would be seen at a distance of around 10 km to the south-east and would be framed by the intervening topography to the north and south of Loch Glascarnoch. No other wind farm development would be visible. The nature of this view continues for just a short distance until the path user reaches the A835 and the path ends.

4.7.77 Cumulatively, impacts are only likely from the summit of the walk due to the expansive nature of views from this location on the path. The proposed development would extend the horizontal extent of existing development within views from the upper elevations of the path. However, the proposed development would reflect the emerging pattern of clustered development within the landscape. Distant views (i.e. greater than 28 km) of Auchmore, Auchmore 2, Beinn Tharsuinn, Coire na Cloiche and Fairburn Wind Farms are present however form small, at times imperceptible elements in the view.

4.7.78 The magnitude of impact on the amenity of hill walkers, based on the preceding analysis, would be moderate. The key impact would be experienced as the hill walker enters the valley floor, and the proposed development would introduce a new infrastructural feature into views where there is no wind farm development currently visible. The effect would be **major/moderate** (significant).

Walk Highland Path - Beinn Liath Mhor a' Ghiubhais Li, Loch Glascarnoch

4.7.79 Views of the proposed development would only be available for hill walkers approaching the summit, walking in a clockwise direction along the circular route. Of the 8.14 km route, 3.17 km would experience views to the proposed development.

4.7.80 From the A835, the hubs and blades of up to four turbines would be visible at the end of the Glascarnoch valley. As the path turns south and begins to climb the hillside, topography would screen views for approximately 800 m of the route. The path rises across a minor summit and views of the full extent development would become available, partially screened at the base by topography. Corriemoillie Wind Farm is glimpsed to the south east.

4.7.81 The proposed development would remain visible from the path until the summit is attained. There would generally be full visibility of the turbines, with some intermittent screening afforded by topography.

4.7.82 Views of other wind farm development are only noticeably present from the summit of the walk. The proposed development would be viewed within a cluster of development, in the context of existing development at Corriemoillie, Lochluichart and Lochluichart Extension Wind Farms. Other wind energy development, such as Novar, Fairburn and Coire na Cloiche are present in the view but form small features in the landscape and would be almost indiscernible.

4.7.83 The proposed development would constitute a moderate impact on approximately half of this route, introducing prominent wind turbines and forming a notable lateral extension to the existing pattern of development. Consequently, significant (**major/moderate**) effects are predicted on the amenity of this route.

Walk Highland Path - Beinn a' Chaisteil, via Strath Vaich

4.7.84 The Beinn a' Chaisteil, via Strath Vaich is 18.72 km in length. The proposed development would be visible from 12.45 km section of this route, on the ascent to the of Beinn a' Chaisteil summit and on the descent down the southern flank of Meall a' Ghrianain towards Strath Vaich.

4.7.85 From the summit, the proposed development would be seen to the south at a distance of over 11 km. The proposed development would be viewed in the context of Corriemoillie and Lochluichart turbines but separated from them in the view by the intervening topography of Meall a' Ghrianain. As the path progresses southwards towards Meall a' Ghrianain the proposed development would be obscured by intervening topography, until the summit of Meall a' Ghrianain is reached. Further south, as the path descends, direct views to the proposed development would be continuous. Other wind farm development is intermittently screened by topography. Only when the path reaches the lower hillside, joining onto an existing estate track, that topography would begin to provide any screening of the proposed development.

4.7.86 As the path reaches Strath Vaich, the proposed development would be visible at the end of the valley. No other development is visible from this location until the path nears the A835 and Corriemoillie Wind Farm comes into view. The proposed development would be a prominent feature in the view along the strath.

4.7.87 Given the extent of the route subject to views of the proposed development, its prominence and relationship with existing wind farm developments, the impact on the amenity of this route would be moderate, and the residual effect would be **major/moderate** (significant).

Walk Highland Path - Ben Wyvis, Near Garve

4.7.88 Views of the proposed development would primarily be experienced by hill walkers descending westwards from the summit of Ben Wyvis, in the direction of the proposed development, as walkers ascending the hill on this pat would be facing towards the hill and away from the proposed development. Of the full 3.88 km route, up to 3.18 km would have views of the proposed development.

4.7.89 As the hill walker travels south west along the ridgeline of Ben Wyvis, open views of the proposed development would be available at a distance of over 8 km. The proposed development would be seen in front, and overlapping with, the existing Corriemoillie and Lochluichart wind farms.

4.7.90 As the path descends toward the Garbat Forest, views to the proposed development would remain, however, more of the development would be subject to increased screening by intervening topography, with lower turbine towers often obscured.

4.7.91 The magnitude of impact would be slight. The proposed development would be a discernible change in the view from the route, however would be seen within the context of existing development and would not alter the overall composition of the view. The effect would be moderate and not significant.

Walk Highland Path - Little Wyvis, Near Garve

4.7.92 The Little Wyvis walk is 10 km in length. Of this 6.56 km would be subject to views of the proposed development. As the path crosses the ridge of Little Wyvis, hillwalkers would have views of the proposals. As the path enters/ exits the minor valley to the north of the summit, views would only be available for westbound walkers.

4.7.93 Viewed from the summit, the proposed development would be seen to the north-west at a distance of around 6 km. The proposed development would be seen in conjunction with and partially overlapping with the existing Corriemoillie and Lochluichart turbines but would represent a notable lateral extension to development. The proposals would extend the horizontal spread of turbines across a portion of the view and would be located in closer proximity to the receptor. The difference in size and scale of the turbines in comparison to existing development would be noticeable.

4.7.94 The magnitude of impact would be moderate. The proposed development would be prominent in the view from a large proportion of the path however it would not become the defining feature of the view or landscape. The effect would be **major/moderate** (significant).

Walk Highland Path - Sgurr Mor and the Eastern Fannichs

4.7.95 Views of the proposed development would be provided from 4 km of this 17.38 km walk. Views would commence as the path rises to the summit of Beinn Liath Mhor Fannich where blades would be visible along the minor ridgeline in the middle distance alongside existing development at Corriemoillie and Lochluichart wind farms. Intermittent visibility of blades and some hubs would continue along the ridge to Sgurr Mor. There would be no view from this summit. As the path turns south east along the Creachan Rairigidh ridge, views of hubs and blades of all turbines would be visible in views to the north.

4.7.96 The proposed development would be most apparent in views from the Meall Gorm spur but would be seen behind and overlapped by Corriemoillie Wind Farm. Once the path begins its descent, views to the proposed development would be screened.

4.7.97 The magnitude of impact would be slight. The proposed development would locally change views of the landscape from the path however the underlying visual composition would not be altered. The residual effect on this route would therefore be moderate.

Walk Highland Path - Sgurr a'Mhuilinn and Meallan nan Uan – Strathconnon

4.7.98 The proposed development would be visible from around 4 km of this 11.62 km path, and would generally be seen at distances of over 14.5 km.

4.7.99 Visibility would be concentrated at summits and some connecting ridgelines. Where visible, the proposed development would be partially overlapped by existing Corriemoillie turbines but would extend eastwards from the existing Corriemoillie and Lochluichart development cluster. Sequential views of the existing Fairburn Wind Farm would be visible from this route, this scheme appearing distantly to the east south-east.

4.7.100 Notwithstanding the extent of the path affected, the proposed developments existing developed context, coupled with its distance from receptors means that the magnitude of impact would be slight and the residual effect on the amenity of this path would be moderate and not significant.

Viewpoint Assessment

4.7.101 In order to verify the effect of the proposed development a series of nineteen representative viewpoints were utilised these were agreed with THC and SNH in advance of the preparation of the LVIA.

4.7.102 One of the agreed viewpoints by Black Bridge, a view selected for its position transitioning out of Strath Garve and potential cumulative visibility of the proposed development and the existing Lochluichart and Corriemoillie wind farms was subsequently disregarded following design alterations that resulted in the proposed development not being visible from this position. Impacts on the amenity of road users at this location are addressed at paragraph 4.7.58 above.

4.7.103 Selected viewpoints were chosen to represent a range of sensitive landscape and visual receptors at different directions, distances and elevations from the proposed development. These were also selected to represent locations where the greatest visibility of the proposed development would occur. Given the pattern of theoretical visibility, the viewpoints are often situated on elevated summits or slopes as the majority of settlement and roads would be shielded from views of the proposed development by intervening topography and/or vegetation.

4.7.104 The assessment viewpoints are listed in TA4.7: Viewpoint Assessment and are assessed in respect of their baseline context and residual effects arising from the operational phase of the proposed development. The written assessment is accompanied by a series of visualisations in Figures 4.7 to 4.26k.

4.7.105 Of the viewpoints assessed six were predicted to be subject to significant landscape and/or visual effects, including:

- Viewpoint 1: Aultguish Inn, A835 – around 2.3 km to the north of the proposed developments turbines;
- Viewpoint 2: Old Drovers Road, Corriemoillie – around 0.7 km to the south-east of the nearest of the proposed developments turbines;
- Viewpoint 5: Summit of Sgurr Marcasaidh – around 7.52 km to the south of the proposed development;
- Viewpoint 15: Summit of Meall a' Ghrianain – approximately 9.6 km to the north of the proposed development;
- Viewpoint 17: Layby, Loch Glascarnoch – around 7.1 km to the north-west; and
- Viewpoint 19: Little Wyvis – around 6.59 km to the south-east of the proposed development.

4.7.106 The incidence of significant effects identified is relatively constrained in geographical spread and mainly arises in views where the proposed development is seen in the middle distance or foreground of views and is seen extending laterally from the existing cluster of development comprising Corriemoillie and Lochluichart turbines. In such circumstances the addition of the proposed development represents a significant increase in the prominence and influence of wind energy development.

Assessment of Light Impacts

4.7.107 TA4.8: Lighting Assessment contains a qualitative assessment of the potential effects of the en-route aviation lights that are likely to be required by the Civil Aviation Authority. This assessment sets out the regulatory requirements as well as potential landscape and visual effects and options for mitigation and assesses residual effects on landscape character and visual amenity based on a worst-case scenario.

4.7.108 Lighting effects on landscape character would primarily concern effects on the darkness and remoteness of landscapes, and primarily affect elevated upland landscapes locations, which are, with the exception of a small number of wild campers, unpopulated after dark. Consequently, the predicted significant effects within the Rounded Hills and Rocky Moorland landscape types would be experienced infrequently and by a small number of receptors.

4.7.109 Effects experienced within low lying incised landscapes such as straths and glens would be substantially restricted. Such landscapes also have a lesser degree of perceived remoteness, often containing existing light sources associated with scattered farmsteads and dwellings as well as the headlights and interiors of vehicles. Significant effects in these landscapes would be confined mainly to eastbound road users in vehicles on the A835 between Loch Droma and Black Bridge and at the Aultguish Inn where the lights would form prominent elevated points of light and pronounced focal points in views. However, car dash-lights and headlights coupled with the transient nature of views from vehicles would lessen the magnitude of impacts arising from the turbine lights. Similarly, interior lights and external lamps and car lights would result in a lessening of the prominence of turbine lights when experienced at the Aultguish Inn would be confined mainly to eastbound road users in vehicles on the A835 between Loch Droma and Black Bridge and at the Aultguish Inn where the lights would form prominent elevated points of light and pronounced focal points in views. Significant effects are, however, not anticipated within the interior of the Inn due to its enclosed and lit condition.

4.7.110 There is some potential for additional mitigation of these effects through the reduction in turbine lighting (i.e. to cardinal lighting only) and/or adoption of a radar activated lighting system, both of which would reduce impacts and effects.

4.8 Summary and Conclusions

4.8.1 The preceding LVIA was undertaken by an experienced and competent Landscape Architect and in accordance with an agreed scope and methodology. It considers the current landscape and visual baseline context of the proposed development, which is inextricably linked to the baseline of cumulative developments including the existing Corriemoillie and Lochluichart wind farms and identifies key sensitive receptors to be addressed in the assessment.

4.8.2 Section 4.4 of the LVIA identifies key impact generators associated with the construction and operation of the proposed development and prioritises them for mitigation in order to ameliorate potential for significant effects on the landscape and visual resource of a 45 km radius study area.

4.8.3 The design of the proposed development was informed by a number of technical, commercial and environmental drivers. Section 4.5 of the LVIA sets out the key guidance and priorities adopted in order to mitigate potential landscape and visual effects.

4.8.4 Section 4.6 of the LVIA describes anticipated residual construction effects, whilst Section 4.7 of the LVIA contains a summary of assessment findings in the following TAs:

- TA4.4: Effects on Landscape Character Types;

- TA4.5: Effects on Designated Landscapes and Landscape Classifications;
- TA4.6: Wild Land Impact Assessment;
- TA4.7: Viewpoint Assessment; and
- TA 4.8: Route Analysis; and
- TA 4.9: Lighting Assessment.

4.8.5 Table 4.7, below, summarises the significant landscape and visual effects identified by the LVIA for construction and operational phases of the proposed development. It is apparent from this analysis that significant effects would be geographically limited in extent and would not significantly affect nationally important landscapes.

The decommissioning phase of the proposed development would be of a shorter duration to that of the construction phase, with the dismantling of all above ground structures and reinstatement of disturbed ground, subject to a hydrological assessment. Below ground structures would be left in place to avoid further disturbance. There would therefore be a temporary impact from the activities on site to remove structures, but this would be of relatively short duration. Accordingly, the decommissioning phase is considered to be likely to have a minimal effect on the landscape and visual amenity of the locality. Mitigation measures associated with decommissioning would be agreed during the preparation of the final decommissioning plan, that would require approval of statutory consultees and ECU.

Table 4.7: Summary of Potential Significant Effects

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome / Residual Effect
Construction			
Effects on landscape fabric	See construction mitigation in Section 4.5	Construction mitigation measures would be implemented as part of the CEMP which would be required to be agreed as a condition of consent.	No significant effect
Effects on landscape character	Mitigation embedded as part of the siting and design, as described in Section 4.5 and in EIAR Volume 2: Chapter 2: Proposed Development	Embedded in the siting and design of the proposed development	No significant effect
Effects on designated landscapes	Mitigation embedded as part of the siting and design, as described in Section 4.5 and in EIAR Volume 2: Chapter 2:	Embedded in the siting and design of the proposed development	No significant effect

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome / Residual Effect
	Proposed Development		
Effects on visual receptors including walkers and hill walkers	Mitigation embedded as part of the siting and design, as described in Section 4.5 and in EIAR Volume 2: Chapter 2: Proposed Development	Embedded in the siting and design of the proposed development	No significant effect
Operation			
Effects on landscape character types	Mitigation embedded as part of the siting and design, as described in Section 4.5 and in EIAR Volume 2: Chapter 2: Proposed Development	Embedded in the siting and design of the proposed development	Significant effects are predicted within: • RCY2: Undulating Moorland – Strath Bran Unit; • RCY4: Rocky Moorland – Loch Luichart unit • RCY7: Rounded Hills - Dornoch Firth/Loch Fannich unit
Effects on designated landscapes: Wester Ross NSA Ben Wyvis SLA Fannichs, Beinn Dearg and Glencalvie SLA Strathconon, Monor and Mullardoch SLA Fairburn House GDL Leys Castle GDL	Mitigation embedded as part of the siting and design, as described in Section 4.5 and in EIAR Volume 2: Chapter 2: Proposed Development	Embedded in the siting and design of the proposed development	No significant effects were predicted on designated or classified landscapes.
Effects on Wild Land	Mitigation embedded as part of the siting and design, as described in Section 4.5 and in EIAR Volume 2: Chapter 3: Design Evolution and Alternatives	Embedded in the siting and design of the proposed development	No significant effects are predicted on WLAs.
Settlements and scattered properties	Mitigation embedded as part of the siting and design, as described in Section 4.5 and in EIAR Volume 2: Chapter 3: Design Evolution and Alternatives	Embedded in the siting and design of the proposed development	No significant effects are predicted within settlements and no overwhelming or oppressive effects were identified at individual properties which might otherwise have indicated unacceptable effects on the amenity of such properties.

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome / Residual Effect
Transportation routes	Mitigation embedded as part of the siting and design, as described in Section 4,5 and in EIAR Volume 2: Chapter 3: Design Evolution and Alternatives	Embedded in the siting and design of the proposed development	Significant effects are anticipated to affect eastbound road users between Loch Droma and the Aultguish Inn. Significant effects on the amenity of westbound receptors are predicted between Inchbae and Aultguish.
Effects on hill walkers and walkers	Mitigation embedded as part of the siting and design, as described in Section 4.5 and in EIAR Volume 2: Chapter 3: Design Evolution and Alternatives	Embedded in the siting and design of the proposed development	Significant effects on the amenity of walkers is predicted on sections of the following routes: • Scotways - Croick to Black Bridge at Loch Vaich dam and between the dam and the A835; • Scotways - Old Drovers Road (The Fish Track); • Walk Highland Paths - Am Faochagach; • Walk Highland Path - Beinn Liath Mhor a' Ghiubhais Li, Loch Glascarnoch; • Walk Highland Path - Beinn a' Chaisteil, via Strath Vaich; and • Walk Highland Path - Little Wyvis, Near Garve.

4.9 References

SNH (2017) Visual Representation of Wind Farm – Guidance Version 2.2

Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidance for Landscape and Visual Impact Assessment – Third Edition.

The Countryside Agency and Scottish Natural Heritage (2002) Landscape Character Assessment.

Scottish Natural Heritage and the Countryside Agency (2002) Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity.

Scottish Natural Heritage (2017) Siting and Designing Wind Farms in the Landscape – Version 3a.

Scottish Natural Heritage (2017) consultation on draft guidance: Assessing impacts on Wild Land Areas – technical guidance consultation on draft guidance: Assessing impacts on Wild Land Areas – technical guidance.

Scottish Natural Heritage (2012) Assessing the Cumulative Impact of Onshore Wind Energy Developments.

THC/SNH (2011) Assessment of Highland Special Landscape Areas

SNH (2017) Assessing impacts on Wild Land Areas – Technical Guidance Note (draft – in consultation)

The Highland Council Highland-Wide Local Development Plan, April 2012

The Macaulay Land Use Research Institute (2010) Assessment of Landscape Sensitivity to Wind Turbine Development in Highland. The Highland Council

Argyll and Bute Council Adopted Core Paths Plan June 2015 Statutory List of Core Paths, Argyll and Bute Council Development and Infrastructure

http://heritagepaths.co.uk/#zoom=11&lat=57.5412&lon=-4.7476 (Retrieved via https://www.scotways.com/ on 10.12.2018)

https://www.walkhighlands.co.uk/

SNH (2017) Siting and Design of Wind Farms in the Landscape – Version 3a

https://www.nature.scot/wild-land-area-descriptions

5 CULTURAL HERITAGE AND ARCHAEOLOGY

5.1 Introduction

5.1.1 This chapter describes the likely significant effects of the proposed development on identified and potential archaeological and cultural heritage resources in and around the project area. The assessment comprises an archaeological desk-based baseline assessment including a walkover survey to inform an assessment of potential direct physicaland impacts on the setting of heritage assets as a result of the proposed development. The scope of this chapter is based upon on the Kirkan Wind Farm Scoping Report[2] (Appendix 3.1) and scoping responses received from Historic Environment Scotland (HES), and the Highland Council Historic Environment Team (HET) (Appendix 3.2).

5.2 Scope and methodology

Study areas

5.2.1 For the purpose of the assessment, two study areas were defined, as follows:

5.2.2 Study Area A comprised the project area and a minimum 1 km zone extending beyond its boundary (see Figure 5.1), designed to identify potential physical impacts on the known archaeological and cultural heritage resource, and to enable an assessment of potential for hitherto unknown archaeological remains to be present within the project area through the identification of local trends within or near the footprint of the proposed development. This area includes the footprint of the proposed development, including access tracks, turbine locations and cable routes.

5.2.3 Study Area B comprised a 15 km radius from the project area to identify visual or indirect impacts on designated heritage assets (see Figure 5.2). Scheduled monuments, category A listed buildings, historic battlefields and inventory historic gardens and designed landscapes, and monuments proposed for scheduling have been assessed. The significance of such monuments commonly relates to their landscape setting in terms of location, elevation, landscape dominance and prominence and inter-visibility, and can thus be influenced by changes within their setting from developments of the type proposed.

5.2.4 Visual impacts on category B and C listed buildings and conservation areas have been assessed within a 5 km radius of the project area only, since impacts on setting are unlikely to be significant beyond this distance for these types of heritage asset.

5.2.5 Each individual area, or “plot” where wind farm infrastructure could be placed was allocated an individual number for identification, description and assessment. These are shown on Figure 5.3 and referenced throughout this chapter.

[2] RSK 2018. Kirkan Wind Farm: Scoping Report

Data Sources

5.2.6 The following sources of information were consulted in the assembly of the cultural heritage and archaeology baseline:

- The Highland Council Historic Environment Record (HER); consulted for lists of known heritage assets and previous archaeological interventions;
- HES databases of designated heritage assets, comprising listed buildings, scheduled monuments, Inventory historic battlefields, conservation areas, inventory historic gardens and designed landscapes and monuments proposed for scheduling;
- The National Record of the Historic Environment (NRHE) for records of non-designated heritage assets and Historic Landscape Characterisation Areas;
- Relevant Landscape and Visual assessment data, such as the Zone of Theoretical Visibility (ZTV);
- Vertical stereo aerial photographic coverage held by the National Collection of Aerial Photography (NCAP) and more recent sources (e.g. Google Earth);
- Local Authority lists, including conservation area designations, landscape designations, Tree Preservation Orders (TPOs) or other designations which may affect the scope of archaeological works, such as the existence of ancient or significant tree cover;
- Ordnance Survey (OS) map coverage from 1850 onwards, and available early cartographic sources held at the National Library of Scotland Map Library;
- Accessible relevant documentary information held by the Strathvaich Estate; and
- Bibliographic references, early parish accounts and the Ordnance Survey Name Books available online and in the Highlands Council archives.

5.2.7 Gazetteers included as Appendix 5.1 have been compiled for Study Areas A and B, using information from the data sources listed above.

Site Visit

5.2.8 The project area was visited on 18th and 19th July 2018. Each plot where the proposed development infrastructure might be located was visited and walked systematically (see Figure 5.3). Notes were taken on topography, land use, field boundaries, the condition of any previously recorded heritage assets, and previously unrecorded archaeological features. The position of any identified sites or features were logged, with photographic evidence taken alongside written records. Previously unidentified sites were marked by GPS points to confirm their location to an accuracy of ±1 m.

Assessment of Setting

5.2.9 Setting is defined in HES guidance as, “the way the surroundings of a historic asset or place contribute to how it is understood, appreciated and experienced.” (HES 2016) Impact to setting is defined as any perceived change, including any change in levels of noise, movement or light (flicker) at the known asset (indirect impacts); or any visual effects such as impact on the sightlines to and from protected assets, or any impact on the inter-visibility between assets or deliberate vistas from assets (visual impacts), where this distracts from the context, integrity or appreciation of the asset affected.

5.2.10 The methodology for assessment of impact on setting is based on Historic Environment Scotland’s guidance note, *Managing Change in the Historic Environment: Setting* (HES 2016), which defines a three-stage process:

- Stage 1: identify historic assets
- Stage 2: define and analyse setting
- Stage 3: assess the impact of the new development

5.2.11 In addition to the project area, site visits were also made on 18th and 19th July 2018 to designated heritage assets identified within the overlap between the ZTV and Study Area B. Site visits were made to provide a baseline description of significance and an assessment of the contribution of setting to significance. In accordance with Historic Environment Scotland's guidance note, *Managing Change in the Historic Environment: Setting* (HES 2016), baseline data with regards to sensitivity to visual and indirect effects for each heritage asset was considered as follows:

- Current landscape or townscape context;
- Views to, from and across or beyond the historic asset or place;
- Key vistas;
- The prominence of the historic asset or place in views throughout the surrounding area;
- Aesthetic qualities;
- Character of the surrounding landscape;
- General and specific views including foregrounds and backdrops;
- Views from within an asset outwards over key elements in the surrounding landscape;
- Relationships with other features, both built and natural;
- Non-visual factors such as historical, artistic, literary, place name, or scenic
- associations, intellectual relationships (e.g. to a theory, plan or design), or sensory factors; and
- A 'sense of place': the overall experience of an asset which may combine some of the above factors.

Assessment of Impacts

5.2.12 Physical impacts are defined as damage to the fabric of a heritage asset, which typically could occur during the construction phase (see Chapter 2 Proposed Development).

5.2.13 Visual impacts are defined as visual change within a heritage asset or its setting as a result of the proposed development, resulting in an affected ability to interpret, understand or appreciate the asset's significance.

5.2.14 Indirect impacts are secondary, brought about by knock-on impacts as a result of the proposed development, such as machinery noise affecting appreciation of a heritage asset.

Importance

5.2.15 The importance of each heritage asset has been determined to provide a framework for comparison. The categories of importance do not reflect a definitive level of importance or value of a heritage asset, but a provisional one based on a range of factors including rarity, completeness, historical and cultural associations, and community, research and place-making potential. Assessing importance requires both professional judgement and consideration of the asset's legal or policy status. When combined, these factors offer representations of the importance of a given resource and provide an analytical tool that can inform later stages of archaeological assessment and the development of appropriate mitigation.

Table 5.1 Criteria for Determining Importance of Heritage Asset

Importance	Definition
Very High	Assets and structures of acknowledged international importance. Examples include World Heritage Sites, and buildings of recognised international importance.
High	Assets and structures of acknowledged national importance. Examples include scheduled monuments and monuments proposed for scheduling, category A listed buildings, inventory historic gardens and designed landscapes, historic battlefields, and conservation areas.
Medium	Assets and structures of acknowledged regional importance. Examples include Category B listed buildings, and non-designated assets of particular value recorded within the HER.
Low	Assets and structures of acknowledged local importance. Examples include Category C listed buildings, assets of limited value recorded within the HER, and assets compromised by poor preservation.
Negligible	Assets and structures known to be of little archaeological or historical importance. Examples include remains previously subject to large-scale destruction, assets with very little or no surviving archaeological or historic interest and assets that hold little intrinsic archaeological value.
Unknown	Assets and structures of uncertain character, extent and/or date where the importance cannot be ascertained.

Magnitude

5.2.16 Magnitude of impact has been assessed according to the scale set out in Table 5.2 below.

Table 5.2 Criteria for Determining Magnitude of Impact

Magnitude	Definition
Major	Change to most or all key physical elements resulting in a total modification of the asset or structure, or comprehensive alteration to its setting and character.
Moderate	Change to many key physical elements resulting in a clear modification to the asset or structure, or considerable alteration to its setting and character.
Minor	Change to key physical elements resulting in a noticeable modification to the asset or structure, or slight alteration to its setting and character.
Negligible	Changes to physical elements resulting in a barely perceptible modification to the asset or structure, or very slight alteration to its setting and character.

Magnitude	Definition
No Change	Assets and structures subject to no change to their fabric or setting

5.2.17 Impacts can be considered to be either beneficial or adverse. Unless expressly stated within the text, all impacts described in the Predicted Impacts section below (section 5.7) are adverse impacts.

Significance of Effect

5.2.18 The significance of any effect has been assessed by reconciling the importance of each known heritage asset with the magnitude of the impact upon it (i.e. likely physical or visual change arising from the implementation of the proposed development).

Table 5.3 Grading System Defining Significance of Effect

		Importance				
		Very High	High	Medium	Low	Negligible
Magnitude of Impact	Major	Very Large	Very Large	Moderate	Slight	None
	Moderate	Very Large	Large	Moderate	Slight	None
	Minor	Large	Moderate	Slight	None	None
	Negligible	Moderate	Slight	None	None	None
	No Change	None	None	None	None	None

5.2.19 The significance of effect is discussed in Section 5.7 below. For the purposes of this assessment, Very Large and Large effects are considered to be significant as described by the EIA Regulations. Moderate and Slight effects are not significant.

Limitations of the Assessment

Data Sources

5.2.20 Generally, information held by public data sources is usually considered to be reliable; however:

- Any HER can be limited because opportunities for research, fieldwork and discovery depend on the incidence of commercial development, rather than the result of systematic data collection;
- There can often be a lack of dating evidence for archaeological sites;
- Documentary sources are rare before the medieval period, and many historic documents are inherently biased; and
- Primary sources, especially older records, often fail to accurately locate heritage assets and can be erroneous in any interpretation.

Site Visit

5.2.21 An archaeological walkover survey has inherent limitations primarily because archaeological remains below ground level often cannot be identified from present surface conditions, and because land-use such as coniferous plantations may mask extant earthworks.

Impact Assessment

5.2.22 The limitations of the physical impact assessment include:

- The lack of clarity surrounding the extent of some buried heritage assets. This makes it difficult to provide a precise assessment of potential physical impact;
- The possibility that previously unknown archaeological sites will be encountered during construction; and
- The assessment has considered all impacts associated with the proposed development, as described in Chapter 2. The route and nature of the grid connection does not form part of the application for consent and is yet to be finalised. The grid connection would be considered in more detail and subject to environmental assessment by the Distribution Network Operator (DNO) or Transmission Operator (TO) as part of the consenting procedure for this element of infrastructure. The scope of any such assessment would be agreed with The Highland Council and/or Energy Consents Unit as appropriate.

5.2.23 Whilst acknowledging that there are limitations to the archaeological and cultural heritage baseline and impact assessment, consideration of the potential for the discovery of previously unidentified archaeological remains (see Section 5.5.11 below) and proposing mitigation to address this potential (see Section 5.8) can obviate this to some extent.

5.3 Consultation undertaken

5.3.1 The Highland Council and HES were consulted during pre-application consultation, the EIA scoping and gate check processes and provided formal pre-application and scoping responses. HES also provided formal responses to additional pre-application consultation and the gate check report. ScotWays, the Scottish Rights of Way and Access Society, also provided a scoping response relevant to cultural heritage and archaeology. These are summarised in Table 5.4 below.

Table 5.4 Consultations undertaken

Consultee	Matters arising	Where addressed
Historic Environment Scotland (HES)	Confirmed that there are no designated historic environment assets within project area. There are a number of heritage assets in HES interest in the wider area surrounding the proposed development, the setting of which may be impacted upon as a result of the proposal. Following submission of the scoping response, agreement was reached that assessment of setting would focus on the three designated assets as follows: • LB1: Conon Valley Hydro Electric Scheme, Loch Glascarnoch Dam (LB51706), a Category B listed building located 1.06 km from the project area; • LB2: Conon Valley Hydro Electric Scheme, Vaich Dam, including Spillway Towers and Weir (LB51707), a Category C listed building located 4.6 km from the project area; and • GDL1: Fairburn (GDL00174), an inventory garden and designed landscape located 15 km from the project area. No monuments proposed for scheduling are located within the 15 km study area. At gate check, HES confirmed they were satisfied with the approach taken to assess the historic environment, as detailed in the gate check report, and that the developer had engaged with HES in an appropriate manner.	See Section 5.7 predicted impacts

Consultee	Matters arising	Where addressed
Highland Council Historic Environment Team (HET)	Detailed information on non-designated assets and previous archaeological work undertaken within Study Area A was provided by the Highland Council HET during the course of the EIA. The methodology and scope of assessment laid out in the scoping report is acceptable. Cultural heritage chapter is to be undertaken by a professional and competent historic environment consultant. The chapter is to follow Highland Council Standards for Archaeological Work (THC 2012). Archaeological walkover survey of the development area required. Assessment to consider both the potential direct impacts and indirect of the development to cultural heritage. The indirect impact assessment must include a study of cumulative impacts. Where indirect impacts are predicted, these will be illustrated using photomontages. Where impacts are unavoidable, HET expect proposed methods to mitigate this impact to be discussed in detail, including both physical (i.e. re-design) and where appropriate, compensatory/off-setting. HET consulted regarding the scope of assessment of physical impacts and indirect impacts to assets on the site, and to the impacts on setting of designated assets.	Details of the historic environment consultants involved are in Table 1.1 above. Survey completed. Detailed results included in Appendix 5.2. Results inform the environmental impact assessment process in Sections 5.5 baseline, 5.7 impact assessment and 5.8 mitigation. Cumulative impacts and impacts on setting are discussed in Section 5.8. with appropriate illustrations. Findings from these discussions included in Sections 5.7 and 5.8 below.
ScotWays	ScotWays identify that right of way HR46 (the Fish Road) is mentioned in the Scoping Report’s section. The Society suggests that impacts of the proposed development on the Fish Road should be considered with reference to Scottish Planning Policy (SPP), paragraph 151. ScotWays anticipate the Fish Road will be considered under Cultural Heritage and Archaeology in the Environmental Assessment.	Impacts on the Fish Road (corresponding to non-designated asset NDA36) discussed in Sections 5.7 and 5.8.

5.4 Statutory and planning context

Legislation

5.4.1 This section summarises the statutory legislation relating to cultural heritage and archaeology and relevant to the proposed development.

Table 5.5 Statutory Protection

Legislation	Jurisdiction	Key Issues
Ancient Monuments and Archaeological Areas Act (1979)	Scottish Government /Historic Environment Scotland	Provides statutory protection of scheduled monuments. It is a criminal offence to carry out any works on or near a scheduled monument without scheduled monument consent
Town and Country Planning (Scotland) Act 1997; Planning etc (Scotland) Act (Scotland) 2006	Scottish Government/ The Highland Council	Establishes a framework for determining planning applications, the role of the local planning authority and the role of Development (Structure and Local) Plans within the process
Planning (Listed Buildings and Conservation Areas) (Scotland) Act (1997)	Scottish Government/ The Highland Council	Provides for statutory protection of listed buildings and conservation areas. No physical works can be carried out in relation to a listed building and its curtilage without listed building consent. It introduces a requirement to have special regard to the desirability of preserving the building or its setting in considering any proposed development which may affect these. In conservation areas, designation introduces general controls to conserve their character and appearance within the conservation area.
Town and Country Planning (General Development Procedure) Scotland Order 1992, Section 15(1)(j) as amended by the Town and Country Planning (General Development Procedure) (Scotland) (Amendment (No2) Order 1994, Section (5)	Scottish Government/ The Highland Council	Requires that before granting planning permission for development, a planning authority shall consult with the Scottish Ministers, in the case of development which may affect a historic garden or designed landscape; development which may affect the site of a scheduled monument or its setting or may affect a category A listed building or its setting.
Protection of Military Remains Act (1986)	Ministry of Defence	Outlines the criteria for designating a military crash site. Certain activities are prohibited at protected sites, without the authority of the Ministry of Defence

Legislation	Jurisdiction	Key Issues
Scots Common Law	Procurator Fiscal/ Police	The movement or disturbance of human remains without lawful authority is illegal. Any human remains should be reported to the local police or Procurator Fiscal's office. Further disturbance must cease until permission to continue has been granted by the legal authorities

Policy

5.4.2 Various other documents also provide non-statutory protection for the historic environment in Scotland. The requirements of these documents have been compiled into the consolidated Scottish Planning Policy (SPP) and supplementary information, which is outlined in Table 5.6. below.

Table 5.6 Policies

Document	Jurisdiction	Key Issues
Scottish Planning Policy (SPP), 2014	Scottish Government	SPP provides advice as to how local authorities should approach the preparation of local development plans (LDPs). Paragraph 150 advises that planning authorities should protect archaeological sites as an important, finite and non-renewable resource to be preserved *in situ* wherever possible. Where preservation *in situ* is not possible, appropriate excavation, recording, analysis, publication and archiving should be undertaken by the developer. Paragraph 151 identifies there is a range of non-designated historic assets and areas of historical interest, including historic landscapes, other gardens and designed landscapes, woodlands and routes such as drove roads which do not have statutory protection, but form an important part of Scotland's heritage which should be protected.
Planning Advice Note (PAN) 2 / 2011 Planning and Archaeology (published July 27, 2011)	Scottish Government	Superseded PAN 42 Archaeology – the Planning Process and Scheduled Monuments Procedures. Provides local government officers with advice for treating archaeological sites through the planning process, including consideration of setting and preservation in situ. Sets out Government policy on how archaeological remains and discoveries are dealt with within the existing development plan and development control processes
Scottish Historic Environment Policy Statement (published June 2016)	Historic Environment Scotland	Sets out how Historic Environment Scotland fulfils its regulatory and advisory roles and how it expects others to interpret and implement Scottish Planning Policy.
Highland-wide Local Development Plan (2012)	The Highland Council	Policy 57 – Natural, Built and Cultural Heritage. Establishes criteria for the assessment of development proposals taking into account the level of importance and type of heritage features,

Document	Jurisdiction	Key Issues
		the form and scale of the development, and any impact on the feature and its setting.
Supplementary Guidance on the Highland Historic Environment Strategy (published January 2013).	The Highland Council	Principles to ensure that: • Future developments take account of the historic environment and that they are of a design and quality to enhance the historic environment bringing both economic and social benefits; • It sets a proactive, consistent approach to the protection of the historic environment.

Archaeological Standards

5.4.3 This assessment was undertaken in accordance with relevant Standard and Guidance and Code of Conduct (2014) from the Charted Institute for Archaeologists (CIfA), and relevant Historic Environment Scotland guidance, which is outlined in Table 5.7. The archaeological assessment was carried out between July 2018 and January 2019.

Table 5.7 Archaeological Standards

Document(s)	Jurisdiction	Key Issues
Code of Conduct (December 2014) and Standards and Guidance for Archaeological Desk-based Assessments (January 2017)	Chartered Institute for Archaeologists	Sets standards for undertaking archaeological desk-based work and sets principles by which all archaeological work should be undertaken
Managing Change in the Historic Environment Guidance Notes (June 2016)	Historic Environment Scotland	Guidance to planning authorities and stakeholders regarding key issues relating to development, the planning process, and key issues pertaining to the historic environment. Most relevant are the guidance notes covering Setting.
Standards for Archaeological Work (2012)	The Highland Council	Sets minimum standards for archaeological procedures that may be required as part of the planning process in the Highlands. Covers all fieldwork, reporting and post-excavation procedures.

5.5 Existing environment

Introduction

5.5.1 This section provides a concise summary of the archaeological and cultural heritage baseline, focusing on the project area and Study Area A as identified above. It should be read in conjunction with the accompanying Appendix 5.1 Gazetteer and 5.2 Cultural Heritage Baseline report. All the heritage assets identified in the baseline are depicted on Figures 5.1 and 5.2 in Volume II.

Summary of identified heritage assets in Study Area A

5.5.2 There are no designated assets within the project area. There is a single Category B listed building, Glascarnoch Dam (LB1) in Study Area A. There are 41 non-designated assets (NDAs) identified in Study Area A, 35 of which are recorded in the HER and/or NRHE. Two of these: the Ullapool to Contin "fish road" (NDA36) and later Ullapool to Garve road (NDA41) are located within the project area. Details of all assets are included in Appendix 5.1 Gazetteer and 5.2 Cultural Heritage Baseline.

Narrative summary of the baseline

5.5.3 A detailed narrative of the cultural heritage baseline from which this summary is derived is included in Appendix 5.2 Cultural Heritage Baseline.

5.5.4 During early prehistoric periods known as the Palaeolithic and Mesolithic (500,000 – 12,000 BC and 12,000 – 4,000 BC), it is likely that natural resources in Study Area A were occasionally exploited by hunter-gatherers in a temporary and seasonal fashion.

5.5.5 During the later prehistoric periods known as the Neolithic, Bronze Age and Stone Age (4,000 BC – 560 AD), evidence suggesting permanent settlement and megalithic architecture was first established in the wider area of Study Area B. It is through the large-scale funerary monuments such as the henge at Achilty (SM3), and chambered cairns at Preas Mairi (SM4), Heights of Brae (SM9), and Balnacrae (SM11) that this evidence is visible. While Study Area A does not contain such monuments, it is possible that settlements and the clearance of the Caledonian forest for agriculture and stock-raising took place in Study Area A during this time.

5.5.6 During the early Medieval period (561– 1057 AD), Study Area A formed part of the kingdom of the Picts. Evidence for their occupation of Study Area A is not apparent, but there is a Pictish symbol stone located within Study Area B at Clach an Tiompain (SM6). A Class I symbol stone, Clach an Tiompain suggests occupation of the area dating to the 6^{th}, 7^{th} or 8^{th} centuries AD.

5.5.7 During the medieval period (1058–1559 AD), it is likely that Study Area A continued to be lightly settled. While no sites have been positively identified as belonging to this date, it is possible that steadings such as Lubfearn (NDA22) were first occupied during this period. The centre of political power in the wider area was Dingwall Castle under the Earl of Ross, with religious power centred at Fortrose.

5.5.8 It is not until the post-medieval period (1560– 1900 AD) that archaeological evidence for occupation is present in the form of identified heritage assets in Study Area A. The majority of these reflect the agricultural and stock-raising activities undertaken in the area. They include small rural settlements, such as the townships of Lubfearn (NDA24), Garbat (NDA35), and Kirkan (NDA18), as well as seasonally occupied settlements known as shielings (NDA7 and NDA34). Evidence for agriculture and stock-raising is evident through numerous other sites such as enclosures, sheepfolds and stells: Doire Nan Clach (NDA10, 13); Kirkan (NDA11, 17); Feith Bhaite (NDA12), Glascarnoch River (NDA14); Black Bridge (NDA21); Lubfearn (NDA22, 23 and 25); Coille Na Sroine (NDA26); and Ruigh Na Cloiche (NDA29). Arable agriculture is in evidence in the lower parts of Study Area A through field systems at Lub Na Bruaich (NDA19), Coille Na Sroine (NDA27, 28) and Dubh Choille (NDA33).

5.5.9 It is during the post-medieval period that the area came to prominence for cattle droving. The Aultguish Inn (NDA9) dates from this period, as does the 18^{th}-century former road between Ullapool and Contin (NDA6 and NDA 36) known as the “fish road”, and the bridge over the Allt Guibhais Beag (NDA8). The modern A835 follows the later Ullapool to Garve road (NDA41) constructed by Telford in the 19^{th} century replaced the “fish road” as the main thoroughfare through Study Area A. An illicit whisky still located near Kirkan (NDA 39) suggests that cattle was not the only product produced and transported along the roads through the parish.

5.5.10 During the modern period (1900 to present), investments in major transport and energy infrastructure projects and commercial forestry changed the nature and appearance of Study Area B. These include Glascarnoch Dam (LB1), the A835, and the numerous coniferous plantations in the area.

Archaeological Potential

5.5.11 Evidence for human occupation within the project area is described in the accompanying baseline report (Appendix 5.2). None of these pre-date the post-medieval period; the only site that can be confidently dated to pre-1745 in the vicinity of the project area is the township of Lubfearn (NDA24).

5.5.12 The lack of previous intrusive survey leaves a potential for unknown archaeological remains and/or, earthworks of all periods to be present within the project area.

5.5.13 While no prehistoric occupation or ritual sites are present within Study Area A, those present within Study Area B are located at up to 250 m AOD in the case of both settlements (e.g. Firth View prehistoric settlement: SM7, and Strath Sgitheach, SM8) and ritual monuments (Balnacrae chambered cairn: SM11). The project area varies in height between 225 m and 379 m, so it is conceivable that lower parts of the project area (e.g. plot 1) would have been considered suitable for occupation and use during prehistoric periods. However, much of the project area (particularly plots 4, 6 and 7) is marginal in terms of its suitability for continuous occupation and exploitation during the modern period, and this characteristic is likely to have been the case during historical and late prehistoric periods.

5.5.14 The density of identified prehistoric and early historic occupation sites within Strath Sgitheach in Study Area B suggests that occupation was focused on the lower straths and glens. During prehistoric periods, seasonal hunting and grazing are likely to have also taken place with fluctuating levels of intensity.

5.5.15 In historical (medieval to modern) periods, at 190 m AOD and adjacent to the Black Water, Lubfearn (NDA24) is likely to have been a focus of settlement, arable agriculture and stock raising dating back several hundred years. Kirkan (NDA18) is likely to have been more recent, potentially originating from the late 18^{th} century when large-scale sheep farming was adopted in the area. However, it is possible that it pre-dates this period. During these periods, the project area was exploited in the form of grazing for Highland black cattle, cattle droving along the Ullapool to Contin road (NDA36), sheep farming and later deerstalking.

5.5.16 In summary, the potential for archaeological evidence of settlements and permanent structural remains in the project area is considered to be negligible for all periods.

5.5.17 The potential for encountering remains from seasonal or temporary exploitation of the project area (e.g. temporary enclosures, evidence of temporary shelters, and artefacts such as lead shot, cartridges, horseshoes or arrowheads) is considered to be moderate.

5.6 Project Characteristics

Potential physical impacts of the proposed development

5.6.1 The proposed development would involve several activities during the construction phase, which have the potential for a physical impact on both buried and upstanding archaeological and cultural heritage resources. These activities include:

- Excavations for turbine foundations;
- Excavations for crane hard standing areas;
- Excavations for temporary construction compounds;
- Excavations for borrow pits;
- Excavations for access tracks (including improvements to existing road systems to allow for access of construction traffic);
- Excavation for the control building/substation and associated construction compound/ prospective energy storage facility location; and
- Excavation of service trenches and cable routes.

5.6.2 Based on the assessment of archaeological potential outlined in paragraph 5.5.11 onwards above, the likelihood of encountering previously unrecorded buried archaeological remains within the footprint of the proposed development is considered to be low.

Potential Impacts on the Setting of Cultural Heritage Receptors

5.6.3 The proposed development has the potential to impact on the setting of cultural heritage receptors during its construction phase (albeit temporarily) and operational phase, described as follows:

- Interruption of sight lines and monument intervisibility is possible where the heritage asset is superseded in terms of landscape prominence and/or dominance by the proposed development.
- Views into, out of, and within the area of interest: the visual impact is caused if the proposed development becomes a significant factor in the views from the designated asset or to it from the surrounding landscape. This is especially relevant if the designation description specifically references the landscape (or townscape) setting as fundamental to significance.

5.6.4 Possible indirect impacts can also include:

- Change in levels of noise or movement at a designated asset near a turbine; and
- Light (flicker) at a designated asset located near a turbine.

5.7 Predicted impacts

Site-specific direct physical and indirect impacts

5.7.1 Two non-designated assets: the Ullapool to Contin former drovers' road (NDA36) and Telford's Ullapool to Garve road, now the A835 (NDA41) are located within the project area.

Ullapool to Contin former drovers' road (NDA36)

5.7.2 The Ullapool to Contin former drovers' road, also known as the "fish road" (NDA36) is the earliest road constructed between these two locations. Constructed in 1792-3, it follows the route of an earlier drove road. It was recorded as being of poor quality, requiring repair only 12 years after its completion.

5.7.3 During the site visit, it was observed to be visible as an approximately 3 m-wide level track following the contours of the hills in the project area. It is currently used as a footpath. A photograph of its current appearance is shown in Figure 5.3. It is also recorded by ScotWays as a Right of Way HR46, known as the Fish Road, and promoted by the Heritage Paths project.

5.7.4 As it crosses through the project area, a 490 m-long section of NDA36 is proposed to be upgraded to form part of the access track leading to the windfarm array to the southwest. The length of this asset between where it was identified south of Loch Glascarnoch and where it meets the A835 at Gorstan is 9.7 km, comprising footpaths and forestry tracks, meaning that approximately 5 per cent of its route would be directly impacted. It forms part of what would have been a much longer road of more than 60 km between Ullapool and Contin.

5.7.5 Both a permanent direct (physical) impact, a permanent indirect impact, and a temporary and reversible impact on this asset, which is considered of Low importance, are predicted, as follows:

- A permanent direct physical impact: the upgrading of NDA36 from a footpath to a wind farm access track would lead to the permanent loss of the archaeological deposits/information associated with its construction and use as a drovers' road and subsequent 18^{th}-century road suitable for carts and draught animals over the proportionately short distance within the project area. A Moderate direct (physical) impact is predicted, leading to a **Slight** significance of effect.
- A permanent indirect impact: the change of NDA36 from a footpath to a wind farm access track would cause a loss of coherence as part of a much larger linear route of local heritage interest extending beyond the project area. A Moderate indirect impact is predicted, leading to a **Slight** significance of effect.
- A temporary indirect impact: during construction, access along this footpath and historic drovers route will not be permitted, leading to temporary loss of public access and recreational amenity. A Minor indirect impact is predicted, leading to a significance of effect of "**None**".

Ullapool to Garve Road (NDA41)

5.7.6 The Ullapool to Garve Road, constructed by the District Roads Trustees between 1840 and 1850, formed the replacement for the "fish road" (NDA36 above) when it fell into misuse. The A835 is the modern incarnation of this road and follows its same route through Study Area A except where modifications following the construction of the Glascarnoch Dam (LB1) were necessary. The A835 trunk road has subsequently been extensively upgraded and modernised. During the site visit, no features were identified as relating to early phases of construction of the road; there are several areas of modification to the natural topography along the southern side of the A835 that are likely to have been the result of construction and/or upgrading of the road, such as quarry scoops.

5.7.7 The asset is considered to be of Negligible heritage importance due to its original fabric having been largely removed through the ongoing upgrading and maintenance works required to maintain the A835 as suitable for modern motor vehicles.

5.7.8 The access to the proposed development area is to be taken from the A835, overlapping the original route of the Ullapool to Garve road.

5.7.9 A Negligible permanent direct physical impact is predicted, leading to a significance of effect of "**None**".

Impacts on setting

5.7.10 The three-stage process for the assessment of impacts on the setting of designated heritage assets described in Section 5.2 above was followed.

5.7.11 For Stage 1: identification of historic assets, at an early stage of the design and EIA process for Kirkan Wind Farm it was apparent that there was very little visibility of turbines from designated heritage assets within Study Area B It was agreed with HES and HET to focus assessment of setting on the following designated assets:

- LB1: Conon Valley Hydro Electric Scheme, Loch Glascarnoch Dam (LB51706), a Category B listed building located 1.06 km from the project area;
- LB2: Conon Valley Hydro Electric Scheme, Vaich Dam, including Spillway Towers and Weir (LB51707), a Category C listed building located 4.6 km from the project area; and
- GDL1: Fairburn (GDL00174), an inventory garden and designed landscape located 15 km from the project area.

5.7.12 Stages 2 (define and analyse setting) and 3 (impact assessment) for each of these three assets is described below.

Conon Valley Hydro Electric Scheme, Loch Glascarnoch Dam (LB1)

5.7.13 The Loch Glascarnoch Dam is a large-scale dam built in 1957 that dominates its surroundings in the valley of Strath Dirrie. See Photographs 5.1 and 5.2 below. It is an extensive concrete structure with a central control tower. When the water level is low, large boulders and gabion walls are also visible above the water line of the loch. The dam holds back the Glascarnoch River to form Loch Glascarnoch. The size and flow of the

Glascarnoch River and Black Water to the east (downstream) of the dam have clearly been reduced.

5.7.14 Its location, design and current appearance are informed by the strategic objectives of the North of Scotland Hydro Electric Board (NoSHEB) and their designers James Williamson and Partners, which were to develop Scotland's resources for water power and reinvigorate the economy of the Highlands. In particular, the location and design were informed by the opportunity to use earth wings, exploiting the natural gorge topography of the location, to minimise the amount of concrete (and concomitant time, labour and cost) required.

5.7.15 Therefore, while Glascarnoch Dam (LB1) is a prominent designated asset within Study Area A, the function of the dam as a hydro-electric renewable power plant determines its appearance and visual relationship with its surroundings, with aesthetic qualities contributing to its setting being of less relevance.

5.7.16 It is the largest modern man-made structure in its vicinity, though the A835 road, Aultguish Inn,modern overhead powerlines and extensive deer and commercial forestry fencing are also apparent within the valley. The operational onshore wind turbines of Corriemoillie, Lochluichart and its extension to the south of LB1 are also visible on the higher hills to the south.

5.7.17 14 to 17 new proposed development turbines would be visible from the dam. These would appear behind the hill of Sìthean nan Cearc, 2.7 km to the southeast. These turbines and the proposed access track leading to the wind farm array would form new permanent modern features within its setting. The proposed compounds south of the A835 would be a temporary modern feature within its setting. These changes would not detract from our ability to understand and appreciate this historic asset.

5.7.18 As a Category B LB, it is considered of Medium importance. As its setting is not considered to contribute an important part of its significance, a Minor impact is predicted, leading to a **Slight** significance of effect.

5.7.19 Photograph 5.1 View from Glascarnoch Dam (LB1) looking southwards towards Corriemoillie Wind Farm, with the project area on the left of the photograph.

5.7.20 Photograph 5.2 View from Glascarnoch Dam (LB1) looking eastwards along Strath Dirrie, with the Aultguish Inn in the centre of the photograph, and the project area to the right.

Conon Valley Hydro Electric Scheme, Vaich Dam (LB2)

5.7.21 Built in the same year as the Loch Glascarnoch Dam (LB1), the Vaich Dam is constructed of a rubble fill either side of a waterproof concrete wall. It is locally prominent within the secluded glen of Strath Vaich, 4.6 km north of the project area. See Photographs 5.3 and 5.4 below.

5.7.22 Strath Vaich is a sparsely populated valley forming part of a deer stalking estate. Its topography consists of a narrow north-to-south incised valley of enclosed pasture fields, with relatively young deciduous forestry on its flanks. Settlement and man-made structures are limited to lodges and cottages on the lower parts of the Strath, all dating to the 19th century.

5.7.23 The Vaich Dam is considerably the largest and most modern man-made structure within the glen, dwarfing Strath Vaich lodge, its ancillary buildings and cottages. There are several other modern structures associated with it, including a sluice and overhead transmission lines. A watercourse called the Abhainn Strath a' Bhathaich, a tributary of the Black Water, issues from the sluice of the LB. There is currently no visibility of wind turbines from the Vaich Dam.

5.7.24 As with the Loch Glascarnoch Dam (LB1) above, the Vaich Dam's location, design and current appearance are informed by the strategic objectives of NoSHEB and their designers. The current grassed-over appearance of the downstream face of the Vaich Dam (LB2) is a result of the design decisions made by Williamson and Partners' engineers, which prioritised the use of locally available materials such as rubble and turf over imported concrete.

5.7.25 Therefore, the Vaich Dam is a prominent designated asset within Strath Vaich, but it is its function as a hydro-electric renewable power plant that determines its current appearance and visual relationship with its surroundings. Aesthetic qualities (e.g. designed vistas or sight-lines) contributing to its setting are of less relevance is the case for other types of assets where the visual appearance and relationship with its surrounding landscape are of greater influence.

5.7.26 According to the ZTV included in Figure 5.2, between 1 and 6 new turbines from the proposed development would be visible, 6.79 km to the south-southeast. However, in reality the visibility of turbines is likely to be less due to the intervening vegetation such as the forestry on the southwestern slopes of Strath Vaich.

5.7.27 Therefore, while Glascarnoch Dam (LB1) is a prominent designated asset within Study Area A, the function of the dam as a hydro-electric renewable power plant determines its appearance and visual relationship with its surroundings, with aesthetic qualities contributing to its setting being of less relevance.

5.7.28 As a Category C LB, it is considered of low importance. A Negligible impact is predicted, leading to a significance of effect rated as "**None**".

5.7.29 Photograph 5.3 View from Vaich Dam (LB2) looking southwards towards the project area

5.7.30 Photograph 5.4 View from Vaich Dam (LB2) looking eastwards along the dam

Fairburn inventory garden and designed landscape (GDL1)

5.7.31 Fairburn GDL consists of a late 18th or early 19th-century designed landscape around Fairburn House. It occupies elevated, north-facing ground above the River Conon. The GDL consists of gardens, woodland and architectural features. It is considered of high architectural value, as the HGDL provides the setting for multiple Category B LBs and has outstanding horticultural and scenic value through the woodland garden (around Fairburn House) and open parkland.

5.7.32 The designed landscape around the formal core of the woodland garden consists of tree-lined pasture fields, with forestry on upland areas to the south. In terms of the GDL's scenic importance, the site visit identified key views within the receptor as comprising: the woodland garden viewed from Fairburn House, a Category B LB (see Photo 5.5); and along the tree-lined driveway leading to the house from the east (Photo 5.6). Views out from the house and formal garden are extensively screened by the woodland garden.

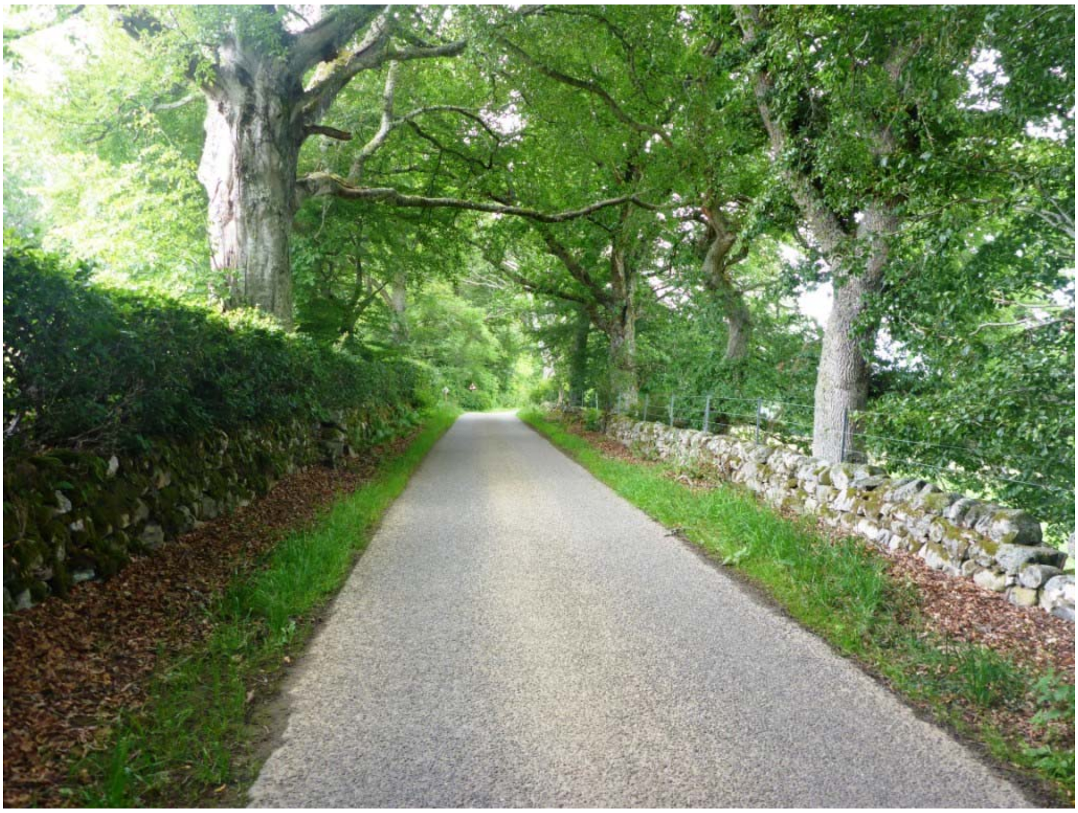
5.7.33 The setting of the designed landscape around the formal garden core has been altered by an existing large overhead power line within its boundary running east to west through Strathconon. There is a view of a single existing operational turbine (at a distance of approximately 15 km) from Corriemoillie or Lochluichart framed between two peaks to the northwest over Loch Achonachie.

5.7.34 The ZTV for the proposed development identifies between zero and 17 turbines being visible within this extensive GDL; the extensive tree cover along the east to west driveway and around Fairburn House would reduce the visibility of turbines significantly. The prominence of the GDL within Strathconon would remain unaffected. Key views from the Fairburn House over the designed elements of the GDL would remain unaffected, and similarly, lines of sight drawn towards Fairburn House along the driveway within the GDL would remain unaffected. There would be distant views of turbines located 15.0 km to the northwest from within farmland elements of the HGDL, and obliquely from the driveway within its designed landscape element (see Photo 5.7 and Figure 4.14a Viewpoint 7: Muir of Fairburn). Neither is considered a significant impact to setting of the HGDL.

5.7.35 The magnitude of impact is rated as Negligible on a receptor of High importance, leading to a significance of effect considered to be **Slight**.

5.7.36 Photograph 5.5 View of Fairburn House within Fairburn GDL (GDL1) looking westwards

5.7.37 Photograph 5.6 View along east to west driveway within Fairburn GDL (GDL1) looking westwards



5.7.38 Photograph 5.7 View towards proposed development from Fairburn GDL (GDL1) looking north-westwards

Cumulative effects

5.7.39 Based on known developments within Study Area A, no physical cumulative impacts are predicted. Consideration of cumulative effects on the setting of the three designated assets identified above are described below. These consider the cumulative impact of the proposed development and the following onshore wind projects:

- The proposed Lochluichart Extension II
- The operational Lochluichart Wind Farm
- The operational Corriemoillie Wind Farm
- The operational Lochluichart Extension I

5.7.40 The locations, layouts and ZTVs for these developments are shown in Figure 4.6. For Fairburn (GDL1), the developments of Novar, Novar Extension and Fairburn wind farms were also considered, given their proximity to and visibility from the GDL.

Conon Valley Hydro Electric Scheme, Loch Glascarnoch Dam (LB1)

5.7.41 Wind turbines from the operational Lochluichart, Lochluichart Extension I and Corriemoillie Wind Farms are present within the setting of LB1 (see Photo 5.1). The addition the proposed development with the proposed Lochluichart Extension II would add to the number of turbines present within the setting of the Loch Glascarnoch Dam along its southern and south-eastern aspects. However, given the modern, industrial and functional character of the LB, an increasing number of turbines visible from Glascarnoch

Dam will not significantly reduce the ability to understand, appreciate or experience the asset.

5.7.42 A designated asset of Medium importance, a Minor impact is predicted, leading to a **Slight** significance of effect.

Conon Valley Hydro Electric Scheme, Vaich Dam (LB2)

5.7.43 No onshore wind developments are currently visible from Vaich Dam (LB2), therefore no cumulative effects are predicted.

Fairburn inventory garden and designed landscape (GDL1)

5.7.44 Corriemoillie, Lochluichart and Lochluichart Extension I Wind Farms are currently visible 18 to 21 km away from Fairburn as an array of turbines to the northwest of the GDL, and form part of the existing backdrop to the GDL. From within the GDL, further turbines from the Novar, Novar Extension and Fairburn wind farms are also visible. The proposed development turbines would also be visible as a series of new turbines to the east of Corriemoillie, forming part of an array of turbines on the distant horizon.

5.7.45 Cumulative effects are considered to be a Negligible impact on a receptor of High importance, leading to a significance of effect considered to be **Slight**.

5.8 Mitigation

Direct Physical and Indirect Effects

5.8.1 Archaeological strategies for mitigating potential physical impacts typically consider two options:

- Preservation *in situ*: the preservation without disturbance of sensitive archaeological remains. This can be achieved through engineering solutions (e.g. foundation design) or minor amendments to the proposed development layout by micro-siting turbines; or
- Preservation by record (excavation): where preservation in situ is not feasible or desirable an alternative mitigation is pre-construction archaeological excavation. This consists of a detailed programme of archaeological fieldwork to preserve, by record, the archaeological value of the heritage asset.

5.8.2 No significant direct physical or indirect effects are predicted through construction or operation of the proposed development. Slight permanent physical direct and indirect effects are predicted on a single non-designated asset: the former road between Ullapool and Contin (NDA36). There is also the potential for previously unidentified archaeological remains to be present within the project area, and these may also be physically impacted by the proposed development.

5.8.3 It is anticipated that, should the project receive consent, the mitigation measures detailed in this section will form part of a condition for consent for the proposed development. The detail of mitigation measures will be agreed in advance with HET through written schemes of investigation (WSIs) or method statements. Appropriate archaeological reporting (and, if necessary, archiving, analysis and publication) will be undertaken in accordance with Scottish Planning Policy, the agreed WSI, relevant CIfA *Standard and Guidance* and Highland Council *Standards for Archaeological Work* (2012).

Mitigation to address the potential for the discovery of unidentified archaeological remains

5.8.4 To address the potential for impacts on previously unknown archaeological remains, an archaeological watching brief and appropriate archiving, reporting, analysis and publication (as necessary) can be undertaken on ground works undertaken during the construction phase.

Ullapool to Contin former drovers' road (NDA36)

5.8.5 To mitigate the direct physical effects, a programme of appropriate excavation, recording, analysis, publication and archiving of elements of the drovers' road affected by the construction of the wind farm infrastructure will be undertaken. This will take the form of an earthworks survey followed by targeted intrusive excavation and recording of representative cross-sections of the road where it is subject to direct, physical effects. The aim of this programme of work is to help to understand the construction method for the "fish road" phase of the route (completed in 1797), and to see if any elements of the earlier drovers' road are preserved.

5.8.6 To mitigate the indirect effects (namely the loss of coherence of the droveway as part of a larger linear route of local heritage interest extending beyond the project area, and from temporary loss of public access and recreational amenity), the following mitigation is proposed:

- The route of the former Ullapool to Contin road (NDA36) is marked out with appropriate signage during the operational phase of the proposed development;
- Opportunities for promoting the project area's wider heritage (e.g. information boards [at the Aultguish Inn and] where NDA36 is accessed from the A835, at Kirkan township and the site of a nearby illicit whisky still, NDA39) form part of the operational phase of the proposed development; and
- Appropriate measures are put in place to ensure that recreational public access through the project area broadly following the drovers' road (NDA36) is secured after completion of the construction phase of the development.

Residual Direct Physical and Indirect Effects

5.8.7 Following the implementation of the mitigation measures described above, no negative residual physical or indirect effects are predicted.

Impacts on Setting

5.8.8 Slight, non-significant impacts were identified on the setting of two receptors: Loch Glascarnoch Dam (LB1) and Fairburn garden and designed landscape (GDL1).

5.8.9 No further mitigation concerning visual impacts is proposed.

5.9 Summary of effects

5.9.1 Table 5.8 below provides a summary of the residual effects following the adoption of the mitigation measures identified in Section 5.8 above.

Table 5.8 Summary of effects

Asset No.	Asset name	Summary of residual effects
LB1	Loch Glascarnoch Dam	**Slight** negative effect on the setting of the asset
		Slight cumulative negative effect on the asset
GDL1	Fairburn garden and designed landscape	**Slight** negative effect on the setting of the asset
		Slight cumulative negative effect on the asset

5.10 References

Chartered Institute for Archaeologists (2014) *Code of Conduct*

Historic Environment Scotland (2016) *Managing Change in the Historic Environment: Setting*.

Historic Environment Scotland (2016) *Scottish Historic Environment Policy Statement*

RSK (2018). Kirkan Wind Farm: Scoping Report, RSK Environment Ltd.

Scottish Government (2014) *Scottish Planning Policy*

Scottish Government (2011) *Planning Advice Note (PAN) 2 / 2011 Planning and Archaeology*

The Highland Council (2012) *Highland-wide Local Development Plan*

The Highland Council (2012) *Standards for Archaeological Work*

The Highland Council (2013) *Supplementary Guidance on the Highland Historic Environment Strategy*

The Highland Council (2013) *Supplementary Guidance on the Highland Historic Environment Strategy*

6 ECOLOGY

6.1 Introduction

6.1.1 This chapter provides an assessment of the potential effects upon important ecological features in relation to the construction, operation and decommissioning of the proposed development.

6.1.2 The chapter is supported by Figures 6.1 to 6.14 presented in Volume 3 and the following appendices presented in in Volume 2:

- Appendix 6.1 – Habitats and Vegetation;
- Appendix 6.2 – Protected Species;
- Appendix 6.3 – Bat Activity Survey;
- Appendix 6.4 – Fish Habitat Survey;
- Appendix 6.5 – Deer Assessment; and,
- Appendix 6.6 – Outline Habitat Management Plan.

6.2 Legislation, policy and guidance

6.2.1 In preparation of this chapter, reference has been made to the following key pieces of legislation, planning policy and guidance:

European

- EIA Directive (85/337/EEC) (as amended); and,
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive).

National

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Conservation of Habitats and Species Regulations 2010, as amended in Scotland (the Habitat Regulations);
- The Wildlife and Countryside Act 1981 (as amended);
- The Wildlife and Natural Environment (Scotland) Act 2011;
- The Nature Conservation (Scotland) Act 2004;
- The National Planning Policy Framework 3 (2014);
- Scottish Planning Policy (2014);
- SNH general pre-application/ scoping advice to developers of onshore wind farms (SNH, 2018);
- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018);
- Assessing the Cumulative Impact of Onshore Wind Energy Developments (SNH, 2012);
- Protected Species Advice for Developers: Otter (SNH, 2018);
- Protected Species Advice for Developers: Pine Marten (SNH, 2018b);

- Protected Species Advice for Developers: Red Squirrel (SNH, 2018c);
- Protected Species Advice for Developers: Water Vole (SNH, 2018d);
- Protected Species Advice for Developers: Wildcat (SNH, 2018e);
- Bat surveys: Good Practice Guidance 2nd edition (Hundt, 2012);
- Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd edition (Collins, 2016);
- Planning for development: What to consider and include in deer assessments and management at development sites (SNH, 2016);
- Planning for development: What to consider and include in Habitat Management Plans (SNH, 2016a); and,
- Scottish Biodiversity List (SBL) 2013.

Local

- The Ross and Cromarty (East) Biodiversity Action Plan (LBAP).

6.2.2 Local planning policies of relevance to this assessment are provided in the accompanying Planning Statement.

6.3 Scope of assessment

6.3.1 Assessment has been undertaken in accordance with the Chartered Institute for Ecology and Environmental Management (CIEEM) guidelines 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine' (CIEEM, 2018) and considers the following three main potential impacts upon ecological features associated with wind farm developments:

- Designated Sites - potential indirect effects upon designated sites for nature conservation;
- Habitat Loss / Deterioration - direct and indirect loss and deterioration of habitats;
- Mortality / loss of life - incidental loss of life or injury through construction activities to species; and,
- Disturbance / Displacement of Species - disturbance and displacement of faunal species; loss, damage or disturbance to their breeding and/or resting places.

6.3.2 The potential for effects are considered as a result of the proposed development alone and cumulatively, in-combination with other wind turbine developments.

6.4 Assessment methodology

6.4.1 Assessment has been undertaken in accordance with CIEEM guidelines (2018) and includes the following stages:

- determination and evaluation of important ecological features;
- identification and characterisation of impacts;
- outline of mitigating measures to avoid and reduce significant impacts;
- assessment of the significance of any residual effects after such measures; and,
- identification of appropriate compensation measures to offset significant residual effects.

Determining importance

6.4.2 Relevant European, national and local guidance has been referred to in order to determine the importance of ecological features.

6.4.3 In addition, importance has also been determined using professional judgement and taking account of the results of baseline surveys, desk study and the importance of features within the context of an appropriate geographic scale.

6.4.4 For the purposes of this assessment the importance of an ecological feature is considered within a defined geographical context from Local to International, as outlined in Table 6.1.

6.4.5 It should be noted that importance does not necessarily relate solely to the level of legal protection that a feature receives and ecological features may be important for a variety of reasons, such as their connectivity to a designated site, rarity of species or the geographical location of species relative to their known range.

6.4.6 Similarly, whilst a particular feature may be associated with a nearby internationally designated site, the feature is not automatically assigned a value of "International" importance.

Table 6.1 Geographic scale of ecological feature importance

Importance	Definition
International	An internationally designated site i.e. Special Area of Conservation (SAC) and/or Ramsar site or candidate site (or cSAC). Large areas of priority habitat listed under Annex I of the Habitats Directive, and smaller areas of such a habitat that are essential to maintain the viability of that ecological resource. A regularly occurring, nationally significant population of any internationally important species, listed under Annex II or Annex IV of the Habitats Directive.
National	A nationally designated site e.g. Site of Special Scientific Interest (SSSI), or area meeting criteria for national level designations. Significant extents of a priority habitat identified in the UKBAP / Scottish Biodiversity List, or smaller areas which are essential to maintain the viability of that ecological resource. A regularly occurring, regionally significant population of any nationally important species listed as a UK BAP / Scottish Biodiversity List priority species and Species listed under Schedule 1 or Schedule 5 of the Wildlife and Countryside Act or Annex II or Annex IV of the Habitats Directive.
Regional	Viable areas of key semi-natural habitat identified in the UKBAP. A regularly occurring, locally significant population of any nationally important species listed as a UK BAP / Scottish Biodiversity List priority species and Species listed under Schedule 5 of the Wildlife and Countryside Act or Annex II or Annex IV of the Habitats Directive. Sites which exceed the local authority-level designations but fall short of SSSI selection guidelines, including extensive areas of semi-natural woodland.
Local	Nature conservation sites selected on local authority criteria. Other species of conservation concern, including species listed under the Local BAP (LBAP). Areas of habitat or species considered to appreciably

Importance	Definition
	enrich the ecological resource within the local context e.g. species-rich flushes or hedgerows. Areas of semi-natural ancient woodland smaller than 0.25ha. All other species and habitats that are widespread and common and which are not present in locally, regionally or nationally important numbers or habitats which are considered to be of poor ecological value.

Characterising impacts

6.4.7 Once identified, potential effects are described making reference to the following characteristics as appropriate:

- positive or negative;
- extent;
- magnitude;
- duration;
- timing;
- frequency; and,
- reversibility.

6.4.8 The assessment only makes reference to those characteristics relevant to understanding the nature of an effect and determining its significance.

6.4.9 The likelihood or probability that an effect will occur is also described as far as possible based on best available information and where relevant. The likelihood of an impact occurring is also referred to using the following terms: certain, likely, unlikely or highly unlikely where appropriate.

6.4.10 The criteria used to determine the magnitude of impact are set out in Table 6.2.

Table 6.2 Impact Magnitude

Magnitude	Definition
High	The effect (either on its own or with other proposals) may adversely or positively affect the biodiversity conservation status of a site/population, in terms of the coherence of its ecological structure and function (integrity), across its whole area, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest.
Medium	Biodiversity conservation status of a site or population would not be adversely or positively affected, but some element of the functioning might be affected and impacts could potentially affect its ability to sustain some part of itself in the long term.
Low	Neither of the above applies, but some minor adverse or beneficial effect is evident on a temporary basis or affects extent of habitat/species abundance in the local area.
Negligible	No observable effect in either direction.

Determining significance

6.4.11 For the purposes of assessment, a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important features' or for biodiversity in general.

6.4.12 Significant effects encompass impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution) and are identified on the basis of magnitude, professional judgment and best available evidence.

6.4.13 CIEEM guidelines (2018) note that "A significant effect does not necessarily equate to an effect so severe that consent for the project should be refused planning permission. For example, many projects with significant negative ecological effects have been lawfully permitted following EIA procedures."

6.4.14 In broad terms, significant effects encompass impacts on the structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution).

6.4.15 For the purposes of this assessment, significant effects are primarily expressed with reference to an appropriate geographical scale.

6.4.16 In cases of reasonable doubt, where it is not possible to robustly justify a conclusion of no significant effect, a significant effect has been assumed as a precautionary approach. Where uncertainty exists, this is acknowledged.

6.4.17 Where the ecological assessment proposes measures to mitigate adverse effects on ecological features, a further assessment of residual ecological effects, taking into account any ecological mitigation recommended, has been undertaken.

6.4.18 CIEEM guidelines do not recommend the use a matrix table as commonly set out in EIA Report (EIAR) chapters to determine 'significant' and 'non-significant' effects. For the purposes of this assessment presented herein, Table 6.3 sets out adapted CIEEM terminology and equivalent EIA terms.

Table 6.3 Effect Significance

Effect (EIA Significance)		
Non-significant	Negligible	No significant impact on ecological integrity or conservation status.
Non-significant	Minor Adverse	Significant adverse impact on ecological integrity or conservation status at a Local level only.
Significant	Moderate Adverse	Significant adverse impact on ecological integrity or conservation status at a Regional level.
Significant	Major Adverse	Significant adverse impact on ecological integrity or conservation status at a National or International level.

Assessment of cumulative effects

6.4.19 Potentially significant cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location.

6.4.20 The potential for cumulative impacts have therefore been assessed with reference to SNH guidance (2012), and encompass the effects of the proposal in-combination with relevant:

- existing developments, either built or under construction;
- approved developments, awaiting implementation; and,
- proposals awaiting determination within the planning process with design information in the public domain.

6.5 Consultation undertaken

6.5.1 Consultation with statutory and non-statutory advisors, together with species specialist groups has been undertaken to inform the approach to and undertaking of assessment.

6.5.2 A summary of consultations undertaken, responses received and how they have been considered is provided in Table 6.4.

Table 6.4 Summary of consultations

Consultee	Response Received	Action Taken
Cromarty Fisheries Board	Have not done surveys of the watercourses on the site but have done habitat survey and electro-fishing survey of Glascarnoch River and upper Blackwater downstream of the site. Both watercourses are stocked with juvenile salmon annually, as part of the mitigation for the Conon Basin Hydro Electric Scheme. Although not surveyed, the watercourses onsite are likely to support brown trout and, in the lower reaches, salmon. About to update fishery management plan but are waiting for a new template for plans to be agreed with Fishery Management Scotland and Marine Scotland Science. If required, the old fishery management plan can be downloaded from Cromarty.dsfb.org.uk.	Information from the Cromatry Fisheries Board provided an indication of the fish species likely to be present. Watercourses, including those within the study area, and Glascarnoch River and Blackwater were included as part of the fish habitat survey.
Scottish Wildcat Action	Provided confirmation of a wildcat record from October 2015 located outside the study area to the north-east, and another wildcat record from 2013/14 from woodland to the east of the study area. Advised on effective camera trap surveys to detect wildcat, and that valerian root is appropriate bait. Also provided a link to best practice for camera trapping wildcat:	Surveys for wildcat were carried out throughout the study area. Valerian root was used as bait at camera traps as

Consultee	Response Received	Action Taken
	http://www.scottishwildcataction.org/media/42480/camera-trapping-leaflet-compressed.pdf	recommended, and the methodology in the best practice leaflet was followed.
SEPA	Provided advice particularly regarding protecting peat habitats onsite. They welcome that the Gatecheck report confirmed that the areas suspected as having the 'deepest peat' will be avoided. They requested that they are consulted so they can be satisfied that the scheme design will indeed avoid these most sensitive peat areas, and GWDTE should also be avoided. They requested that a peat management plan be drafted.	The recommendations of avoidance of areas of deepest peat (and GWDTE) within the Gatecheck report followed through to scheme design. A peat management plan has been developed and can be seen in Appendix 9.4.
SNH	No specific comments made regarding ecological features, and instead confirmed they are happy with the approach followed, as long as SNH guidance is adhered to.	Ecological surveys have been carried out following the most recent SNH guidance.

6.6 Baseline methodology

6.6.1 Baseline information to inform the design and assessment of the proposed development has been collated through desk study and field surveys.

Desk study

6.6.2 A desk study was undertaken to collate existing information on the presence of designated sites for nature conservation and existing records of protected and notable habitats and faunal species in proximity to the proposed development.

6.6.3 The following key sources were consulted:

- Scottish Natural Heritage (SNH) Sitelink (http://gateway.snh.gov.ul/sitelink/);
- National Biodiversity Network (NBN) Database;
- Scottish Wildcat Action;
- Cromarty Firth Fisheries Board; and,
- Highland Biological Recording Group (HBRG).

6.6.4 A review of publicly available EIA documentation for the adjacent operational Corriemoillie, Lochluichart and Lochluichart Extension wind farms has also been undertaken.

6.6.5 Full details and results of the desk study undertaken are provided in Appendices 6.1 and 6.2.

Field Surveys

6.6.6 Detailed knowledge of habitats and the presence or likely presence of protected and notable species has been derived from field surveys.

6.6.7 The following field surveys have been completed:

- Phase 1 habitat survey;
- National Vegetation Classification (NVC) survey;
- Bat activity surveys;
- Bat roost assessment;
- Terrestrial mammal surveys; and,
- Fish habitat survey.

6.6.8 Table 6.5 provides a summary of field survey methodologies followed. Full details are provided in Appendices 6.1 to 6.4.

6.6.9 All field surveys have been undertaken within the most recently available 18-month survey window prior to submission, as per SNH guidance (2018).

Table 6.5 Field survey methodologies

Ecological Feature	Methodology
Habitats and Vegetation	A Phase 1 habitat survey was undertaken between the 14th and 16th of July 2017. The survey was undertaken in accordance the UK industry standard Joint Nature Conservation Committee (JNCC) Phase 1 Habitat Methodology (JNCC, 2010), extended to include the additional recording of specific features indicating the presence, or likely presence, of protected or notable species. A National Vegetation Classification (NVC) survey was subsequently undertaken between the 17th and 20th of July following the guiding principles detailed in the National Vegetation Classification: Users' handbook (Rodwell, 2006). The study area comprised all habitats within the project area and within at least 250 m of the project area as access allowed. Full details are provided in Appendix 6.1.

Ecological Feature	Methodology
Bats	Bat activity surveys were undertaken adopting a seasonal effort, over the 2018 Spring, Summer and Autumn activity periods, on the basis of a survey approach appropriate for a “low risk” site in accordance with BCT guidance (Hundt, 2012), applicable at the time. New joint agency guidance (2019) ‘*Bats and onshore wind turbines: Survey, assessment and mitigation’* was published in January 2019, after the completion of surveys and subsequent technical reporting. However consideration has been given to the new guidance during the impact assessment process. Surveys have included a combination of walked manual transects and automated monitoring. The study area has comprised habitats which are consider suitable for bats within the project area, and out to 250 m as access allowed. A single transect comprising eight listening points together with 10 automated monitoring stations were used to provide a representative coverage of habitat features within the study area. A preliminary ground level roost assessment of trees within the study area has also been undertaken, in conjunction with the Phase 1 habitat survey in July 2017. Full details are provided in Appendix 6.3.
Other Terrestrial Mammals	Targeted surveys for terrestrial mammals were undertaken between March and April 2018, using a combination of camera traps and walkover surveys. Target species for survey included otter *Lutra lutra*, water vole *Arvicola amphibius*, pine marten *Martes martes*, badger *Meles meles* and wildcat *Felis silvestris*. The study area has comprised all suitable habitats for target species within the project area and out to at least 200 m for otter, 50 m for water vole, 250 m for pine marten, 100 m for badger and 200 m for wildcat as access allowed. Surveys have been undertaken in accordance with SNH guidance (2018a; 2018b; 2018d; 2018e). Full details are provided in Appendix 6.2.
Fish	A fish habitat survey to identify any areas of critical fish habitats (i.e. spawning, nursery areas, juvenile and adult holding areas) potentially impacted by the proposed development was completed in July 2018 following the Scottish Fisheries Co-ordination Centre methodology. The survey included gradient analysis, habitat mapping and classification and searches for evidence of fish species. The study area comprised all watercourses within and intersecting the project area and adjacent sections of the Glascarnoch River and Blackwater. Full details are provided in Appendix 6.4.

Additional surveys

6.6.10 As per SNH guidance (2018), there are some species that with standard mitigation are unlikely to experience significant effects as a result of the development of onshore wind farms (e.g. invertebrates, reptiles and amphibians) and as such, do not require surveys to inform an EIA.

6.6.11 On this basis, baseline surveys for invertebrates, reptiles and amphibians have not been undertaken to inform the design and assessment of the proposed development. Mitigation measures to avoid or where otherwise reduce adverse effects and ensure legislative compliance (where applicable) have however, been outlined.

6.6.12 Targeted surveys for red squirrel have not been undertaken. Woodland habitats within the project area are restricted to a small extent of stunted woodland, with extensive areas of mature coniferous woodland located within the immediate and wider surrounding area. The species presence has also been previously established locally within EIA documentation for the operational Corriemoillie Wind Farm

6.6.13 With measures to avoid disturbance to red squirrels and/or damage to dreys during construction works requiring woodland clearance outlined herein, targeted surveys are not required as per SNH guidance (2018c).

Assessment limitations

6.6.14 No limitations to baseline information gathering and subsequent assessment presented herein are identified.

6.6.15 Surveyor access onto lands within the adjacent Corriemoillie Estate was not available for the purposes of survey in relation to the proposed development. Pertinent observations of habitats and the potential for protected species was however possible by way of binoculars and observations from public rights of way.

6.6.16 As such, access restrictions are not considered a limitation to baseline information gathering with survey coverage remaining comprehensive and a precautionary approach adopting on the basis of uncertainty.

6.7 Existing environment

6.7.1 This section provides a summary of baseline ecological conditions in relation to:

- Designated sites nature conservation;
- Habitats and vegetation;
- Protected and notable species;
- Bats;
- Terrestrial mammals;
- Fisheries; and,
- Additional species.

6.7.2 Detailed information regarding desk study records and field survey results is presented in Appendices 6.1 to 6.4 where relevant, and also as relevant within the “Predicted impacts” with regards important ecological features.

Designated sites for nature conservation

6.7.3 This section should be read with reference to Figure 6.1.

6.7.4 Table 6.6 provides a summary of statutory designated sites for nature conservation located within 5 km of the project area, extended to 10 km for internationally designated sites.

6.7.5 The distances specified within Table 6.6 are from the project area to the designation boundary at its nearest point.

6.7.6 There are no nationally or internationally designated sites with ecological qualifying interests located within 5 km of the project area. There are no non-statutory (local) designated sites located within 5 km of the project area.

6.7.7 Sites designated for ornithological features only are addressed separately in Chapter 7: Ornithology.

Table 6.6 Statutory designated sites for nature conservation

Statutory Designated Site	Distance	Qualifying Interests
Ben Wyvis SAC	6.9km E	Acidic scree Alpine and subalpine heaths Blanket bog* Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels Dry heaths Montane acid grasslands Plants in crevices on acid rocks Tall herb communities
Fannich Hills SAC	8km W	Acidic scree Alpine and subalpine heaths Blanket bog* Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels Dry heaths Montane acid grasslands Plants in crevices on acid rocks Wet heathland with cross-leaved heath

SAC: Special Area of Conservation. * Indicates priority habitat

Habitats and vegetation

6.7.8 A summary of habitats recorded within the project area is summarised below and in Table 6.7. Habitats are discussed with both reference to the Phase 1 habitat and NVC survey findings.

6.7.9 Detailed survey results are provided in Appendix 6.1 and illustrated on Figures 6.2 and 6.3.

6.7.10 The majority of habitats within the project area comprise large areas of wet dwarf shrub heath (D2) and blanket bog (E.1.6.1) dominated by ling *Calluna Vulgaris* and deergrass *Tricophorum germanicum*, together with stunted pockets of coniferous and broad-leaved plantation woodland (A1.2.2 and A1.1.2), establishing upon the underlying heath and bog habitats. Small areas of mire (E2) are also present, in the wetter parts of the project area, along watercourses and minor issues.

6.7.11 The dwarf shrub heath and blanket bog habitats correspond to Habitats Directive Annex 1 habitats European wet heath and Active raised bog and blanket bog respectively. The habitat types also comprise UKBAP habitats.

Table 6.7 Key habitat summary

Site	NVC Community Description
Blanket bog	The best community match for blanket bog within the project area is M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire. This community type is typically dominated by *Trichophorum cespitosum* , *Eriophorum vaginatum* and *Eriophorum angustifolium* with *Calluna vulgaris* and *Erica tetralix*. *Sphagnum papillosum* and *S. capillifolium* are the commonest sphagnums present whilst *Narthecium ossifragum* and the *Drosera* species are also present in good numbers. There are two sub-communities present within the project area; the *Drosera rotundifolium-sphagnum species* sub-community M17a and the Cladonia sub-community M17b. The *Drosera rotundifolium-sphagnum species* sub-community occurs sparsely in the wettest parts of the bog habitat area, where *Drosera* species are especially common with the oceanic liverwort *Pleurozia purpurea*. Stands of Myrica gale are also present. The Cladonia sub-community M17b represents the more dominant sub-community, occurring on slightly drier peats. Cladonia occurs very extensively in parts, but in other parts of this sub-community the Cladonia is largely replaced by hummocks of the moss *Racomitrium lanuginosum*. M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire is rare globally and is one of the most important types of British upland vegetation (Averis et.al. 2004). The community type is however, common and widespread throughout the North West Highlands of Scotland.
Wet heath	The best community match for wet heath within the project area is M15 *Trichophorum cespitosum-Erica tetralix* wet heath. This is a ubiquitous community over much of the north and west of Scotland. The community is dominated by *Calluna vulgaris, Erica tetralix*, *Trichophorum cespitosum* and *Molinia caerulea* and has much *Narthecium ossifragum* and *Eriophorum angustifolium*. The sub-community present is the M15b typical sub-community.
Mire	The best match for small areas of mire occurring within the project area is M6 *Carex echinata – Sphagnum fallax*. The community type largely follows the course of streams intersecting pockets of blanket bog within the eastern extent of the project area. The community is dominated by *Carex echinata*, with other sedges including *Carex nigra*, and forbes including *Viola palustris* and *Potentilla erecta*. *Sphagnum fallax* is the dominant bryophyte.

6.7.12 No protected plant species were recorded within the project area. Dwarf birch *Betula nana*, a nationally scarce species in Scotland, is however relatively widespread within the project area and locally.

Bats

6.7.13 No existing bat records were returned by the HBRG.

6.7.14 Habitat structure within the project area, predominantly comprising open, exposed moorland habitats, is considered to be of Negligible/Low suitability for roosting, commuting and foraging bats. Pockets of woodland within the project area comprise coniferous and broad-leaved species stunted woodland, establishing atop wet heath and blanket bog habitats. Trees are stunted, and are largely single stemmed, with narrow leaders and limbs, lacking potential roosting features (PRFs) which may be used by roosting bats. There are no other features or structures within the study area with the potential to support PRFs and overall habitats within the study area are considered to provide Negligible suitability for roosting bats in accordance with Bat Conservation Trust (BCT) guidelines (Collins, 2016).

6.7.15 More mature plantation forestry and sheltered valleys in the surrounding area are likely to provide higher value interest for bats.

Baseline activity surveys

6.7.16 Baseline activity surveys in 2018 identified calls with the characteristics of the following species:

- Common pipistrelle;
- Soprano pipistrelle; and,
- Myotis species.

6.7.17 Such species are considered to be at “low risk” to impacts from wind turbine developments at the population level (Natural England, 2012).

6.7.18 Overall bat activity recorded during surveys was very low, with little activity recorded during automated surveys and no bats recorded during the walked transect surveys. No favoured foraging areas or commuting routes were identified and it is considered that the habitats within the study area are of low important for local bat populations.

Terrestrial mammals

6.7.19 Baseline terrestrial mammal conditions are summarised in Table 6.8.

6.7.20 Full details are provided in Appendix 6.2.

Table 6.8 Summary of baseline terrestrial mammal conditions

Ecological Feature	Summary
Otter	No existing records of otter were returned by the HBRG. No signs identifying the use of water course sections within the project area were recorded however, the presence of otter within watercourse sections within (and just outside) the study area including the Glascarnoch River

Ecological Feature	Summary
	and the Allt Bad an t-Seabhaig was confirmed through the recording of spraints and couch locations (Figure 6.5). Watercourses intersecting the project area are therefore likely to provide some commuting opportunities for otter, as part of their wider territories. No holts were recorded during baseline surveys, however surrounding mature woodland pockets were considered suitable to support such features.
Badger	A single badger record was returned by the HBRG within the study area, comprising a single road fatality from the Lubfearn area (**Figure 6.4**). No signs of badger were recorded within the project area or the study area. The open moorland habitats of the project area are of sub-optimal interest to badgers providing little sheltered foraging opportunities, or conditions for sett creation. Surrounding woodland pockets are however considered to be more suitable and the species presence locally is likely.
Pine marten	No existing records of pine marten were returned by the HBRG. The presence of pine marten within the study area was established through sightings (including camera trap triggers), scats and tracks (**Figure 6.7**). No potential den sites were recorded. Overall habitats within the project area provide some, but limited foraging opportunities for pine marten. Woodland pockets present are largely stunted woodland and provide low suitability for den establishment. Opportunities for den establishment together with foraging habitats are however, abundant within mature woodland surrounding the study area. It is therefore considered that the study area overlaps with a small number of pine marten territories present locally, providing opportunities for dispersal and some foraging interest.
Water vole	No existing records of water vole were returned by the HBRG however, the species local presence has been previously established through baseline surveys to inform the assessment of the adjacent Corriemoillie and Lochluichart wind farms developments. The presence of water vole was recorded within and adjacent to the project area on the basis of sightings, latrines, feeding remains and presence of burrows. The most suitable watercourses for water voles recorded within the study area comprised slow flowing parts of the Glascarnoch River located to the north of the project area, adjacent to the A835 (**Figure 6.8**). Within the project area and study area, habitat suitability and the presence of water voles was sporadic, owed to the typography and generally rocky nature of watercourses banks throughout. Suitable habitats and water vole presence were however recorded in the upper reaches of the Allt Giubhais Beag and Allt Cearc an s-Slugain (**Figure 6.8**). Signs indicating the local presence of mink was also recorded along the Glascarnoch River (**Figure 6.8**).
Wildcat	No existing records of wildcat were returned by the HBRG. Two records were however identified from the surrounding local and wider area in consultation with Scottish Wildcat Action comprising sightings records from 2013/14 and 2016. No evidence of wildcat was recorded within the project area. A 'dark' cat was seen outside of the study area, to the east, however this was

Ecological Feature	Summary
	considered to be a feral cat, rather than a wildcat, given the lack of wildcat characteristics (e.g. based on markings and tail size). The open moorland habitats of the project area and noted absence of rabbits (prey species) suggest sub-optimal interest for the species (Figure 6.9). Woodland edge habitats together with more mature woodland habitats within the surrounding area are considered to provide more optimal foraging and den creation opportunities, should the species be present.
Deer	The Appendix 6.5: Deer Assessment details the results of the deer appraisal within the project area. The project area is within an area of red deer *Cervus elapahus* management. Roe deer *Capreolus capreolus* and sika deer *Cervus nippon* are also known to be present in the locale. The project area provides mosaic habitat optimal for deer.

Fisheries

6.7.21 The project area is located within the Blackwater Catchment, with tributaries of the Glascarnoch River and upper reaches of the Blackwater intersecting and bordering the project area. The known distribution of fish within the area is summarised in the Cromarty Firth Fisheries Fishery Management Plan: 2008.

6.7.22 It is noted from the Management Plan that the upper waters of the Blackwater have been severely impacted by the Conon Basin Hydroelectric Scheme, resulting in the loss of spawning streams and habitats. The catchment is now subject to a compensation package, which amongst other measures, includes a hatchery, with Atlantic salmon trapped at a heck on Loch na Croic, some 10 km downstream of the project area. Fish are then used as broodstock for the hatchery and the Glascarnoch River and Blackwater stocked with juvenile salmon on an annual basis.

6.7.23 In addition to Atlantic Salmon, sea and brown trout, the Management Plan notes that European eel and *Lampetra* species are present on the Blackwater, although sea trout are largely confined to the lower reaches. Given the barriers downstream, it is considered that *Lampetra* species within the study area would be confined to brook lamprey; sea and river lamprey are likely to be absent. Eels have been confirmed by electrofishing in the upper reaches of the Black Water.

6.7.24 The Management Plan also provides information on obstacles to salmonid migration; noting that the Silver Falls (some 7 km downstream of the project area) comprises a significant obstacle to fish passage but with the upstream section of the Blackwater not considered impassable and the section of the Glascarnoch River from the dam to the Blackwater confluence being impassable. Likewise, the lower reaches of Allt Bad-an t-Seabhaig are shown as impassable.

Fish habitat

6.7.25 The distribution of fish habitats within the study area (Figure 6.12) is illustrated in Figure 6.13. No significant areas of high calibre Category *2a Salmonid spawning habitat* were recorded within the study area, with adult Atlantic salmon likely to be confined to the stocked Glascarnoch River, Blackwater and possibly the lower reaches of the Allt Bad an t-Seabhaig, the Abhainn Srath Rainich, and the Allt Cearc an t-Slugain.

6.7.26 Brown trout are likely to be widely distributed in areas of suitable habitat throughout the study area and were casually observed during a watercourse crossing survey on the Allt Glac an t-Sithein in August 2018. Although identified as present in the Blackwater in consultation with the Cromarty Firth Fisheries Trust, suitable habitat for European eel is patchy throughout the study area and is probably restricted to more benign sections (e.g. Categories *5 Glide* and *6 Pool*), outwith the more dynamic reaches.

6.7.27 Although spawning habitat for brook lamprey is present, nursery habitat is severely limited with no significant areas noted. Distribution is likely to be patchy at best.

Additional species

6.7.28 The presence of common lizard was recorded during Phase 1 habitat and NVC surveys and is likely to be present throughout the project area and surrounding area.

6.7.29 No sightings of red squirrel were made during field surveys and the stunted woodland within the project area is not considered suitable to support any viable populations.

6.7.30 No other species are considered as having the potential for significant effects as a result of the proposed development.

6.8 Future baseline

6.8.1 In the absence of the proposed development, or assuming a gap between baseline surveys and the commencement of the proposed wind farm development construction, changes in baseline ecology conditions (i.e. distributions and populations) are most likely to result from habitat modifications within or surrounding the project area due to land management practices.

6.8.2 On-going measures implemented through Habitat Management Plans for the operational Corriemoillie and Lochluichart wind farms have also been considered. Whilst these include measures to improve or increase the extent of bog habitats, such measures are not anticipated to substantively change conditions on or immediately around the project site.

6.8.3 In the absence of development, the habitats within the project area are considered to largely remain under the existing management regime. This comprises grazing by small numbers of livestock and deer.

6.8.4 Commercial forestry operations within adjacent plantation forestry, such as felling, may also alter the distribution of faunal species recorded during baseline surveys; however, it is highly unlikely this would be in such a way as to substantially alter the baseline reported here.

6.8.5 The project area is not subject to any other development pressures or management which would affect the habitats or species in such a way that the present baseline conditions presented here would become substantively different.

6.8.6 Whilst short-term and small-scale variability in populations and distributions may occur, and revisions to conservation statuses and designations are possible, such changes would be unlikely to qualitatively alter the conclusion of the assessment presented within and have been accounted for through application of a precautionary approach and appropriate mitigation.

6.9 Design considerations

6.9.1 The following design considerations have been incorporated to specifically reduce and/or otherwise avoid adverse impacts upon ecological features.

6.9.2 Full details of the scheme design evolution and embedded mitigation measures are detailed in Chapter 2: Proposed Development.

Land-take

6.9.3 Proposed turbine locations, proposed access tracks and infrastructure have been designed to minimise the requirement for land-take, impacts on areas of deeper peat and the number of water crossings, reducing the loss of moorland habitats and potentially sensitive fish habitats.

Watercourse buffers

6.9.4 A minimum 50 m buffer between scheme infrastructure was applied around all watercourses in so far as possible, with the requirement for watercourse crossings also minimised is so far as possible.

Construction Environmental Management Plan

6.9.5 A Construction Environmental Management Plan (CEMP) will be in place during the construction, phase of the development. The CEMP will include all good practice construction measures, pollution prevention controls and monitoring to be implemented over the course of the development in line with current industry and mandatory statutory guidance and as detailed within Chapter 2.

6.9.6 The CEMP will also include Habitat Specific Protection Plans (HSPPs) detailing good practice measures for construction works within wet dwarf shrub heath and blanket bog habitats. HSPPs will detail measures required to manage construction works within these sensitive habitats and include habitat restoration measures.

6.9.7 The CEMP will be submitted to SNH for approval prior to the commencement of construction works, in consultation with The Highland Council (THC) and the Scottish Environmental Protection Agency (SEPA).

Habitat Management Plan

6.9.8 In addition to the CEMP which will be produced to protect environmental receptors during the construction phase of the development, a Habitat Management Plan (HMP) will be produced, a draft for which can be found as Appendix 6.6. This includes restoration measures of the most sensitive habitats within the project area, and subsequent monitoring which will measure the effectiveness of restoration works, with restoration works adaptable in response to monitoring outcomes.

Watercourse crossings

6.9.9 The majority of main watercourse crossings required will comprise bottomless arched culverts in accordance with current SEPA guidance (2010). This will maintain the existing bed substrate, hydraulic connectivity and passage for fish and additional wildlife such as water vole and otter.

6.9.10 There is one unregulated crossing with circular culvert proposed.

6.9.11 Post-construction checks for water vole prior to works at locations of all culverts is required to ensure that water voles are not using the banks at this location (determined through the presence or absence of burrows, and evidence of use).

6.9.12 The proposed water crossings will be of sufficient size so as not to restrict or concentrate flows downstream and to convey flows during periods of heavy rainfall (e.g. 1 in 200 year event plus climate change allowance).

6.9.13 In addition, as detailed above, the CEMP prepared for the proposed development will include all good practice construction measures and pollution prevention controls, to negate potentially significant effects upon the aquatic environment over the construction phase and operational lifetime of the development.

6.9.14 A monitoring plan will also be established and incorporated into the CEMP in consultation and agreement with SEPA and the Cromarty Firth Fisheries Trust. The aim of the monitoring plan would be to characterise baseline conditions prior to construction works commencing and to continue throughout the construction phase to confirm that the mitigation measures with respect to water quality and maintenance of potential fish passages are performing.

6.9.15 The monitoring plan would also include details of response and remediation measures in the event mitigation measures are found not to be performing.

Bat habitat features

6.9.16 A minimum 50 m buffer (from blade tip) was applied to key watercourses and woodland edges, in so far as possible, to protect potential bat flight lines and foraging areas associated with these habitats.

6.9.17 A 152 m squared initial keyhole for woodland clearance during construction has also been adopted around each proposed turbine locations. Appendix 2.1 provides further details. Some limited replanting is proposed within these construction fell areas, however the majority of compensatory planting would occur elsewhere within the Strathvaich Estate.

6.10 Predicted impacts

6.10.1 This section presents an assessment of effects upon important ecological features, in the absence of non-embedded design mitigation both as a result of the proposed development alone and cumulatively in-combination with other wind farm developments.

6.10.2 The proposed development has been assessed for an operational life of 30 years.

Important ecological features

6.10.3 A summary of important ecological features is provided in Table 6.9. The level of importance assigned to each species is based upon baseline survey results and professional judgement.

6.10.4 Features which are unlikely to be affected or which are considered sufficiently widespread, unthreatened or resilient to impacts from the proposed development, and hence will remain viable and sustainable, have not been subject to a detailed assessment and have been "scoped-out".

6.10.5 Mitigation measures are however outlined as appropriate to ensure legislative compliance.

Table 6.9 Summary of important ecological features

Ecological feature	Importance	Justification
Designated Sites	International/National	The Proposed Development does not form part of any statutory designated site for nature conservation. By virtue of spatial separation and embedded mitigation measures in relation to good practice construction measures and pollution prevention controls (as detailed within Chapter 8 Hydrology) no direct or indirect effects upon ecological qualifying interests of any nationally or internationally designated site for nature conservation will occur. **Scoped out of detailed assessment.**
Habitats and Vegetation	Blanket bog and Wet Heath– Regional Other habitats - Local	Habitat loss as a result of the proposed development has been minimised through a sensitive scheme design. Direct land-take resulting in some loss of Annex 1 habitat types will however be unavoidable given their widespread nature throughout the project area. Such habitats are also widespread locally. Additional temporary habitat losses are also anticipated to occur during the construction and decommissioning phases of the proposed development. The potential for indirect effects on adjoining/nearby habitats for example through local changes to hydrology is also considered. **Scoped in to detailed assessment.**
Bats	Local	Overall habitats within the project area provide negligible/low habitat suitability for roosting, foraging and commuting bats. Bat activity within proximity to the proposed development has been established as being very low and restricted to species considered to be at low risk from wind turbines at the population level, in accordance with Hundt (2012), Natural England (2012) and SNH (2019) guidance. Bat activity recorded during baseline survey in 2018 was attributed to common and widespread species.

Ecological feature	Importance	Justification
		On the basis of very low bat activity levels recorded, the availability of high value foraging habitat beyond the project area, the mortality risk to bats arising from the proposed development is considered to be low. Over the long-term, operational effects are unlikely to adversely affect the conservation status of any bat species, and as such are not considered to be significant at any population level. **Scoped out of detailed assessment.**
Otter	Local	Baseline surveys did not identify the presence of any holts within the project area, with favourable habitats for holt creation largely provided by neighbouring plantation woodland and the Glascarnoch River and Blackwater to the north and which will be unaffected by the proposed development. Watercourses intersecting the project area are considered to provide some opportunities for foraging and breeding otter however, levels of use were considered to be very low and they are more likely to provide commuting opportunities and connectivity within and between established territories. The number of watercourse crossings required to facilitate the proposed development has been minimised and will be of a design to allow the free passage of wildlife beneath. **Scoped out of detailed assessment.** Precautionary mitigation measures are outlined to ensure legislative compliance during the construction and decommissioning phases.
Pine marten	Local	Habitats with the project area are largely unsuitable for pine marten, however the species will traverse open moorland habitats as part of their wider territories. No potential den site locations were recorded within the project area, with more suitable habitats for such present within surrounding mature pockets of plantation woodland. Overall habitat losses for pine marten are considered to be very small, relative to the extensive availability of similar and more favourable habitats within the surrounding local and wider area. **Scoped out of detailed assessment.**

Ecological feature	Importance	Justification
		Precautionary mitigation measures are outlined to ensure legislative compliance during the construction and decommissioning phases.
Water vole	Regional	Water vole presence has been established within several water courses within and intersecting the project area. It is also assumed that the species will utilise minor burns and issues to disperse across and beyond the project area. The proposed development therefore has the potential to result in habitat loss for the species together with destruction of or preventing access to burrows and killing of injuring individuals. **Scoped into detailed assessment.**
Badger	Local	No evidence of badger presence was recorded within the project area, or within the study area and the species is considered absent. **Scoped out of detailed assessment.** Precautionary mitigation measures are outlined to ensure legislative compliance during the construction and decommissioning phases.
Red squirrel	Local	No evidence of the red squirrel presence was noted within the project area, with woodland habitats considered suboptimal for the species. **Scoped out of detailed assessment.** Precautionary mitigation measures are outlined to ensure legislative compliance during the construction and decommissioning phases.
Wildcat	Local	No evidence of wildcat was identified within the project area or within adjacent habitats and the habitats. Overall habitats within the project area are sub-optimal for the species; with more favourable foraging and den creation opportunities provided by surrounding pockets of woodland. **Scoped out of detailed assessment.** Precautionary mitigation measures are outlined to ensure legislative compliance during the construction and decommissioning phases.
Deer	Local	Deer are likely to be present within the project area, and were confirmed as present within the search area (as recorded during

Ecological feature	Importance	Justification
		the camera trapping), and habitats present are optimal for deer. Red deer are managed in the locale. Deer do not therefore constitute an important ecological feature and are not considered to be at risk from the proposed development. **Scoped out of detailed assessment.**
Fish	Regional	The proposed development has the potential to directly impact on fish habitats at watercourse crossings, however no impact upon any high calibre fish spawning habitat will occur. Watercourse crossings will occur over 1c Unsuitable (Subterranean, infilling etc), 5b Glide; Deep >0.5m and 6a Pool; Plunge/Scour pool. There is potential for indirect effects upon fish populations downstream of the proposed development, where unmitigated works could result in sedimentation or the escape of other pollutants. Embedded mitigation including the adoption of bottomless culverts for main watercourse crossings together with good practice construction measures and pollution prevention controls (as detailed within Chapter 8 Hydrology) are however considered adequate to avoid any potentially significant adverse effects upon local fish populations. The one unregulated circular culvert crossing will be similarly subjected to good practice measures detailed above, to avoid adverse effects on fish populations. **Scoped out of detailed assessment.**
Additional species	Local	Habitats within the project area do provide some suitability for reptile species, with common lizard recorded during baseline surveys. Overall the predominant habitats within the project area to be impacted by the proposed development, comprising open heathland, provide sub-optimal habitats for reptiles and are extensive within the surrounding wider area. Significant adverse effects upon reptile species are not predicted. **Scoped out of detailed assessment.** Given the protection afforded to individual reptiles against international or reckless killing and injuring reptiles are considered for mitigation to ensure legislative compliance

Ecological feature	Importance	Justification
		during the construction and decommissioning phases.

Potential effects in the absence of mitigation

6.10.6 This section identifies the potential effects upon habitats and water vole in the absence of non-embedded design mitigation in relation to the construction and operational phases of the proposed development.

6.10.7 Impacts arising from the decommissioning phase of the wind farm have not been presented in detail because they are considered to be of a similar nature to the construction issues identified but of a smaller scale and shorter duration. Therefore, effects arising from decommissioning are anticipated to be broadly similar in nature to, but of a lower level effect than, those arising during construction phase.

Habitats and Vegetation

6.10.8 There are three main ways by which habitat features may be affected during the construction phase of the proposed development:

- Direct loss – to accommodate the proposed development infrastructure. These losses are considered permanent in the context of this assessment;
- Disturbance – the effects of disturbance are variable in their extent, depending on the nature of the disturbance and sensitivity of the habitat feature. Some disturbance types (for example, creation of temporary hard standing areas at the contractor's compound) result in medium - to long-term disturbance which require extended recovery periods. In other cases (for example, installation of cables at the sides of access tracks, traversing of machinery) disturbance is short-term, and certain habitat types are able to recover quickly; and,
- Indirect effects – these primarily relate to changes in hydrology of wetlands in the context of a wind farm development, the potential for runoff, erosion and sedimentation, along with pollution which may result in the event of contaminant spillage.

6.10.9 The potential for effects upon the hydrological supporting conditions of bog, water quality, soils and peat as a result of surface and groundwater flows, sediment and contaminant discharges, soil loss, erosion and compaction are detailed within Chapter 9 Geology, Hydrogeology and Peat.

6.10.10 Overall potential effects upon the aquatic environment are considered to be highly localised and mitigated through sensitive scheme design, standard best practice construction methods and pollution prevention controls in accordance with current guidance. As such habitat deterioration effects are not discussed further within this assessment.

6.10.11 The areas of stunted woodland are considered synonymous with the bog and wet heath habitats due to their poor nature. Pockets of plantation woodland are considered to be of **Negligible** nature conservation value.

Construction Effects

6.10.12 The landtake of the proposed development i.e. the area to be permanently lost under the surface footprint of the proposed turbine hardstandings, access track and associated infrastructure is 9.17 ha. Furthermore, 16.6 ha of woodland will also be removed for the proposed development, principally through keyholing (as detailed in the 'Bat habitat features' section above).

6.10.13 A summary of habitats to be lost permanently under the built footprint of the proposed development, or through keyholing, is provided in Table 6.10.

Table 6.10 Permanent habitat losses

Phase 1 Habitat Type	Area to be Lost (ha)	Area remaining within project area (ha)	Proportion of habitat type within project area lost (%)	Corresponding NVC Community
Wet dwarf shrub heath	5.569	194.431	2.78	M15 *Trichophorum cespitosum-Erica tetralix* wet heath
Dry dwarf shrub heath	0.001	0.769	0.13	
Blanket bog	3.599	119.001	2.94	M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire
Flush	0	2.43	0	M6 *Carex echinata – Sphagnum fallax* mire
Woodland (includes broad-leaved and coniferous plantation)	16.6	35.93	31.6	n/a

6.10.14 A total of 9.17 ha of Annex 1 habitats, comprising blanket bog (M17) and wet heath (M15) habitats, will be lost permanently during construction (Figure 6.3). This figure includes those habitats underlying stunted woodland pockets present within the project area.

6.10.15 Overall this represents a very small loss in the total area of these habitats remaining within the project area (2.92%), and also in the immediate and surrounding area. Permanent habitat loss effects will therefore be no more than **Minor** and **Non-significant** at a local level.

6.10.16 Dwarf birch specimens where present within the footprint of the proposed development would also be lost however, the species is relatively widespread locally.

6.10.17 During the construction phase an additional 15.4 ha of onsite habitat disturbance will also occur. This area includes a 2.5m corridor around the permanent footprint of the development, required for construction working areas, construction compounds, temporary laydown areas, drainage and cabling, along with wider areas for turbine excavation and access tracks. Habitats primarily affected will be blanket bog (M17) and wet heath (M15).

6.10.18 These habitats will be reinstated following the completion of construction works in accordance with HSPPs produced for inclusion with the proposed developments CEMP, and as such losses would be considered short-term and reversible.

6.10.19 Subsequently temporary habitat loss effects will be of **Negligible/Low** magnitude and **Non-significant** at a local level.

6.10.20 The on-site habitats to be lost both permanently and temporarily as a result of the proposed development are considered to be widespread habitats throughout the Northern Highlands of Scotland.

Operational Effects

6.10.21 During the operational phase there will be a small increased risk of runoff and pollution however, this considered to be mitigated through scheme design and the implementation of pollution prevention measures during any maintenance works.

6.10.22 Any effect is considered to be of **Negligible** magnitude and effects would **be Non-significant** at a local level.

Decommissioning Effects

6.10.23 The potential decommissioning effects are considered to be of a similar nature as temporary habitat losses incurred during the construction phase, and as such will not be significant.

Water Vole

6.10.24 The presence of water vole has been established at several locations along watercourses intersecting the project area. It is also likely the species will utilise additional issues and burns to disperse between watercourses within the project area.

Construction Effects

6.10.25 The construction of the proposed development has the potential to impact upon water voles as a result of:

- Habitat loss and deterioration;
- Habitat fragmentation;
- Incidental mortality and disturbance; and,
- Pollution.

6.10.26 The spatial extent over which construction works associated with the proposed development will be highly localised, restricted to four main watercourse crossings and as such is only likely to impact upon a small number of individual water vole territories within or overlapping with the project area.

6.10.27 The construction of each water course crossings will require the permanent loss of approximately 15 m of watercourse bank habitat (5 m, plus 5 m buffers either side) available for potential use by the established local water vole population within and surrounding the project area.

6.10.28 In the context of remaining available and suitable habitat for water voles within the project area and locally, this is considered to represent no more than a **Low** magnitude effect and which will not affect the favourable conservation status of the species. As such will be **Non-significant** at a Local level.

6.10.29 The design of main watercourse crossings will retain free passage of water voles and other wildlife beneath and as such, given the small number of crossings required, little severance or fragmentation of water vole habitat within the project area will occur.

6.10.30 The location of the proposed construction of the unregulated crossing (circular culvert) will be subjected to an ecological check for the presence of water vole prior to works to ensure the species is not inhabiting the banks at that location.

6.10.31 The construction of water course crossings has the potential to result in the damage or destruction of water vole burrows and/or killing or injuring of individual water voles. Construction works at watercourse crossings will however, be restricted to defined working areas and together with the mobility of the species allowing for escape, is highly unlikely to result in the death or injury of individual water voles.

6.10.32 Noise and visual disturbances are also generally considered unlikely to have any significant impacts upon water voles (Dean et al., 2016) however should disturbances occur to the point at which a water vole may potentially abandon its burrow this would constitute a breach of the provisions of the Wildlife and Countryside Act 1981 (as amended in Scotland).

6.10.33 Given the widespread nature of water vole burrows along watercourses within the project area, the destruction or damage to individual burrows is unlikely to be avoidable.

6.10.34 Mitigation measures are therefore outlined to ensure legislative compliance during the construction phase.

Operational effects

6.10.35 No potentially significant effects to water voles during the operational phase are anticipated.

Decommissioning effects

6.10.36 Decommissioning phase effects upon water vole as a result of habitat loss, deterioration, incidental mortality and disturbance are considered to be largely consistent with construction phase impacts and would not be Significant.

6.10.37 Mitigation measures are however required and are outlined to ensure legislative compliance.

6.11 Mitigation

6.11.1 No significant adverse effects upon ecological features will occur as a result of the proposed development.

6.11.2 Mitigation measures are however, outlined to ensure legislative compliance with regards protected species during the course of construction and decommissioning works.

Ecological Clerk of Works

6.11.3 A suitably qualified and experienced Ecological Clerk of Works (ECoW) will be appointed prior to the commencement of construction and decommissioning activities and through whom appropriate ecological advice will be provided throughout.

6.11.4 The ECoW will be responsible for undertaking and/or co-ordinating checks for protected species before construction and decommissioning activities commence. The ECoW (or appointed 'clerks' on behalf of the ECoW) will also maintain a watching brief as necessary throughout the construction and decommissioning phase to ensure compliance with relevant legislation.

6.11.5 The detailed scope of the role and responsibilities of the ECoW will be agreed in consultation with SNH.

Protected species

6.11.6 Pre-construction and pre-decommissioning surveys for protected mammal species (including otter, badger, pine marten, red squirrel and wildcat) will be undertaken no more than 6 months before the commencement of activities. Surveys will be undertaken in accordance with current survey guidance and will aim to identify the presence or likely presence of protected mammals within working areas and appropriate buffers.

6.11.7 Updated ecological information obtained from the pre-construction protected species' surveys will be used to inform and guide the implementation of Species Protection Plans (SPPs) or species-specific mitigation plans, identification of any licencing requirements and appropriate mitigation (including micro-siting) if required.

6.11.8 SPPs will be designed to provide the contractor and ECoW with approved methodologies and mitigation measures for carrying out certain activities and will be agreed in consultation with SNH.

Water Vole

6.11.9 Water voles are protected in Scotland under the provisions of the Wildlife and Countryside Act 1981 (as amended). The species is listed on Schedule 5 of the Act and is protected under Section 9, which makes it an offence to:

- Damage, destroy or obstruct access to a water vole burrow; or
- Disturb a water vole whilst it is using its burrow.

6.11.10 The layout of the proposed development has been optimised in so far as has been possible to avoid construction activities occurring in close proximity to main watercourses within the project area and the requirement for watercourse crossings.

6.11.11 Four main watercourse crossings are however required to facilitate the proposed development and will likely result in the damage or destruction of individual burrows and/or disturbance of water voles within their burrows. A further un-regulated crossing is required and this too will likely result in the damage or destruction of burrows, or disturbance of water voles within their burrows.

6.11.12 A water vole SPP will be prepared for the proposed development in accordance with *Dean et al.* (2016) and SNH (2018d) guidance, with an appropriate licence obtained from SNH where required.

6.11.13 Water vole populations are highly dynamic with the potential for individual water voles to establish or abandon territories in relatively short spaces of time. As such, the SPP will be finalised in consultation with SNH following a pre-construction water vole survey undertaken in accordance with current guidance.

Reptiles

6.11.14 Common reptiles are afforded partial protection under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). This makes it an offence to "intentionally or recklessly kill or injure" a reptile.

6.11.15 Common lizard and potentially adder are the only reptile species likely to be found during construction works associated with the proposed development, with only incidental observation of common lizard recorded during baseline surveys.

6.11.16 A SPP will be prepared for reptiles prior to the commencement of construction activities. The SPP will detail measures to be implemented during construction activities to protect reptiles (and amphibians encountered) from harm during the construction of the proposed development.

6.11.17 The SPP will be agreed in consultation with SNH and detail emergency procedures to be implemented by site workers in the event reptiles are encountered during works.

Residual effects

6.11.18 No significant adverse residual effects upon ecological figures will occur as a result of the proposed development.

Cumulative effects

6.11.19 In accordance with SNH guidance (2012), a cumulative impact assessment need only be sought where it is considered that a proposal could result in significant cumulative impacts.

6.11.20 Effects upon ecological features are considered to be highly localised and will not extend beyond the boundaries of the project area. Subsequently no potentially significant cumulative effects upon ecological features are reasonably predicted to occur.

6.12 Ecological enhancement measures

6.12.1 An Outline Habitat Management Plan has been provided as Appendix 6.6 and details outline habitat enhancement principals to be implemented as part of the proposed development.

6.12.2 The Outline Habitat Management Plan will be further prescribed and agreed in consultation with SNH and seek to provide net biodiversity gains for black grouse, fisheries, water vole and general moorland biodiversity through targeted species management measures and best practice moorland management.

6.13 Summary of effects

6.13.1 A summary of significant ecological effects is provided in Table 6.11.

Table 6.11 Summary table of impacts upon the recorded ecological features

Feature	Proposed Activity	Characterisation of unmitigated impact upon feature	Significance without mitigation and confidence level	Mitigation and Enhancement	Residual significance and confidence level (following mitigation)
Habitats and Vegetation	Direct loss (construction)	Low magnitude, some temporary loss to be reinstated	Minor adverse, not significant	Not required	Not significant
	Disturbance (runoff/ pollution)	Low magnitude	Negligible, not significant.	Not required	Not significant
Water vole	Direct loss of habitat (construction)	Low magnitude	Minor adverse, not significant	Not required but precautionary measures included	Not significant
	Mortality (construction)	Low magnitude	Minor adverse, not significant	Not required but precautionary measures included	Not significant
	Displacement (noise/visual)	Low magnitude	Negligible, not significant.	Not required.	Not significant

6.14 References

Hundt (2012) 'Bat Surveys: Good Practice Guidelines 2nd edition'. Bat Conservation Trust, London.

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.

Collins, J. (ed) (2016) 'Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd edition'. Bat Conservation Trust, London.

SNH (2019) 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation'. 'Joint publication by Scottish Natural Heritage, Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter and the Bat Conservation Trust (BCT) with input from other key stakeholders.

SNH (2018d) 'Protected species advice for developers: Water Vole'. SNH, Inverness.

SNH (2018e) 'Protected species advice for developers: Wildcat'. SNH, Inverness.

SNH (2016) 'Planning for development: What to consider and include in deer assessment and management at development sites'. SNH, Inverness.

SNH (2016a) ‘Planning for development: What to consider and include in Habitat Management Plans’. SNH, Inverness.

SEPA (2010) ‘Engineering in the water environment: good practice guide - river crossings’. SEPA, Edinburgh.

7 ORNITHOLOGY

7.1 Introduction

7.1.1 This chapter provides an assessment of the potential effects upon important ornithological features in relation to the construction and operation of the proposed development.

7.1.2 The chapter is supported by Figures 7.1 to 7.15 presented in Volume 3 and the following technical appendices presented in Volume 2:

- Appendix 7.1: Technical Ornithology Appendix;
- Appendix 7.2: Collision Risk Assessment; and
- Appendix 7.3: Confidential Ornithology Appendix.

7.1.3 Appendix 7.3 contains detailed information pertaining to the locations of sensitive breeding bird species and which is considered confidential. Such information will not be made publicly available but will be provided to the Scottish Government and Scottish Natural Heritage (SNH).

7.1.4 This chapter should also be read with reference to Chapter 6: ‘Ecology’.

7.1.5 Only common bird names are referred to within this chapter. A summary of species referred to including common names, species names and relevant conservation status is provided in Appendix 7.1.

7.2 Legislation, policy and guidance

7.2.1 In preparation of this chapter, reference has been made to the following key pieces of legislation, planning policy and guidance:

European

- EIA Directive (85/337/EEC) (as amended);
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive); and,
- Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds (codified version of Directive 79/409/EEC as amended) (the Birds Directive).

National

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Conservation of Habitats and Species Regulations 2010, as amended in Scotland (the Habitat Regulations);
- The Wildlife and Countryside Act 1981 (as amended);
- The Wildlife and Natural Environment (Scotland) Act 2011;
- The Nature Conservation (Scotland) Act 2004;
- The National Planning Policy Framework 3 (2014);
- Scottish Planning Policy (2014);

- SNH General Pre-application/scoping advice to developers of onshore wind farms (SNH, 2018);
- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018);
- Recommended bird survey methods to inform impact assessment of onshore wind farms (SNH, 2014, updated 2017);
- Assessing Connectivity with Special Protection Areas (SPAs) (SNH, 2016);
- Assessing Significance of Impact From Onshore Windfarms on Birds Outwith Designated Areas (SNH, 2018a);
- Assessing the Cumulative Impact of Onshore Wind Energy Developments (SNH, 2012);
- Assessing the Cumulative Impact of Onshore Wind Farms on Birds (SNH, 2018b);
- Windfarms and Birds – Calculating a Theoretical Collision Risk Assuming No Avoiding Action (SNH, 2000);
- Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model (SNH, 2017);
- Natural Heritage Zones Bird Population Estimates (Wilson *et al*., 2015);
- 'Birds of Conservation Concern 4' (Eaton *et al*., 2015); and,
- Scottish Biodiversity List (SBL) 2013.

Local

- The Ross and Cromarty (East) Biodiversity Action Plan (2004).

7.2.2 Local planning policies of relevance to this assessment are provided in the accompanying Planning Statement.

7.3 Scope of assessment

7.3.1 Assessment has been undertaken in accordance with the Chartered Institute for Ecology and Environmental Management (CIEEM) guidelines 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine' (CIEEM, 2018) and considers the following three main potential impacts upon ornithological features associated with wind farm developments:

- Direct habitat loss – as a result of the construction of wind farm infrastructure;
- Disturbance/displacement – the displacement of birds from the wind farm and surrounding area as a result of the construction and operation of the proposed development; and,
- Collision mortality – mortality resulting from collision or interaction with turbines or other wind farm infrastructure.

7.3.2 The potential for effects are considered as a result of the proposed development alone and cumulatively, in-combination with other wind farm developments.

7.3.3 CIEEM guidelines (2018) and SNH guidelines stipulate that it is not necessary to carry out a detailed assessment of impacts upon ecological (and ornithological) features that are sufficiently widespread, unthreatened and resilient to impacts of the proposed development.

7.3.4 As such, the assessment considers effects upon designated sites and ornithological features which are considered important on the basis of relevant guidance and professional judgment.

7.3.5 Where ornithological features are not considered so important as to warrant a detailed assessment, or where they will not be significantly affected on the basis of baseline information, these are ‘scoped out’ of the assessment. Mitigation measures for such features may however, still be outlined as appropriate to reduce and/or avoid any potentially adverse effects or to ensure legislative compliance.

Decommissioning phase effects

7.3.6 Decommissioning phase effects are considered to result in no greater scope and magnitude of effects upon ornithological features than as would occur during the construction phase, albeit occurring over a shorter timescale.

7.3.7 As such, decommissioning phase effects upon ornithological features are not considered explicitly within this assessment.

Direct habitat loss

7.3.8 The proposed development will result in the direct and permanent loss of open moorland and woodland habitats as detailed within Chapter 6: ‘Ecology’.

7.3.9 Habitat losses have the potential to result in the loss or otherwise lowered quality of nesting and foraging opportunities for ornithological features which are known to use or inhabit the project area, primarily including black grouse and open moorland species.

7.3.10 Overall direct and permanent habitat losses, on the basis of the nature and scale of the proposed development are considered to be small, resulting in an adverse impact upon ornithological features at no more than a "Local" level only.

7.3.11 Suitable habitats and therefore nesting and foraging opportunities will remain abundant within the project area, the immediate and wider surrounding area. Habitat losses for ornithological features are therefore not considered within the detailed assessment as losses would not be significant for any species.

7.3.12 All wild birds, their in-use nests, eggs and dependent young are protected under the provisions of the Wildlife and Countryside Act 1981 (as amended). Site clearance activities during the construction phase of the proposed development where undertaken during the breeding bird season (broadly March to August inclusive) may therefore result in an offence under the act should activities result in the loss or damage to in use nests, eggs or dependent young of any wild bird species. Mitigation measures are therefore outlined to ensure legislative compliance during the construction phase and further consideration is scoped out of this assessment.

7.3.13 The potential for indirect habitat loss to ornithological features as a result of disturbance and displacement is however, assessed for both the construction and operational phase of the proposed development.

7.4 Assessment methodology

7.4.1 Assessment has been undertaken in accordance with CIEEM guidelines (2018) and includes the following stages:

- determination and evaluation of important ecological features;
- identification and characterisation of impacts;
- outline of mitigating measures to avoid and reduce significant impacts;
- assessment of the significance of any residual effects after such measures; and,
- identification of appropriate compensation measures to offset significant residual effects.

7.4.2 The assessment has also been undertaken with reference to SNH guidance (2016 and 2018) on the assessment of wind farm developments in relation to designated sites and those located within the wider countryside.

7.4.3 In accordance with current SNH guidance (2018) the assessment of impacts has been undertaken at a Regional scale with regards species populations, unless an alternative geographical scale is considered appropriate on the basis of best available information.

7.4.4 The Natural Heritage Zone (NHZ) is considered to be the most appropriate default Regional scale, with the proposed development located entirely within the Northern Highlands NHZ.

Determining importance

7.4.5 Relevant European, national and local guidance has been referred to in order to determine the importance of ornithological features. Reference has also been made to SNH guidance on “Priority” bird species for assessment, when considering the development on onshore wind farms in Scotland (SNH, 2018a).

7.4.6 In addition, importance has also been determined using professional judgement and taking account of the results of baseline surveys, desk study and the importance of features within the context of the Regional geographic area.

7.4.7 For the purposes of this assessment the importance of ornithological features is considered within a defined geographical context from Local to International, as outlined in Table 7.1.

7.4.8 It should be noted that importance does not necessarily relate to the level of legal protection that a feature receives and ornithological features may be important for a variety of reasons, such as their connectivity to a designated site, rarity or the geographical location of species relative to their known range.

7.4.9 Similarly, whilst a particular feature may be associated with a nearby internationally designated site, the feature is not automatically assigned a value of “International” importance.

Table 7.1 Geographic scale of ornithological feature importance

Importance	Definition
International	An internationally designated site e.g. a Special Protection Area (SPA) and/or Ramsar site or proposed / candidate site (e.g. pSPA). A regularly occurring species present in internationally important numbers (>1% of its biogeographic population) listed under Annex I of the Birds Directive, or regularly occurring migratory species listed under Annex II of the Birds Directive connected to an internationally designated site for this species.
National	A nationally designated site e.g. a Site of Special Scientific Interest (SSSI). A regularly occurring species present in nationally important numbers (>1 % of its Scottish population) and listed as a UK BAP, SBL priority species Red-listed bird of Conservation Concern (Eaton *et al*., 2015) and listed under Schedule 1 of the Wildlife & Countryside Act or Annex 1 of the Birds Directive.
Regional	A regularly occurring species present in regionally important numbers i.e. >1 % of its relevant Natural Heritage Zone (NHZ) population (Wilson *et al*., 2015) or appropriate alternative and listed as a UK BAP, SBL priority species Red-listed birds of Conservation Concern (Eaton *et al*., 2015) or listed on Schedule 1 of the Wildlife & Countryside Act or Annex 1 of the Birds Directive.
Local	All other species that are widespread and common and which are not present in regionally or nationally important numbers, but which do contribute to the local breeding/wintering bird assemblage.

Characterising impacts

7.4.10 Once identified, potential effects are described making reference to the following characteristics as appropriate:

- positive or negative;
- extent;
- magnitude;
- duration;
- timing;
- frequency; and,
- reversibility.

7.4.11 The assessment only makes reference to those characteristics relevant to understanding the nature of an effect and determining its significance.

7.4.12 The likelihood or probability that an effect will occur is also described as far as possible based on best available information and is referred to using the following terms: certain, likely, unlikely or highly unlikely.

7.4.13 The criteria used to determine the magnitude of impact are set out in Table 7.2.

7.4.14 It is important to note that where reference is made to population level effects to assess magnitude (e.g. at the Regional NHZ population level), population estimates used are considered to be guides.

7.4.15 In addition, it will often be impossible to equate an impact to an actual population loss. For example, where birds may be displaced from a wind farm site as a result of construction or operational activities, such a loss may be temporary or may reasonably result in the relocation of birds to suitable habitats elsewhere within the wind farm site, immediate or wider area. Where uncertainty arises a precautionary approach has been adopted.

7.4.16 As such, professional judgement, on the basis of best available evidence, has been used to inform the assessment of impacts presented within.

Table 7.2 Impact magnitude

Magnitude	Definition
High	The effect (either on its own or in-combination with other proposals) may adversely or positively affect the conservation status of a site/population, in terms of the coherence of its ecological structure and function (integrity), across its whole area, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest. E.g. Affecting >5% of the relevant Regional NHZ population.
Medium	Biodiversity conservation status of a site or population would not be adversely or positively affected, but some element of the functioning might be affected and impacts could potentially affect its ability to sustain some part of itself in the long term. E.g. Affecting >1-5% of the relevant Regional NHZ population.
Low	Neither of the above applies, but some minor adverse or beneficial effect is evident on a temporary basis or affects extent of habitat/species abundance in the local area. E.g. Affecting >1% of the relevant Regional NHZ population.
Negligible	No observable effect in either direction.

Determining significance

7.4.17 For the purposes of assessment a ‘significant effect’ is an effect that either supports or undermines biodiversity conservation objectives for ‘important features’ or for biodiversity in general.

7.4.18 Significant effects encompass impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution) and are identified on the basis of magnitude, professional judgment and best available evidence.

7.4.19 CIEEM guidelines (2018) note that "A significant effect does not necessarily equate to an effect so severe that consent for the project should be refused planning permission. For example, many projects with significant negative ecological effects can be lawfully permitted following EIA procedures."

7.4.20 For the purposes of this assessment, significant effects are primarily expressed with reference to the Regional population scale, in line with SNHs interests of a species status at wider spatial levels (SNH, 2018a). The significance of effects at other geographical scales (such as Local or National) is also expressed where appropriate and where sufficient information allows a meaningful assessment.

7.4.21 In cases of reasonable doubt, where it is not possible to robustly justify a conclusion of no significant effect, a significant effect has been assumed as a precautionary approach. Where uncertainty exists, this is acknowledged.

7.4.22 Where the ecological assessment proposes measures to mitigate adverse effects on ecological features, a further assessment of residual ecological effects, taking into account any ecological mitigation recommended, has been undertaken.

7.4.23 CIEEM guidelines do not recommend the sole use of a matrix table as commonly set out in EIA Report (EIAR) Chapters to determine 'significant' and 'non-significant' effects. For the purposes of this assessment presented herein, Table 7.3 sets out adapted CIEEM terminology and equivalent EIA terms.

Table 7.3 Effect Significance

Effect (EIA Significance)		
Non-significant	Negligible	No significant impact on ecological integrity or conservation status.
Non-significant	Minor Adverse	Significant adverse impact on ecological integrity or conservation status at a Local level only.
Significant	Moderate Adverse	Significant adverse impact on ecological integrity or conservation status at a Regional level.
Significant	Major Adverse	Significant adverse impact on ecological integrity or conservation status at a National or International level.

Assessment of cumulative effects

7.4.24 Potentially significant cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location.

7.4.25 Cumulative impacts have therefore been assessed with reference to SNH guidance (2012 and 2018b) for important ornithological features subject to a detailed assessment.

7.4.26 The cumulative assessment includes consideration of:

- existing wind farm developments, either built or under construction;
- approved wind farm developments, awaiting implementation; and,
- wind farm proposals awaiting determination within the planning process with design information in the public domain.

7.4.27 With regard to the spatial extent of the cumulative assessment, SNH guidance (2012 and 2018b) recommends that cumulative effects should typically be assessed at the relevant Regional NHZ scale, unless there is a reasonable alternative.

7.4.28 In this case, the undertaking of an in-combination assessment of potential impacts at the NHZ scale would entail the consideration of a very large number of other wind farm developments. SNH guidance (2012) does therefore recognise that access to relevant data for other developments may be limited and therefore a meaningful assessment of cumulative effects is not always possible. Given that relevant data for many of the wind farm developments located within the relevant NHZs is unlikely to be readily available, the results of any cumulative assessment at the NHZ scale would therefore not allow any meaningful conclusions to be drawn.

7.4.29 An alternative species-specific approach has therefore been adopted for the purposes of this assessment, with core foraging ranges of important ornithological features, as per SNH guidance (2016) or best available evidence, used to determine the spatial extent over which the cumulative assessment is undertaken, adopting a precautionary approach as necessary.

7.5 Consultation undertaken

7.5.1 Consultation with statutory and non-statutory advisors, together with species specialist groups has been undertaken to inform the approach to and undertaking of assessment.

7.5.2 A summary of consultations undertaken, responses received and how they have been considered is provided in Table 7.4.

Table 7.4 Summary of consultations

Consultee	Response Received	Action Taken
SNH	Proposed survey methodologies suggested acceptable, with the provision that they are undertaken in accordance with SNH guidance. Specifically, in relation to ornithology advised: • Based on the findings of the Lochluichart and Corriemoillie surveys there seems little need for additional migratory wildfowl surveys. • Winter walkovers in this part of the Highlands tend not to provide much useful data but black grouse info might be useful. • SNH don't consider there is any real connectivity between the site and the wood sandpiper and dotterel SPAs so no dedicated surveys needed. • Survey data from the 2015 national golden eagle survey to be sourced and relate species activity to possible nests.	Surveys undertaken in accordance with SNH advice. Information request submitted to RSPB and Highland Raptor Study Group (HRSG) to obtain golden eagle records from 2015 national species survey.
SNH	Provided further comments in relation to the scope of Year 2 ornithology surveys, based on findings from Year 1 surveys.	Surveys undertaken in accordance with SNH advice and included monitoring of

Consultee	Response Received	Action Taken
	Advised on the known presence of breeding golden eagle in the area and outlined the requirement for monitoring of the territory in 2018 to establish any breeding outcome. Outlined that further survey effort in relation to breeding divers was not required on the basis of existing information on the species within the surrounding area. Outlined that the proposed effort for Vantage Point surveys remained acceptable and that further winter walkovers were not required.	identified golden eagle territory.
SNH	Specifically, in relation to ornithology advised: • A Habitats Regulations Appraisal for Glen Affric to Strathconon Special Protection Area should be carried out (regarding golden eagle activity).	A section containing "Information to inform a HRA" is presented at the end of Chapter 7.
RSPB	Specifically, in relation to ornithology advised: • Recommend undertaking migratory vantage point surveys for geese. • Recommend wildfowl, waders and raptors winter walkover surveys. • Suggest targeted surveys for dotterel and wood sandpiper. • Suggest survey for golden eagle in January to March, following the surveying guidance provided in Gilbert *et al.* (1998).	Surveys undertaken in accordance with preceding SNH advice. Migratory vantage point surveys were however, undertaken in conjunction with additional survey effort for golden eagle in Autumn and Spring. The dotterel and wood sandpiper SPAs are located sufficiently distant from the proposed development to preclude connectivity, as per preceding SNH advice. Observations of both species if present within field survey areas would however, have recorded.
RSPB	Ornithological records provided, including those for sensitive breeding species.	Information provided used to inform species-specific survey, notably in relation to black grouse and breeding raptors. Record details considered sensitive and restricted to **Appendix 7.3.**

Consultee	Response Received	Action Taken
RSPB	Specifically, in relation to ornithology advised: 1 Potential impacts on all species should be adequately covered within the EIA Report. 2 Site is close to the Glen Affric SPA designated for breeding golden eagles. The potential impacts on golden eagle should therefore be a priority for assessment, including in relation to collision risk. 3 Consideration to be given to black grouse and ground nesting birds – golden plover. 4 If tree felling is required SNH (2016) guidance wind farm proposals on afforested sites – advice on reducing suitability for hen harrier, merlin and short eared owl. 5 Cumulative Impacts – Welcome proposal to include an assessment of cumulative impacts in relation to other projects, and this should be undertaken in accordance with relevant SNH advice.	Detailed impact assessment has been undertaken for important ornithological features, identified on the basis of baseline desk study and field survey findings. Collision risk mortality estimates have been calculated for golden eagle and have been assessed cumulatively in-combination with other wind farm developments. No potentially significant impacts upon hen harrier or short-eared owl are predicted as a result of the proposed development and the project area is of no known importance for either species.
Highland Raptor Study Group	Ornithological records provided, including those for sensitive breeding species.	Information provided used to inform species-specific survey, notably in relation to breeding raptors. Record details considered sensitive and restricted to **Appendix 7.3.**

7.6

7.6 Baseline methodology

Study area

7.6.1 The main study area within which baseline information in relation to ornithological features has been obtained has comprised the project area and areas out to at least 500 m, extended up to 6 km for specific species field surveys as per current SNH guidance (2017) and up to 20 km searches for internationally important designated sites (Special Protection Areas).

7.6.2 Full details of study areas adopted for desk study and field surveys are provided in Appendix 7.1 and illustrated on Figures 7.2 to 7.5.

Desk study

7.6.3 As per current SNH guidance (2014, updated 2017) an initial review of existing ornithological information and consultation with SNH and the Royal Society for Protection of Birds (RSPB) was undertaken prior to the commencement of field surveys. This enabled a coarse overview of likely bird species and populations in proximity to the proposed development to be formed, identify possible target species for survey and define field survey requirements, which were subsequently agreed in consultation with SNH and RSPB.

7.6.4 Further desk study has also been undertaken over the course of the field surveys to provide additional context for field survey observations.

7.6.5 The desk study has included a review of designated sites within proximity to the project area and consultation with specialist recording groups for existing ornithological records including the RSPB and the Highland Raptor Study Group (HRSG).

7.6.6 A review of publicly available EIA documentation for the adjacent operational Corriemoillie, Lochluichart and Lochluichart I and II Extension Wind Farms has also been undertaken.

7.6.7 Full details and results of the desk study undertaken are provided in Appendix 7.1 and 7.2.

Target species

7.6.8 Target species for survey and recording have been drawn from the following lists adopting a precautionary approach and with reference to SNH guidance (2014, updated 2017; 2018):

- Annex 1 of the EC Birds Directive;
- Schedule 1 of the Wildlife & Countryside Act 1981; and,
- Red-listed Birds of Conservation Concern (Eaton *et al*., 2015).

7.6.9 The broad selection of target species for survey and recording included qualifying interests for identified designated sites for nature conservation (Table 7.5) and for which core foraging ranges in accordance with current SNH guidance (2016), overlap with the project area. This has included golden eagle as a qualifying interest of the Glen Affric to Strathconon Special Protection Area (SPA), but has excluded dotterel and wood sandpiper as qualifying interests of the Beinn Dearg, Ben Wyvis and Achanalt Marshes Special Protection Areas (SPAs). Observations of such species during Moorland Breeding Bird Surveys (detailed below) would however, have been recorded.

7.6.10 Passerine species were not identified as target species for survey and recording and are not considered sensitive to wind farm developments (SNH, 2014, updated 2017; 2018). Observations of notable species e.g. those listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) and Red-listed BoCC species (i.e. Eaton *et al*., 2015) during Moorland Breeding Bird Surveys were however recorded.

7.6.11 Gulls and commoner raptor species including buzzard, kestrel and sparrowhawk, were also not identified as target species given their general widespread number and abundance, but were recorded as secondary species during Vantage Point (VP) Flight Activity Surveys (detailed below).

Field surveys

7.6.12 The following field surveys were carried out between 2016 and 2018 to inform the design and assessment of the proposed development:

- Vantage Point (VP) flight activity surveys;
- Moorland breeding bird surveys;
- Breeding raptor and owl searches;
- Breeding black grouse searches; and,
- Winter walkover surveys.

7.6.13 Surveys have been undertaken in accordance with SNH guidance (2014, updated 2017) and full details are provided in Appendix 7.1.

7.6.14 Current SNH guidance (2014, updated 2017) recommends that a minimum of two years of ornithological surveys are carried out to inform the assessment of wind farm developments, unless it can be demonstrated that a shorter period of survey is sufficient. The collated data set therefore provides a minimum of two years of ornithological survey data, collected within the most recently available five-year window of survey opportunity, prior to the undertaking of assessment.

Field survey personnel

7.6.15 All field surveys were completed by highly experienced, reputable and professional ornithologists fully conversant in established bird survey methodologies for proposed wind turbine developments.

7.6.16 Details of field surveyors used are provided in Appendix 7.1.

Assessment limitations

7.6.17 No limitations to baseline information gathering and subsequent assessment presented herein are identified.

7.6.18 During VP flight activity surveys, the undertaking of observations from multiple VP locations was undertaken primarily for surveyor safety. No VP location was located within the project area and areas of visibility for each VP location (as shown on Figure 7.2) do not overlap extensively. In addition, no VP location was located in proximity to any sensitive feature for any target species such as nesting, roosting or display site, nor was there a requirement for surveyors to undertake a prolonged traverse through the VP study area prior to survey.

7.6.19 As such, the approach to the undertaking of VP flight is not considered a limitation to baseline information gathering and levels of activity of target species activity recorded are considered an accurate reflection of the importance of the study area for such.

7.6.20 Further discussion is provided in Appendix 7.1.

7.6.21 Surveyor access onto lands within the adjacent Corriemoillie Estate was not permitted for the purposes of survey in relation to the proposed development. The presence and distribution of target species, within lands to the south and south west of the project area is however, considered to be well understood on the basis of ongoing operational monitoring for the operational Corriemoillie and Lochluichart Wind Farms. Pertinent observations of target species (incl. black grouse and raptors) beyond the project area were however possible during moorland breeding bird surveys, breeding black grouse searches and breeding raptor and owl searches from within the project area and public rights of way.

7.6.22 Construction of the Corriemoillie wind farm completed in early 2017. As such, some latter stage construction work was likely to have been underway during surveys for the proposed development (which commenced in September 2016 and completed in August 2018). However no large scale construction works were on-going during either breeding season or throughout the second non-breeding season completed and, as such, construction works from the Corriemoillie wind farm are not considered a limitation to survey results or the subsequent assessment of effects.

7.6.23 As such, access restrictions are not considered a limitation to baseline information gathering.

7.7 Existing environment

7.7.1 This section provides a summary of baseline ornithology conditions in relation to:

- Statutory designated sites nature conservation with ornithological interests;
- Target species flight activity; and,
- Distributions and abundances of breeding bird species as recorded during baseline ornithology surveys and established from desk study.

7.7.2 Detailed information regarding desk study records and field survey results is presented in Appendix 7.1 and 7.2 and also as relevant within the "Predicted impacts" with regards important ornithological features.

Designated sites for nature conservation

7.7.3 This section should be read with reference to Figure 7.1.

7.7.4 Table 7.5 provides a summary of statutory designated sites with cited ornithological interests located within 10 km of the project area, extended to 20 km for internationally designated sites with migratory waterfowl interest.

7.7.5 Sites designated for other ecological features are addressed separately in Chapter 6: 'Ecology'.

7.7.6 The distances specified within Table 7.5 are from the project area to the designation boundary at its nearest point.

7.7.7 There are no internationally designated sites with migratory waterfowl interests located within 20 km of the project area.

Table 7.5 Designated sites for nature conservation

Site	Distance	Qualifying Interests
Glen Affric to Strathconon SPA	4.7km S	Golden eagle (breeding).
Beinn Dearg SPA	6km NW	Dotterel (breeding).
Beinn Dearg SSSI	6km NW	Breeding bird assemblage, including golden eagle, dotterel, snow bunting, ptarmigan, ring ouzel, raven, golden plover and peregrine.
Ben Wyvis SPA	6.9km E	Dotterel (breeding).
Ben Wyvis SSSI	6.9km E	Dotterel (breeding).
Ben Wyvis NNR	6.9km E	Upland habitats, geology and associated flora and fauna.
Achanalt Marshes SPA	9.8km SW	Wood sandpiper (breeding).
Achanalt Marshes SSSI	9.8km SW	Breeding bird assemblage, including golden plover, common sandpiper, wood sandpiper, dunlin, curlew, snipe, redshank, oystercatcher, lapwing, goosander, red-breasted merganser, mute swan, wigeon, tufted duck, teal and mallard.

VP flight activity surveys

7.7.8 Target species “at collision risk” flight activity recorded during the entire VP survey effort (September 2016 – August 2018) is summarised in **Table 7.6**. The total number of flights, total number of birds recorded and the total time spent at “collision risk height” is presented.

7.7.9 Detailed flight records are presented in Appendix 7.1, with flight lines illustrated in Figures 7.6 to 7.14.

Table 7.6 Target species flight activity summary

Species	Total No. of Flights	Total No. of Birds	Total Time Spent "At Collision Risk" [3]
Red-throated diver	1	1	188
Grey heron	2	2	183
Pink-footed goose	5	184	604
Pink-footed/greylag goose mixed flock	1	47	120
Greylag goose	2	73	343
Red kite	2	2	619
Hen harrier	2	2	30
Golden eagle	8	8	1,736
Osprey	1	1	193
Peregrine	2	2	434
Golden plover	3	4	92

Moorland breeding bird surveys

7.7.10 In summary, the study area was found to support an assemblage of upland and lowland passerines considered typical of the locale and habitats present, including several species of conservation value. A small number of breeding wader territories (including golden plover, greenshank, common sandpiper, snipe and woodcock) were also recorded.

7.7.11 Red grouse also breed in low numbers within the study area.

7.7.12 Observations of gulls (common, black-headed, great black-backed, herring and lesser black-backed gull) were also made during survey visits however; no breeding evidence was obtained for these species during survey.

7.7.13 Estimated breeding wader territory numbers recorded in 2017 and 2018, within 500 m of the proposed turbine locations are provided in Table 7.7 and illustrated in Figure 7.15.

7.7.14 Further details of moorland breeding bird assemblages recorded are provided in Appendix 7.1.

[3] "At collision risk" – at rotor sweep height (33 -175 m) and within 200 m of proposed turbine locations for all species, extended to 500 m for eagle species.

Note: for the purposes of collision risk analysis target species "at risk" flight activity observed from VP2 is excluded as the viewshed from this VP does not overlap with the wind farm area (i.e. 200 m or 500 m turbine buffers) adopted for the purposes of assessment.

Table 7.7 Breeding wader territories – within 500 m of the proposed turbine locations

Species	No. of Territories	
	2017	2018
Golden plover	3	0
Greenshank	1	0
Common sandpiper	0	0
Snipe	2	4
Woodcock	0	0

Breeding raptor and owl searches

7.7.15 Breeding raptor and owl searches recording breeding evidence for a narrow range of raptor and owl species within the study area, including golden eagle, osprey, red kite, buzzard, kestrel and sparrowhawk.

7.7.16 No raptors or owl species were confirmed as breeding within the project area over the course of surveys, with only buzzard, kestrel and sparrowhawk confirmed as breeding within 2 km of the project area.

7.7.17 Red kite and osprey do however, hold territories within the wider surrounding area (>2 km from the project area).

7.7.18 A single golden eagle territory was identified through desk study records within 6 km of the project area. The territory was monitored in 2018 at request of SNH and was successful.

7.7.19 Further details relating to the locations of sensitive breeding raptors are provided in Appendix 7.3.

Breeding black grouse surveys

7.7.20 Searches for black grouse lek sites were undertaken in 2017 and 2018 and identified a total of 15 lek sites of varying sizes within the study area.

7.7.21 The locations of black grouse lek sites together with the numbers of lekking males present are considered confidential and as such are detailed within Appendix 7.3.

7.7.22 The peak number of lekking males recorded within the study area over the course of surveys was 20, with female birds also recorded at and within the vicinity of lek sites.

Winter walkover surveys

7.7.23 Winter walkover surveys did not recorded any notable aggregations of migratory waterbirds or waders within the study area but did identify the presence of black grouse to inform subsequent species-specific surveys undertaken in 2017 and 2018.

7.8 Future baseline

7.8.1 In the absence of the proposed development, assuming a "do-nothing" scenario or gap between baseline surveys and the commencement of construction of the proposed development, changes in baseline ornithology conditions (i.e. distributions and populations) are most likely to result from large scale habitat modifications within or surrounding the project area due to local land management practices within the Strathvaich and Corriemoillie Estates, which are not currently anticipated.

7.8.2 On-going measures implemented through Habitat Management Plans for the operational Corriemoillie and Lochluichart wind farms have also been considered. Whilst these include measures to improve or increase the extent of bog habitats for the benefit of targeted bird species, such measures are not anticipated to substantively change bird activity on or immediately around the proposed development.

7.8.3 In the absence of the proposed development, the habitats within the project area are considered likely therefore to remain under the existing management regime, comprising grazing by livestock and wild deer.

7.8.4 Breeding bird densities would therefore reasonably be expected to remain at comparable levels with those recorded during field surveys and identified through desk study i.e. at relatively low levels, albeit central territory locations may shift.

7.8.5 The establishment of breeding raptor territories within the project area is considered highly unlikely, given the general absence of suitable nesting habitat features such as deep heather swards, crags, steep skree and mature woodland.

7.9 Design considerations

7.9.1 The following design considerations have been incorporated to specifically reduce and/or otherwise avoid adverse impacts upon ornithological features.

7.9.2 Full details of the scheme design evolution and embedded mitigation measures are detailed in Chapter 2: Proposed Development.

Black grouse

7.9.3 Recently published research suggests that wind farm construction has no detectable effects on the abundance of lekking black grouse at wind farm sites (Zwart *et al*., 2015), but that some evidence has been found to suggest that black grouse leks within 500 m of planned turbine locations move locally after construction. The same research also clarifies that this does not equate to the complete displacement of black grouse from wind farm sites, with evidence from some sites identifying the use of areas by black grouse within 500 m of operational turbine locations and occasional use of areas beneath turbines (Zwart *et al*., 2015).

7.9.4 Black grouse require a range of habitats throughout the year including heathland, woodland and grasslands, which are abundant within the project area and surrounding local area. The abundance of suitable lekking, foraging and nesting habitats are not considered a limitation for black grouse populations locally. Notably the number and distribution of lek sites recorded during surveys and identified through existing records, suggests that lek population are mobile, with males readily switching between lek sites.

7.9.5 Adopting a precautionary approach in view of the findings of recent published research, a 500 m infrastructure buffer around "main lek sites" (detailed in Appendix 7.2) was however, incorporated into design constraint planning and maintained to avoid potential displacement impacts upon lekking black grouse.

7.10 Predicted impacts

7.10.1 This section presents an assessment of effects upon important ornithological features, in the absence of non-embedded design mitigation both as a result of the proposed development alone and cumulatively in-combination with other wind farm developments.

7.10.2 The proposed development has been assessed for an operational life of 30 years.

Important ornithological features

7.10.3 A summary of identified important ornithological features is provided in Table 7.8.

7.10.4 Species of 'Local' importance are not considered in detail within this assessment.

Table 7.8 Summary of important ornithological features

Importance	Feature		
International	n/a		
National	n/a		
Regional	Golden eagle Black grouse		
Local	Red-throated diver Whooper swan Greylag goose Pink-footed goose Goosander All ducks	Red kite Hen harrier Osprey Peregrine White-tailed eagle	Goshawk All other commoner raptors All waders and herons All gulls All passerines

Ornithological features scoped out of detailed assessment

7.10.5 Ornithological features assigned 'Local' importance have been "scoped out" of detailed assessment on the basis of their established presence in numbers of very low importance, low levels of activity recorded during baseline surveys (Appendix 7.1) and/or as they are not considered a priority for assessment in accordance with SNH guidance (2018), given their generally accepted low sensitivity to wind farm developments.

7.10.6 As all wild birds and their nests are protected under the provisions of the Wildlife and Countryside Act 1981 (as amended) mitigation measures are however, outlined to ensure legislative compliance and protection for the in-use nests, eggs and dependent young of all wild birds.

Designated sites for nature conservation

7.10.7 No direct impacts upon any statutory or non-statutory designated site for nature conservation will occur.

7.10.8 The potential for impacts upon breeding golden eagle interests of the Glen Affric to Strathconon SPA is discussed under the individual species sections below.

7.10.9 A summary of information relevant to inform a Habitats Regulations Appraisal (HRA) in relation to the Glen Affric to Strathconon SPA is provided at the end of this chapter.

7.10.10 The project area is reasonably located beyond the connectivity distances for the qualifying interests of the Beinn Dearg, Ben Wyvis and Achanalt Marshes SPA i.e. for dotterel and wood sandpiper as agreed in consultation with SNH (see Table 7.4). No likely significant effects upon the qualifying interests of these sites would therefore be expected to occur, and as such effects upon these designations are not considered further within this assessment.

Collision risk analysis

7.10.11 Collision risk analysis has been undertaken for golden eagle only, on the basis of the low incidence of "at collision risk" flight activity recorded for all other target species.

7.10.12 Full details are provided in Appendix 7.2.

Golden eagle

7.10.13 Golden eagle is a qualifying interest of the Glen Affric to Strathconon SPA and Beinn Dearg SSSI.

7.10.14 The species is listed on Annex 1 of the Birds Directive and Schedule 1, 1A and A1 of the Wildlife and Countryside Act 1981 (as amended), is an SBL species and is listed as a Priority Species under the Ross and Cromarty (East) Local Biodiversity Action Plan (LBAP).

7.10.15 The most recently published Regional NHZ golden eagle population estimate for NHZ 7 'Northern Highlands' is 43 pairs, based on the 2003 national species survey, with the national Scottish population estimated at that time comprising a total of 443 breeding pairs, across the 21 NHZ areas (Wilson *et al*., 2015).

7.10.16 The latest national species survey was completed 2015, and suggested an increase of 15% in the national Scottish population since the previous survey to 508 territorial pairs (Hayhow *et al*., 2017). In 2017, 154 home ranges occupied by pairs were reported by the SRMS from the Highlands, including 33 from Ross-shire (Challis *et al*., 2018).

7.10.17 Golden eagle flight activity recorded during baseline surveys has included a total of 32 species flights recorded during VP flight activity surveys completed between September 2016 and August 2018 including those of adult, sub-adult and juvenile birds.

7.10.18 Two golden eagle home ranges were identified within 6 km of the project area in consultation with SNH and the RSPB. This included a single range occupied by a pair of birds, which was monitored over the 2018 breeding season and confirmed as successful fledging two young.

7.10.19 For the purposes of this assessment golden eagle is assigned a value of Regional importance, with the presence of the identified breeding pair representing 2% of the most recently published Regional NHZ population estimate (43 pairs; Wilson *et al*., 2015) and 3% of the most recently published Ross-shire breeding population.

Displacement (Construction)

7.10.20 Construction works associated with the proposed development would occur at a sufficient distance from any identified golden eagle eyrie to preclude the likelihood of disturbance to nesting pairs (750-1000 m based on expert opinion; Ruddock & Whitfield, 2007). As such, no disturbance to breeding golden eagles at their nests sites would occur.

7.10.21 In line with current research, which suggests some evidence for construction phase displacement of golden eagles from wind farm sites (Haworth Conservation, 2015), there may be some level of disturbance to individual birds which choose to utilise habitats in the vicinity of working areas over the course of construction works (anticipated to be approximately 18 months).

7.10.22 Such impacts would however be temporary, of no more than Low magnitude given the extensive availability of alternative the Regional NHZ population and therefore Non-significant.

Displacement (Operation)

7.10.23 Collectively, current research suggests little clear evidence for long-term displacement effects upon golden eagles as a result of operational wind farms (as reviewed by Humphreys *et al*., 2015a).

7.10.24 A single long-term study of potential displacement effects upon the species at the Edinbane and Ben Aketil Wind Farms on the Isle of Skye, did suggest the occurrence of displacement on the basis of the decrease in the spatial use of habitats within 500 m of operational turbines (Haworth Conservation, 2015). However, overall flight activity was found to be highly variable between monitoring years, with potential confounding influences of differences in habitat features between wind farm sites (e.g. typography).

7.10.25 A further study carried out at the Beinn an Tuirc wind farm, did also identify a decrease in spatial use of the wind farm site during initial years of operational monitoring (Walker *et al*., 2005). Activity through the turbine clusters was however recorded and the potential confounding influence of habitat enhancement measures undertaken on adjacent moorland areas as mitigation for the development, currently inhibit any clear conclusions on wind farm avoidance by the species.

7.10.26 On the basis of best and currently available evidence at Scottish wind farms, displacement and loss of habitats for foraging golden eagles is calculated for areas within 500 m of turbine locations. This equates to approximately 507 ha of open moorland, rough grassland and forested habitats within the vicinity of the proposed development.

7.10.27 Overall flight activity within 500 m of proposed turbine locations was very low, with observations of birds at collision risk limited to eight flights of single birds only (Table 7.6). A pair of golden eagles was recorded during breeding raptor and owl searches, noting a preference of foraging adult birds associated with the identified occupied home range to occur to the far north of the project area, as detailed within Appendix 7.3. As such, the project area is considered to be of low importance to the identified breeding pair.

7.10.28 Operational displacement whilst permanent is therefore considered to be of no more than a Low magnitude effect which would be Non-significant at the Regional NHZ population level, in the context of extensive and preferred remaining suitable habitats both locally and regionally for the species.

7.10.29 Losses of potential foraging habitat would not be considered to affect the perceived quality of the potential foraging range of any known breeding pair of golden eagle, or result in reduced breeding success of subsequent abandonment by the pair.

Collision Risk Mortality

7.10.30 A CRM for golden eagle has been completed using flight activity data for the periods September 2016 to August 2017 (Year 1) and September 2017 to August 2018 (Year 2), which predict an annual mortality of 0.014 to 0.070 birds.

7.10.31 The upper predicted annual mortality of 0.070 birds per year represents 0.15% of the most recently published Regional NHZ population (46 birds) and 0.11% of the most recently published Ross-shire breeding population (33 pairs; assumed 66 birds).

7.10.32 Estimated adult survival rates for golden eagle are stated as 95% (Watson, 1997), which gives a baseline mortality of 5% for adult birds. Assuming a Regional NHZ population estimate of 43 pairs (86 birds), the baseline mortality rate in the absence of the Proposed Development would be 4 adult birds. The upper additional estimated annual mortality (0.070 birds) resulting from the proposed development represents a 1.75% increase in annual baseline Regional NHZ mortality.

7.10.33 Overall collision mortality risks to golden eagle are therefore considered to represent no more than a **Low** magnitude effect and which would be **Non-significant** at the Regional NHZ population level.

7.10.34 There have been no published incidents of golden eagle collision fatalities at operational wind farms in Scotland at the time of writing and whilst the potential for collisions to occur for the species over the lifetime of the development cannot be entirely precluded, such events are considered unlikely.

Black grouse

7.10.35 Black grouse is a Red-listed BoCC, an SBL species and is listed as a Priority Species under the Ross and Cromarty (East) LBAP.

7.10.36 The most recently published NHZ breeding black grouse population estimate for the Northern Highlands NHZ comprises 473 lekking males (Wilson *et al*., 2015), based on the 2005 national survey.

7.10.37 A total of 15 lek sites were recorded during baseline surveys in 2017 and 2018, which supported a combined peak total of 20 lekking males. A number of lek sites identified were only used sporadically and/or by single males over the course of surveys and which are considered to comprise ‘satellite’ leks. Field observations and desk study records also suggest that local lek populations are somewhat mobile with males readily moving between lek sites.

7.10.38 Two ‘main’ lek sites, used consistently by higher numbers of males were however recorded during surveys, with only a single of these lek sites located within 1.5 km of the turbines. Further details are provided in Appendix 7.3.

7.10.39 The peak number of 20 lekking males recorded over the course of baseline surveys represents 4% of the most recently published Regional NHZ population estimate (473 lekking males).

7.10.40 As such, a value of Regional importance is assigned to black grouse for the purposes of this assessment.

Displacement (Construction)

7.10.41 A review of disturbance distances for the species suggest that breeding female black grouse would not be passively disturbed at distances greater than 100 - 150 m and leks would not be passively disturbed at over 500 - 750 m (Ruddock & Whitfield, 2007).

7.10.42 Construction activities within the project area during the breeding season for black grouse (March to August inclusive; SNH, 2014), therefore have the potential to result in the disturbance to lekking males at identified lek sites and brooding females, should they be present within proximity to working areas.

7.10.43 The potential for disturbance to black grouse would however be temporary, with effects greatest where works are undertaken within proximity (i.e. within 750 m) to known lek sites during the breeding season. As such, assuming works will be undertaken over the course of at least one breeding season, this has the potential to result in the temporary displacement of males at lek sites identified within 750 m of proposed development footprint.

7.10.44 For the purposes of a precautionary assessment, assuming the absence of suitable alternative lek sites within the surrounding moorland, disturbance of black grouse during the construction phase is considered to comprise a **Low** magnitude but temporary effect, **Non-significant** at the Regional NHZ population level.

7.10.45 Such effects are however considered unlikely on the basis of the known availability of alternative lek sites locally to which males may displace.

7.10.46 Mitigation measures are however, proposed to reduce the potential disturbance effects to lekking black grouse, over the course of construction works.

Displacement (Operation)

7.10.47 Research into the operational displacement of black grouse from wind farm sites remains limited. However, at several sites in Scotland, studies have shown that the abundance of lekking males at wind farm sites did not change during the operational period, although some lek sites, within 500 m of planned turbine locations, moved locally after construction (Zwart *et al*., 2015).

7.10.48 The same research also outlines evidence of the species occasional use of areas beneath turbines (Zwart *et al.,* 2015) and confounding factors such as habitat management and the lack of pre-construction data do however, place limitations on evidence suggesting displacement and population level effects for the species (Zwart *et al.*, 2015).

7.10.49 The locations of 'main' lek sites identified during baseline surveys has been considered as part of the evolution of scheme design, and as such, no such lek site is located within 500 m of any proposed turbine locations. Operational displacement of males utilising these lek sites are therefore highly unlikely on the basis of best available evidence. Whilst the displacement of individual lekking males at ‘satellite’ lek sites cannot be entirely precluded, such effects would not be attributable to local population losses.

7.10.50 Operational displacement effects to black grouse are therefore considered to comprise no more than a **Low** magnitude effects, **Non-significant** at the Regional NHZ population level.

Collision Mortality Risk

7.10.51 Only a small number of black grouse flights were recorded during VP flight activity surveys, the majority of which occurred below collision risk height as would be typical for the species.

7.10.52 Given the very low level of “at collision risk” flight activity, CRMs for the species have not been completed due to the inconsequential levels of collision mortality risk for the species that would reasonably be predicted. The species is acknowledged as being at low risk of collision with turbine blades due to their typical low flight heights and tendency to spend much of their time on the ground.

7.10.53 Collision risk mortality for the species is considered to be **Negligible** and **Non-significant** at the Regional NHZ population level.

7.11 Mitigation

7.11.1 No significant effects upon ornithological features are predicted to occur as a result of the proposed development and, as such, project-specific mitigation measures above and beyond those integrated into the design are not required.

7.11.2 Measures to ensure legislative compliance and reduce the potential for disturbance to lekking black grouse will however be implemented during the construction phase of the proposed development.

Breeding Birds

7.11.3 All wild birds in the UK are protected under Section 1 of the Wildlife and Countryside Act 1981 (as amended), which makes it an offence to intentionally or recklessly kill, injure or take any wild bird or take, damage or destroy the nest (whilst being built or in use) or its eggs. All wild birds listed on Schedule 1 of the Act receive additional legal protection which makes it an offence to intentionally or recklessly disturb these species while building a nest or in, on or near a nest containing eggs or young; or to disturb their dependent young.

7.11.4 Site clearance activities, where commenced during the core breeding bird season (1st March to 31st August inclusive), will therefore be subject to a pre-clearance survey by a competent ornithologist to identify any active wild bird nests. Should any active nests be found, works will only proceed under the advice of the appointed ornithologist. Work exclusion buffers around identified nest sites would be implemented where necessary in accordance with best available species guidance applicable at the time and/or as agreed in consultation with SNH.

Black Grouse

7.11.5 Current research suggests that lekking black grouse are not passively disturbed at distances over 500 - 750 m from source (Ruddock & Whitfield, 2007). Adopting these findings, as a precautionary measure no potentially disturbing construction works within 750m of identified “main lek sites” (detailed within Appendix 7.3) will be undertaken prior to 9am in the months of April and May.

7.11.6 This will serve to avoid construction phase disturbance to important numbers of lekking males.

7.12 Cumulative effects

7.12.1 This section considers the potential effects of the proposed development upon important ornithological features in combination with other operational, consented and proposed wind farm developments in accordance with SNH guidance (2018b).

7.12.2 Only cumulative collision risks for golden eagle have been considered as being potentially significant for the purposes of this assessment.

7.12.3 The geographic scale at which a cumulative assessment of collision risks to golden eagle has been undertaken is based upon the core species foraging range as per SNH guidance (2016) and comprising 6 km**.**

7.12.4 Wind farm developments located within 6 km of the project area are listed in Table 7.9 together with a summary of collision risk mortality estimates predicted.

7.12.5 Figures presented for other wind farm developments have not been checked or amended to reflect avoidance rates used within this assessment. Where it is stated NA i.e. "Not assessed", the wind farm development was not supported by an assessment of collision risks to golden eagle and as such, no collision risks have been assumed.

Table 7.9 Cumulative collision risk estimates

Wind Farm	Annual Collision Risk Estimate
Lochluichart (Ref: 05/01052/S36RC)	Not available.
Corriemoillie (Ref 10/04137/FUL)	0.005
Lochluichart Extension (Ref 11/03204/S36)	0.0047
Lochluichart Extension II (Scoping)	Not available at time of submission.
Kirkan	0.07
Total	**0.08**

7.12.6 Cumulative collision risk estimates for golden eagle are calculated at 0.08 birds per year, which represents 0.09% of the most recently published Regional NHZ population (86 birds) and a 2% increase in annual baseline Regional NHZ mortality.

7.12.7 As detailed, there have been no published incidents of golden eagle collision fatalities at operational wind farms in Scotland at the time of writing, with collision risks presented considered to be an overestimate.

7.12.8 Overall cumulative collision mortality risks to golden eagle are therefore considered to represent no more than a **Low** magnitude effect and which would be unlikely realised at the Regional NHZ population level. **Non-significant** effects are therefore anticipated.

7.13 Enhancement measures

7.13.1 Riparian planting is proposed within the Outline Habitat Management Plan (HMP).

7.13.2 An objective of the riparian planting will be to enhance terrestrial biodiversity, with woodland and edge habitat suitable for species including black grouse.

7.13.3 Planting is proposed to include both continuous and discontinuous shrub and tree dominated planting. Discontinuous areas of planting will ensure that extensive shading of existing food plants (e.g. grasses and blueberry, where present) for black grouse does not occur, with tree and shrub species planted selected for their preference by black grouse such as (amongst others) birch, and willow species together with Scots pine, rowan and juniper.

7.13.4 Such species will provide additional food sources for black grouse in the spring and winter, together with suitable cover from predation for both adults and broods.

7.13.5 Riparian planting proposed is therefore considered to provide habitat enhancement for black grouse at least at a Local level and will deliver new and enhanced foraging and nesting opportunities for additional species including passerines.

7.14 Summary of effects

7.14.1 A summary of significant ornithological effects is provided in Table 7.10.

Table 7.10 Summary table of impacts upon the recorded ornithological features

Feature	Proposed Activity	Characterisation of unmitigated impact upon feature	Significance without mitigation and confidence level	Mitigation and Enhancement	Residual significance and confidence level (following mitigation)
Statutory Designated Sites for Ornithology	Indirect effects on qualifying feature species during construction and/or operation	Negligible	Negligible, not significant	Not required	Not significant
Golden Eagle	Displacement (construction)	Low magnitude, temporary.	Minor adverse, not significant.	Not required.	Not significant
	Displacement (operation)	Low magnitude	Minor adverse, not significant.	Not required.	Not significant
	Collision Mortality	Low magnitude	Negligible, not significant.	Not required.	Not significant
Black Grouse	Displacement (construction)	Low magnitude, temporary.	Negligible, not significant.	Not required but precautionary measures included.	Not significant
	Displacement (operation)	Low magnitude	Negligible, not significant.	Not required.	Not significant
	Collision Mortality	Low magnitude	Negligible, not significant.	Not required.	Not significant

7.15 Information to inform a Habitats Regulations Appraisal

7.15.1 This section summarises information relating to the potential for Likely Significant Effects upon ornithological qualifying features of Glen Affric to Strathconon SPA as a result of the Proposed Development.

7.15.2 The potential for Likely Significant Effects upon any other European sites and Ramsar sites (as presented in Table 7.5) is screened out on the basis of spatial separation of the Site from additional designations in accordance with SNH guidance (2016).

7.15.3 The Glen Affric to Strathconon SPA, located 4.7 km south of the proposed development site, is designated by virtue of its importance for breeding golden eagle (Table 7.5).

7.15.4 SNH guidance (2016) provides information on dispersal and foraging distances for a key bird species in order to identify the potential for 'connectivity' between development proposals and Special Protection Areas (SPAs). Table 1 of the guidance presents typical foraging distances for these species, which for golden eagle are stated to be "core range of 6 km with a maximum range of 8 km". Subsequently the proposed development lies within the potential core range of golden eagles territories from within the Glen Affric to Strathconon SPA.

7.15.5 Two golden eagle home ranges were identified within 6 km of the project area in consultation with SNH and the RSPB. These are both located to the north of the project area and therefore well outside the SPA boundary. The absence of other golden eagle nests within the 6 km core range from the project area has been established through desk study, consultation and field survey in accordance with SNH guidance (2017a).

7.15.6 Subsequently the potential for Likely Significant Effects on the Glen Affric to Strathconon SPA can be precluded on the basis of absence of known home ranges within 6 km of the project area for territories located within the SPA boundary.

7.16 References

Challis, A., Wilson, M.W., Holling, M., Roos, S., Stevenson, A. & Stirling-Aird, P. (2018). 'Scottish Raptor Monitoring Scheme Report 2017'. BTO Scotland, Stirling.

Dunn, J.C., Zwart, M.C., Kerr, S., Fielding, A.H. & Whittingham, M.J. (2015). 'Desk based evaluation of wind farms and habitat management in Scotland'. Scottish Windfarm Bird Steering Group Commissioned report number 1503.

Eaton, M.A., Aebischer, N.J., Brown, A.F., Hearn, R.D., Lock, L., Musgrove, A.J., Noble, D.G., Stroud, D.A. and Gregory, R.D. (2015) 'Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man'. *British Birds*, 108, pp. 708–74.

Hayhow, D.B, Benn, S., Stevenson, A., Stirling-Aird, P.K & Eaton, M.A. (2017) 'Status of golden eagle Aquila chrysaetos in Britain in 2015'. *Bird Study*, 64 (3), pp. 281-294.

Haworth Conservation (2015).' Edinbane Windfarm: Ornithological Monitoring 2007–2014. A review of the spatial use of the area by birds of prey'. Haworth Conservation Ltd.

Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C.V. (2015a). 'Golden Eagle (Aquila chrysaetos): SWBSG Species Dossier 9'. Report by BTO Scotland to Scottish Windfarm Bird Steering Group as part of Project 1403.

Mitchell, C. (2012).’Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland’. Wildfowl & Wetlands Trust / SNH report, Slimbridge. 108pp.

Mitchell, C. (2012). ‘Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland’. Wildfowl & Wetlands Trust / SNH report, Slimbridge. 108pp.

Patterson, I.J. (2013) ‘Goose distribution in relation to SPAs in Grampian’. SNH Commissioned Report.

Ruddock, M. & Whitfield, P. (2007) ‘A Review of Disturbance Distances in Selected Bird Species’. A Report from Natural Research Ltd. to SNH.

SNH (2018a) ‘Assessing Significance of Impact From Onshore Windfarms on Birds Outwith Designated Areas’. SNH, Inverness.

SNH (2018b) ‘Assessing the cumulative impacts of onshore wind farms on birds’. SNH, Inverness.

SNH (2017a) ‘Recommended bird survey methods to inform impact assessment of onshore wind farms’ SNH, Inverness.

SNH (2017b) ‘Avoidance rates for the onshore SNH Wind Farm Collision Risk Model’. SNH, Inverness.

SNH (2016) ‘Assessing Connectivity with Special Protection Areas (SPAs)’ SNH, Inverness.

SNH (2014) ‘Breeding Season Dates for Key Breeding Species in Scotland’ SNH, Inverness.

SNH (2000) ‘Windfarms and Birds: Calculating a theoretical collision risk assuming no avoiding action’. SNH, Inverness.

Walker, D., McGrady, M., McCluskie, A., Madders, M. & McLeod, D.R.A. (2005) ‘Resident golden eagle ranging behaviour before and after construction of a windfarm in Argyll’. *Scottish Birds*, 25, pp. 24–40

Watson, J. (1997) ‘The Golden Eagle’. (London, Poyser).

Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). ‘Natural Heritage Zone Bird Population Estimates’ Scottish Windfarm Bird Steering Group Commissioned Report No. 1504.

8 HYDROLOGY

8.1 Introduction

8.1.1 This section of the Environmental Impact Assessment Report (EIAR) describes the existing hydrological conditions at the project area and identifies and assesses the potential impacts that may be caused by the proposed development. This includes project area preparation, construction works, restoration of construction works, project operation and decommissioning. Mitigation measures that may be employed to ameliorate any adverse effects are set out.

8.1.2 This chapter is supported by Technical Appendix 8.1: Drainage Impact and Watercourse Crossing Assessment.

8.2 Scope and methodology

8.2.1 The assessment is undertaken through a desk study and inspection of existing drainage features on and surrounding the project area. The existing conditions are described and the potential risks that may be associated with the proposed development are identified and assessed. This includes potential risks from flooding, hydrological changes introduced by project drainage and risks to water supply resources in the area.

8.2.2 A number of data sources were considered in writing this chapter; the main sources are detailed below:

- Ordnance Survey topographical mapping, current and historical;
- Centre for Ecology and Hydrology Flood Estimation Handbook Web Service;
- The Highland Council Environmental Health Department private water supplies records; and
- Scottish Water service records.

Effects evaluation

8.2.3 The significance of potential effects has been classified taking into account three principal factors: the **sensitivity** of the receiving environment; the potential **magnitude** of the effect; and the **likelihood** of that effect occurring. This approach is based on guidance contained within the joint Scottish Natural Heritage/Historic Environment Scotland publication *Environmental Impact Assessment Handbook v5* (SNH/HES, 2018).

Receptor sensitivity

8.2.4 The sensitivity of a receptor represents its ability to absorb the anticipated effect without resulting perceptible change. Four levels of sensitivity have been used, as defined in Table 9.1.

Table 8.1 Sensitivity ratings

Sensitivity	Definition
Very high	The receptor has very limited ability to absorb change without fundamentally altering its present character, is of very high environmental value and/or is of international importance.

Sensitivity	Definition
High	The receptor has limited ability to absorb change without significantly altering its present character, is of high environmental value and/or is of national importance.
Moderate	The receptor has moderate capacity to absorb change without significantly altering its present character, has moderate environmental value and/or is of regional importance.
Low	The receptor is tolerant of change without detriment to its present character, is of low environmental value and/or of local importance.

Effect magnitude

8.2.5 The magnitude of effects includes the timing, scale, size and duration of the potential effect. Four levels of magnitude have been used, as defined in Table 9.2.

Table 8.2 Magnitude ratings

Magnitude	Definition
Substantial	Substantial changes, over a significant area, to key characteristics or to the hydrological classification or status for more than 2 years.
Moderate	Noticeable but not substantial changes for more than 2 years or substantial changes for more than 6 months but less than 2 years, over a substantial area, to key characteristics or to the hydrological classification or status.
Slight	Noticeable changes for less than 2 years, substantial changes for less than 6 months, or barely discernible changes for any length of time.
Negligible or no change	Any change would be negligible, unnoticeable or there are no predicted changes.

Likelihood of effect

8.2.6 The likelihood of an effect occurring is evaluated to three levels: **unlikely**, **possible** or **likely**.

Effects significance

8.2.7 The findings in relation to the three criteria discussed above have been brought together to provide an assessment of significance for each potential effect. Potential effects are concluded to be of **major**, **moderate**, **minor** or **negligible** significance. Potential effects are assessed taking into account the proposed mitigation measures. The assessment concludes with a review of various effects to determine if they would be significant in terms of the *Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017*. Effects assessed as **major** or **moderate** are deemed to be significant; those assessed as **minor** or **negligible** are deemed to be not significant.

Table 8.3 Effects significance matrix

Sensitivity	Magnitude	Likelihood	Significance
Very High	Substantial	Likely	Major
		Possible	Major
		Unlikely	Moderate

Sensitivity	Magnitude	Likelihood	Significance
	Moderate	Likely	Major
		Possible	Moderate
		Unlikely	Moderate
	Slight	Likely	Moderate
		Possible	Minor
		Unlikely	Minor
	Negligible/no change	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
High	Substantial	Likely	Major
		Possible	Major
		Unlikely	Moderate
	Moderate	Likely	Moderate
		Possible	Moderate
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Minor
	Negligible/no change	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
Moderate	Substantial	Likely	Major
		Possible	Moderate
		Unlikely	Minor
	Moderate	Likely	Moderate
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Negligible
	Negligible/no change	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible
Low	Substantial	Likely	Moderate
		Possible	Minor
		Unlikely	Negligible
	Moderate	Likely	Minor

Sensitivity	Magnitude	Likelihood	Significance
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
	Negligible/no change	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible

Limitations and uncertainties

8.2.8 The site visit followed a standard 'reconnaissance level' walkover survey to obtain an overview of the project area conditions at the time of the visit. The information gathered has been combined with information from site visits for other disciplines and available photography to give as full a picture of the project area conditions as possible.

8.2.9 The site visit was undertaken on the 2nd, 3rd and 4th August 2018 following a prolonged dry period. A subsequent visit was undertaken on 28th November 2018. It is likely that some site notes and photographs may not be representative of normal conditions and that flows in watercourses may be lower than usual for the time of year. Subsequent peat survey visits were undertaken in October and November 2018, during wetter conditions, which have helped to provide a better understanding of normal conditions for the region. Notwithstanding this, a precautionary approach to assessment (and design where relevant) has therefore been taken in order to allow for any uncertainty.

8.2.10 Private water supply information was provided by the Highland Council's Environmental Health Department. This information relies on data provided by the property or business owner and may not be complete. Some additional information has been sought from local business owners to supplement the council's data.

8.3 Consultation undertaken

8.3.1 Consultation was undertaken with several statutory and non-statutory consultees and interested parties, including the Scottish Government, The Highland Council, Scottish Environment Protection Agency, Scottish Natural Heritage, Scottish Water and local stakeholders. Responses with relevance to hydrology are provided in

8.3.2

8.3.3 Table 9.4.

Table 8.4 Consultee responses relevant to hydrology, flood risk and drainage

Name of Stakeholder/ Consultee	Key concerns	Response
The Highland Council (THC)	Significant issues for consideration include impacts on the water environment, peat and GWDTEs.	Effects on the water environment are considered in Section 8.6. Effects on peat and

Name of Stakeholder/ Consultee	Key concerns	Response
		GWDTEs are addressed in Technical Appendices 9.1, 9.2 and 9.4.
THC Environmental Health	An investigation will be required to identify any private water supplies, including pipework, which may be adversely affected by the development. Details of proposed measures to prevent contamination or physical disruption should be submitted.	Private water supplies and related pipework have been identified. Details and risk assessment are provided in Section 8.6.
THC Flood Risk Management Team	Minimum 50 m buffer zone around waterbodies.	All development work is at least 50 m away from watercourses and waterbodies, except where crossings are required, and the site entrance construction compounds which make use of existing infrastructure. Please see Figure 8.5.
	Management of surface water to be assessed in a Drainage Impact Assessment for events up to the 1-in-200 year return period.	Please see Technical Appendix 8.1 for the Drainage Impact and Watercourse Crossing Assessment.
	Discharge to be limited to greenfield runoff rates.	Please see Technical Appendix 8.1 for the Drainage Impact and Watercourse Crossing Assessment.
	Flood Risk Assessment may be required.	Flood risk is considered in Section 8.5.21.
Scottish Government	Recommends that any potential impacts on freshwater fisheries are considered, with an outline of any proposals for water quality analysis and monitoring.	Effects on fisheries are considered in Chapter 6. Details of proposed water quality monitoring are provided in Table 8.10 and Figure 8.5.
	Recommends that an investigation is carried out into the presence of any drinking water supplies or Scottish Water assets which may be impacted by the development, and, if any are found, that an assessment is carried out of the potential impacts, risks and mitigation measures.	Drinking water supplies and related pipework have been identified. Details and risk assessment are provided in Section 8.6.
Scottish Environment Protection Agency (SEPA)	A map and assessment of engineering activities in or impacting the water environment, including buffers, flood risk assessment and related CAR applications	Assessment of all activities that may affect the water environment is provided in Section 8.6. Flood risk is covered in Section 8.5.21.

Name of Stakeholder/ Consultee	Key concerns	Response
		Details relating to CAR applications are provided in Technical Appendix 8.1.
	Schedule of mitigation including pollution prevention measures	Please see Section 8.6 for mitigation and pollution prevention measures
	Decommissioning statement	Provided in Section 2.6
	Detail of protection for existing water supply	Details and risk assessment are provided in Section 8.6
	Watercourse crossings should be designed to accommodate 1-in-200 year flood and other infrastructure located well away from watercourses.	Please see Technical Appendix 8.1 for the Drainage Impact and Watercourse Crossing Assessment.
	A detailed flood risk assessment is unlikely to be necessary.	Noted. Flood risk is considered in Section 8.5.21.
Scottish Natural Heritage (SNH)	Assessment of the impact on peat should be made, demonstrating that a wind farm can be built on the site without significant loss and damage. Mitigation measures are required.	Please see Technical Appendices 9.1 and 9.4 for details relating to peat, and relevant mitigation.
	Groundwater Dependent Terrestrial Ecosystems (GWDTE) should be identified.	Please see Technical Appendix 9.2 for the GWDTE Assessment.
Cromarty Firth District Salmon Fishery Board	The Board is concerned regarding potential impacts on habitats downstream of the development, including: Changes in hydrology and land drainage. Crossings of watercourses. Construction of access tracks and associated drainage.	Please see Technical Appendix 8.1 for the Drainage Impact and Watercourse Crossing Assessment for details of land drainage, water-course crossings, access track design and drainage.
	Disturbance of deep peat;	Please see Technical Appendices 9.1 and 9.4 for details relating to peat, and relevant mitigation.
	Mobilisation of sediment from track building and tree felling; Pollution of watercourses.	Sediment management and pollution prevention are covered in Section 8.6
	The Board would like to see mitigations put in place and a monitoring programme established to check their effectiveness.	A schedule of mitigation is provided in Section 8.6. Water quality monitoring is set out in Table 8.10 and Figure 8.5.

Name of Stakeholder/ Consultee	Key concerns	Response
Marine Scotland	Recommends the developer to carry out and present the following in the EIAR: Water quality; Provide appropriate site-specific mitigation measures; Establish an integrated water quality and fish monitoring programme before, during and after construction.	Baseline water quality status is detailed in Section 8.5. A schedule of mitigation is provided in Section 8.6. Water quality monitoring is set out in Table 8.10 and Figure 8.5. Monitoring relating to fish population is covered in Chapter 6.
Scottish Water	No formal consultation response received.	

8.4 Statutory and planning context

8.4.1 In preparing this section of the EIAR, consideration has been given to relevant planning guidance at all levels. This includes, but is not limited to, the following:

- The European Water Framework Directive (200/60/EC) and associated daughter Directives including the Groundwater Daughter Directive (Protection of Groundwater Against Pollution, 2006/118/EC);
- The European Floods Directive (2007/60/EC);
- The Environmental Protection Act 1990 (as amended);
- The Water Environment and Water Services (Scotland) Act 2003;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended);
- The Pollution Prevention and Control (Scotland) Regulations 2012;
- Scottish Planning Policy 2014, with particular respect to the section on Flooding and Drainage;
- Scottish Government's Planning Advice Notes (PAN):
    - PAN 51: planning, environmental protection and regulation, 2006;
    - PAN 61: sustainable urban drainage systems, 2001;
    - PAN 69: flood risk, 2015;
    - PAN 79: water and drainage, 2006.
- Scottish Environment Protection Agency's Guidance for Pollution Prevention (GPP & PPG):
    - PPG 1: Understanding your environmental responsibilities – good environmental practices, 2013;
    - GPP 2: Above ground oil storage tanks, 2018;
    - PPG 3: Use and design of oil separators in surface water drainage systems, 2006;
    - GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer, 2017;
    - GPP 5: Works and maintenance in or near water, 2017;

- GPP 8: Safe storage and disposal of used oils, 2017;
- GPP 13: Vehicle washing and cleaning, 2017;
- PPG 18: Managing fire water and major spillages, 2000;
- GPP 21: Pollution incident response planning, 2017;
- GPP 22: Dealing with spills, 2018;
- Code of Practice for Using Plant Protection Products in Scotland.

8.5 Existing environment

Meteorology and climate

8.5.1 Kirkan Wind Farm is located in the Scottish Highlands, within the UK Meteorological (Met) Office's Northern Scotland regional climatic area. Much of Northern Scotland is exposed to the rain-bearing westerly winds, particularly the Western Isles and areas along the west coast. Kirkan's location, roughly in the centre of the region and to the east of areas of higher ground, affords it some ground-level protection from the westerly winds.

8.5.2 Average annual rainfall for the project area catchments varies between 1,315 mm and 1,425 mm (CEH, 2018), reflecting the elevation and slope aspect of the catchments. Average annual rainfall for the climate monitoring station at Loch Glascarnoch is 1,767 mm. Figure 8.1 shows the average rainfall distribution through the year from Loch Glascarnoch and Kinlochewe monitoring stations.

8.5.3 The Northern Scotland climatic area includes the wettest part of the UK, north-west of Fort William, which experiences over 4,000 mm of rainfall per year. In contrast, the Moray Coast east of Inverness experiences around 700 mm of rainfall.

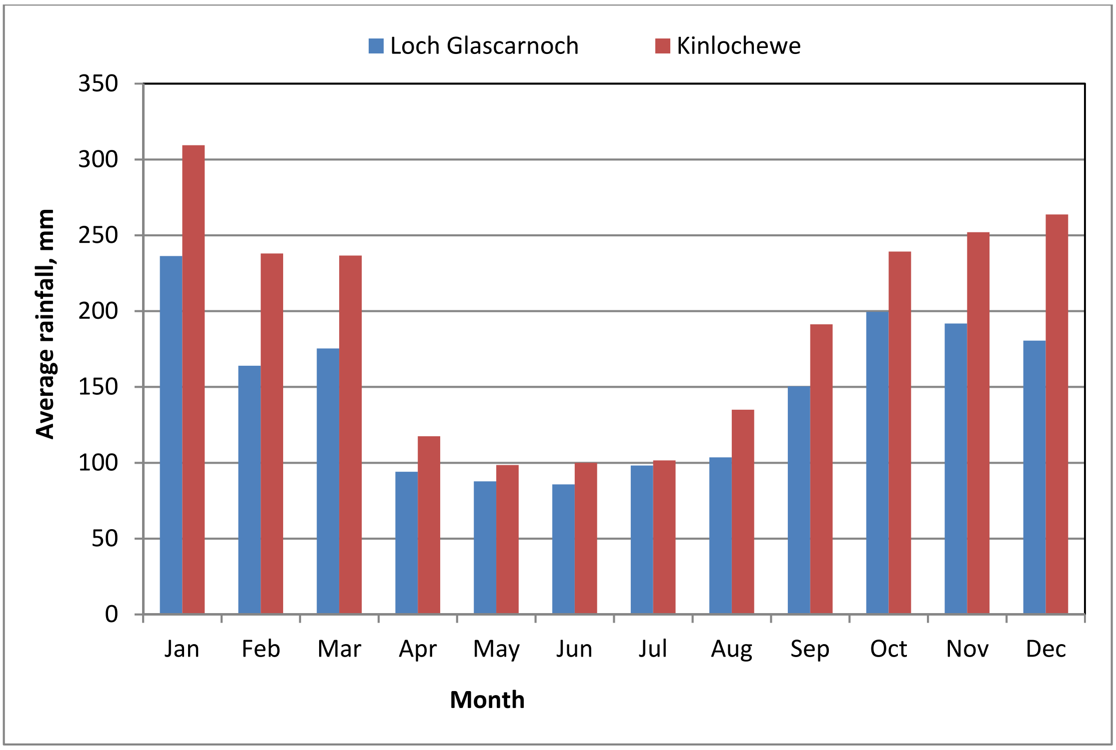


Figure 8.1 Monthly rainfall averages for monitoring stations at Loch Glascarnoch and Kinlochewe. Averages cover the period 1981-2010 for both monitoring stations. Met. Office, 2018.

Hydrology

8.5.4 The project area lies entirely within the catchment of the Glascarnoch River/Black Water system with project area drainage principally directed to the north and north-east. The Glascarnoch River lies immediately north of the northern project area boundary.

8.5.5 From Inchbae, the Glascarnoch/Black Water catchment covers an area of 181 km^2. It includes two main waterbodies: Loch Glascarnoch located approximately 750 m west of the project area boundary, and Loch Vaich 4.5 km to the north. The Glascarnoch/Black Water forms a tributary to the River Conon. The catchment lies at an elevation between 165 m above Ordnance Datum (AOD) at Inchbae to a maximum of 1,084 m AOD at the summit of Beinn Dearg, north-west of Loch Glascarnoch.

8.5.6 Three main watercourses provide drainage within the project area. Allt Giubhais Beag drains the westernmost corner of the project area. This watercourse joins the Glascarnoch River approximately 750 m downstream from the Glascarnoch dam and immediately downstream of the Aultguish Inn. The Allt Giubhais Beag has a total catchment area of 4.5 km^2.

8.5.7 Allt Bad an t-Seabhaig drains the eastern and south-eastern part of the project area and forms part of the eastern project area boundary. This watercourse joins the Black Water approximately 1,050 m upstream of Inchbae and has a total catchment area of 5.9 km^2.

8.5.8 Allt Glac an t-Sìthein drains the central and northern part of the project area. This watercourse divides in its lower reaches, forming two separate watercourses: the Fèith Bhàite, which drains north to the Glascarnoch River, and the Allt Cearc an t-Slugain, which drains north-east to the Black Water. The total catchment has an area of 4.9 km^2.

8.5.9 Part of the access track lies within the catchments of a number of minor unnamed watercourses. This area is 1.6 km^2 in total.

8.5.10 All watercourse catchments are shown on Figures 8.2 and 8.3.

Water quality

8.5.11 SEPA's Water Classification (SEPA, 2018a) and Water Environment Hubs (SEPA, 2018b) have been consulted to determine the existing baseline water quality for the main watercourses and waterbodies within the study area. The details are summarised in Table 8.5.

Table 8.5 Baseline surface water quality status

Water Body Name and ID	Status	Pressures
Glascarnoch River – Black Bridge to Loch Glascarnoch ID: 23380	Overall Classification – Bad ecological potential Ecology – Bad Chemistry – Pass Overall Condition – Bad Water Quality – High	Water flows and levels: hydroelectricity generation
Loch Glascarnoch ID: 100113	Overall Classification – Good ecological potential Ecology – Bad Chemistry – Pass Overall Condition – Good	None

Water Body Name and ID	Status	Pressures
	Water Quality – Good	
Abhainn Srath a' Bhathaich ID: 20187	Overall Classification – Good ecological potential Ecology – Moderate Chemistry – Pass Overall Condition – Good Water Quality - High	None
Black Water – Garbat to Black Bridge ID: 23379	Overall Classification – Good ecological potential Ecology – Moderate Chemistry – Pass Overall Condition – Good Water Quality – High	None

8.5.12 The three watercourses providing project area drainage are not classified and assessed directly as their catchment sizes are too small and fall below the size threshold.

8.5.13 All of the waterbodies listed in Table 8.5 are considered to be Heavily Modified Water Bodies (HMWB) as a result of modifications for the Conon Valley hydroelectric renewable power scheme.

Designated sites

8.5.14 One site designated for features relating to hydrology is present within 5 km of the project area boundary. In addition, one site designated for features relating to hydrology is located downstream of the project area. These sites are detailed in Table 8.6. Please note, separation distances are straight-line distances and effective distance downstream will be greater. Data are collated from SNH (2018).

Table 8.6 Designated sites relevant to hydrology

Site Name	Qualifying Features Relating to Hydrology	Distance From Project Area	Linkage?
Ben Wyvis SAC, SSSI, NNR	Freshwater habitats	2.8 km east	None, site lies in a separate sub-catchment
Lower River Conon SSSI and Conon Islands SAC	Wetlands, saltmarsh, wet woodland	14.4 km south-east	Site lies downstream but distance provides protection

Water resources

8.5.15 A number of private water supplies (PWS) are known to be present near the project area. Information in this section has been provided by the Highland Council's Environmental Health Department with additional information provided by local residents and property owners. Details of identified PWS are provided in

8.5.16

8.5.17 Table 8.7 and locations are shown on Figure 8.4.

Table 8.7 Details of private water supplies within or near the project area

Supply Name	Source Location	Source Type	Properties Served	Information Source	Linkage?
Aultguish Inn	NH 350 698	Surface water and borehole	1	The Highland Council (THC) & property owners	Potential, surface water source is located downstream of infrastructure. Borehole source is located in a separate sub-catchment
Black Bridge Hydro House	NH 374 711	Spring?	1-2	THC	None, source is located in a separate sub-catchment
Strathvaich Lodge	Not known	Surface water	1	THC	None, supply is located in a separate sub-catchment
Inchbae Lodge Inn	NH 400 693	Borehole	1	THC & property owners	None, supply is located in a separate sub-catchment
Silverbridge Tigh Fiodha	NH 420 684	Surface water?	Unknown	THC	None, supply is located in a separate sub-catchment

8.5.18 As private water supply registers are dependent on information being supplied to the Council by property owners or tenants, the information may not be complete and is unlikely to include water required for livestock watering, if relevant.

Flood risk

8.5.19 SEPA's Indicative Flood Map (SEPA, 2018c) was consulted to gain an overview of the likelihood of flooding within the project area.

8.5.20 River flooding is largely confined to the main channels for watercourses within the project area boundary. The only exception is the lower part of Allt Bad an t-Seabhaig, where there is minor flood risk around the watercourse channel in the 1.5 km immediately above the confluence with the Black Water. The Glascarnoch River and Black Water both show a risk of flooding in their immediate channel area.

8.5.21 Flood risk within the study area is shown to be minimal and no elements of the development are indicated to be at risk from flooding from any source.

8.6 Predicted impacts

Development characteristics

8.6.1 The construction phase of the proposed development would involve a number of different elements. Chapter 2 of the EIAR describes the scheme elements in detail. The elements with particular relevance to hydrology are as follows:

- Construction of access routes and watercourse crossings;
- Excavation and construction of turbine foundations and associated crane pads;
- Creation of construction compounds, laydown areas and a substation;
- Excavation of borrow pits and processing of excavated rock;
- Installation of permanent met masts;
- Installation of drainage features around permanent infrastructure;
- Batching of concrete (if required);
- Temporary welfare facilities and site utilities including water supply and foul water disposal.

8.6.2 During operation of the project, activities with particular relevance to hydrology are as follows:

- Surface water drainage, including treatment and discharge of surface drainage;
- Maintenance of tracks and trackside drainage.

8.6.3 During decommissioning and restoration of the project area, activities with particular relevance to hydrology are as follows:

- Water and sediment management during decommissioning and removal of project infrastructure.

Effects during construction

Physical changes to overland drainage and surface water flows

8.6.4 Changes to overland drainage patterns would arise principally from construction of the access track network with subsidiary effects from construction of the turbine foundations, crane pads and ancillary infrastructure.

8.6.5 The access track would require installation of trackside drainage and cross-drains to protect the track from water damage. Constructed drains would be no longer and deeper than necessary to provide the required track drainage. Cross-drains would be installed at an appropriate frequency to minimise concentration of flows from above the track and to prevent diversion of flows between sub-catchment areas, to minimise changes to the hydrological regime. All drainage infrastructure would be designed with suitable capacity for a rainfall intensity of a 1-in-200 year storm event, plus allowance for climate change.

8.6.6 A number of watercourses would be crossed by the access track. Four crossings of regulated watercourses have been identified and details are provided in Technical Appendix 8.1.1. All crossings would be new structures.

8.6.7 One minor, unregulated watercourse would also require a crossing to be installed. This crossing would be designed with sufficient capacity for a rainfall intensity of a 1-in-200 year storm event, plus allowance for climate change.

8.6.8 All necessary permissions required for watercourse crossing works would be obtained prior to commencement of associated works.

8.6.9 The receptor, project area surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be of **Slight** magnitude. The likelihood of effect is considered to be **Likely**.

8.6.10 The effect of physical changes to overland drainage from construction works is assessed as **Minor**, long-term and adverse.

Particulates and suspended solids

8.6.11 All development work involving earthmoving operations would generate loose sediment, which could potentially gain access to surface watercourses and waterbodies through entrainment in surface runoff. This could potentially have an adverse effect on the downstream watercourses through damage to fish spawning habitat and changes to dissolved oxygen and nutrient levels in watercourses and waterbodies.

8.6.12 Surface water from the areas surrounding the turbine bases, all hardstanding areas (including crane pads, substation, construction compounds and laydown areas) and borrow pits would be prevented from entering the working areas by appropriate use of peripheral bunding and cut-off drains. These would help to divert clean water around and away from the working areas.

8.6.13 During excavation works for turbine foundations, cut sections of track, cut areas for hardstandings and borrow pits, silt fencing or appropriate alternative sediment control protection would be installed on the downhill side of the excavation to prevent inadvertent discharge of silty water into any project area watercourse.

8.6.14 All engineering work adjacent to watercourses, including track construction and installation of watercourse crossings, would have appropriate sediment control measures established prior to any groundworks. Vegetation would be retained along watercourse banks to act as additional protection. The main watercourses crossings for the development would not require any in-stream works.

8.6.15 Minor in-stream works would be required for the crossing of the minor watercourse noted above. This work would be undertaken using a temporary dam to control flow whilst the culvert pipe is installed. Over-pumping would only be used if flow conditions require this.

8.6.16 For areas of larger excavation, such as turbine bases and crane pads or borrow pit excavations, temporary water control measures may be used. These may include use of temporary settlement ponds or the use of proprietary treatment systems such as Siltbusters, as appropriate.

8.6.17 Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of identified deeper peat, to minimise mobilisation of sediment in heavy rainfall. The following 'stop' conditions are recommended to guide construction activity (CH2M & Fairhurst, 2018):

Table 8.8 Recommended 'stop' conditions for earthmoving activities

'Stop' rule	Requirements
High intensity rainfall	Rainfall during construction greater than 10 mm per hour
Long duration rainfall	Rainfall in the preceding 24 hours greater than 25 mm
7-day cumulative rainfall (1)	Preceding 7 days of rainfall greater than 50% of the monthly average
7-day cumulative rainfall (2)	Preceding 7 days of rainfall greater than 50 mm

8.6.18 Any water collecting within excavations would be pumped out prior to further work in the excavation. This water may require treatment to remove suspended solids prior to discharge to ground.

8.6.19 Vegetation cover would be re-established as quickly as possible on track verges, screening bunds and cut slopes, by re-laying of excavated peat acrotelm, to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradeable geotextile, would be considered if necessary in specific areas and areas of particular sensitivity.

8.6.20 All necessary permissions relating to construction works, plus accompanying pollution prevention plans, would be obtained prior to any construction work beginning within the project area.

8.6.21 A water quality monitoring programme would be established at key locations around the project area. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details are provided in Table 8.10.

8.6.22 The receptor, project area surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

8.6.23 The effect of particulates and suspended solids from construction works is assessed as **Minor**, temporary and adverse.

Water contamination from fuels, oils, concrete batching or foul drainage

8.6.24 Spillage of fuels, oils, wet concrete or concrete washout water could have an adverse effect on surface water quality, and major spillages could have a potential influence on the Glascarnoch/Black Water river system downstream of project area watercourses.

8.6.25 Oil and fuel storage and handling within the project area would be undertaken following published guidance, in particular *Guidance on Pollution Prevention 2 – Above ground oil storage tanks* (SEPA, 2018) and in compliance with the *Water Environment (Oil Storage) (Scotland) Regulations 2006*. The details are as follows:

- Risk assessments would be undertaken and all Hazardous Substances and Non-Hazardous Pollutants that would be used and/or stored within the project area would be identified. Hazardous substances likely to be within the project area include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be used within the project area. Herbicides would not be used.
- All deliveries of oils and fuels would be supervised.
- All storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank's capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank's capacity or 25% of the total capacity, whichever is the greater.
- Any valve, filter, sight gauge, vent pipe or other ancillary equipment would be located within the containment area.
- Waste oil would not be stored within the project area but would be removed to dedicated storage or disposal facilities.
- Management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms.

- Maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant.
- Refuelling and servicing would be undertaken in a designated area or location with adequate precautions in place, such as a dedicated impermeable surface with lipped edges to contain any contaminants.
- Where vehicle maintenance is necessary in the field, owing to breakdown, additional precautions would be taken to contain contaminants, such as spill trays or absorbent mattresses.
- The access track would be designed and constructed to promote good visibility where possible and two-way access where visibility is restricted, to minimise risk of vehicle collisions.
- If concrete batching within the project area is required, this would take place in one designated location within the project area construction compound. This location would be at least 250 m from the nearest watercourse. Protective bunding would be installed around the batching area to ensure that contaminated runoff is contained. Dedicated drainage would be installed to ensure that water from the batching area can be suitably treated to reduce alkalinity and suspended sediment load prior to discharge, or removed from the project area by tanker for treatment and disposal offsite.

Foul drainage provision

8.6.26 There are no sewerage facilities available near the project area. The site welfare facilities would include a suitably sized holding tank, which would be emptied by tanker and removed from the project area on an appropriate timescale for disposal at a suitably licensed facility.

Spillage and emergency procedures

8.6.27 The Spillage and Emergency Procedures would be prominently displayed at the development and staff would be trained in their application. The Procedures document would incorporate guidance from the relevant SEPA Guidance Notes.

8.6.28 In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water environment, all necessary measures would be taken to remedy the situation. These measures would include:

- Identifying and stopping the source of the spillage;
- Containing the spillage to prevent it spreading or entering watercourses by means of suitable material and equipment;
- Absorbent materials, including materials capable of absorbing oils, would be available within the project area to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials. Sand bags would also be readily available for use to prevent spread of spillages and create dams if appropriate;
- Where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed from the project area by a licensed waste carrier to a suitable landfill facility;
- The emergency contact telephone number of a specialist oil pollution control company would be displayed within the project area; and

- Sub-contractors would be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the development.

8.6.29 SEPA would be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident would be forwarded to SEPA no later than 14 days after the incident.

8.6.30 A water quality monitoring programme would be established at key locations around the project area. Monitoring would begin prior to any construction works, to allow pre-construction baseline quality to be determined. Details are provided in Table 8.10.

8.6.31 The receptor, project area surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **Moderate**. The likelihood of effect is considered to be **Unlikely**.

8.6.32 The effect of water contamination from fuels, oils, concrete batching or foul drainage from construction works is assessed as **Minor**, temporary and adverse.

Changes in or contamination of water supply to vulnerable receptors

8.6.33 Vulnerable receptors that have the potential to be affected by development works have been identified. These include a number of private water supplies. Groundwater-dependent wetland systems are addressed in Chapter 9. No sites designated for hydrological criteria are considered to be at risk from the development.

8.6.34 A number of properties are known to be reliant on private water supplies in the area near to and downstream of the development. All individual private water supplies have been assessed using the source-pathway-receptor method, in line with current best practice guidance.

8.6.35 An initial screening assessment of potential pathways is provided in Table 8.9. The supplies identified through the screening process as potentially at risk from the development are considered in more detail below.

Table 8.9 Private Water Supplies Risk Assessment

Supply Name	Source Type	Distance and Direction from Nearest Infrastructure	Assessment	At Risk?
Aultguish Inn	Surface water Borehole	SW: 0.6 km west (track), 1.9 km north (Turbine 1) BH: 0.5 km west (compound)	Potential, surface water source is located downstream of infrastructure. Borehole source is located in a separate sub-catchment	Yes (SW source) No (BH source)
Black Bridge Hydro House	Spring?	1.9 km north-east (track)	None, source is located in a separate sub-catchment (across river)	No
Strathvaich Lodge	Surface water	4.1 km north (track)	None, supply is located in a separate sub-catchment (across river)	No

Supply Name	Source Type	Distance and Direction from Nearest Infrastructure	Assessment	At Risk?
Inchbae Lodge Inn	Borehole	3.1 km east (Turbine 10)	None, supply is located in a separate sub-catchment (across river)	No
Silverbridge Tigh Fiodha	Surface water?	4.9 km east (Turbine 13)	None, supply is located in a separate sub-catchment (across river)	No

8.6.36 The owners of the Aultguish Inn have confirmed that their property has a dual-source supply. Their main supply draws water from the Allt Giubhais Beag, with a supplementary supply provided by a borehole in the river gravels adjacent to the property.

8.6.37 The borehole supply is located in a separate sub-catchment from the proposed development and is therefore not at risk from any of the site works.

8.6.38 The surface water supply is located downstream of Turbine 1 and ancillary works, and is therefore potentially at risk of contamination. The proposed works are 1.9 km in a straight line from the source intake, or approximately 2.2 km downstream. The following mitigation would be applied to all works within the Allt Giubhais Beag catchment area:

- No excavation works would begin until cut-off drains and sediment protection (silt fencing and/or pegged straw bales, as appropriate) have been installed between the turbine base and hardstanding area and the direct flow paths towards the Allt Giubhais Beag. These would require sign-off by the Environmental Clerk of Works prior to ground works beginning.
- Visual and *in situ* water quality monitoring of the watercourse at its closest point downstream of the ground works, at the intake location and at a control point upstream of the ground works, would be undertaken on a twice-daily basis whilst works are ongoing at Turbine 1. Any signs of siltation of suspended sediment in the water would be recorded and reported to the Environmental Clerk of Works for appropriate follow-up.
- No maintenance of refuelling activities would take place within the watercourse catchment.
- Sediment protection measures would remain in place, with regular checks to ensure their continued effective operation, until all ground works are completed at Turbine 1 and vegetation has re-established on exposed soil areas.
- Should any concerns be raised that may be related to the wind farm works, ongoing activity at Turbine 1 would be restricted if possible to allow further investigation to be undertaken to identify the cause of the concerns and their validity. Works would remain restricted until the investigation has demonstrated that it was a false alarm and/or not related to the wind farm works, or until

additional protection measures are installed to prevent a recurrence, to the Environmental Clerk of Works' satisfaction.

- Some activities, such as pouring of concrete, cannot be stopped prior to completion. If required, an alternative source of water, such as a water bowser, could be provided to the Aultguish Inn as contingency during such activities.

8.6.39 The receptor, Aultguish Inn surface water intake, is considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

8.6.40 The effect of changes in or contamination of water supply to vulnerable receptors, notably private water supplies, from construction works is assessed as **Minor**, temporary and adverse.

Increased flood risk

8.6.41 The site infrastructure is not at risk of flooding from any source.

8.6.42 The drainage infrastructure installed around long-term wind farm infrastructure would be designed to minimise concentration of flows. This would be achieved by:

- Use of cut-off drains to divert runoff around necessary 'hard' infrastructure such as turbine bases and hardstanding areas.
- Use of regular cross-drains underneath access tracks. These would be installed in line with the natural terrain, making use of natural low points where runoff would naturally be focused.
- Use of a slight gradient on installed 'hard' infrastructure to encourage drainage into a filter drain, for infiltration into vegetated areas and as shallow through-flow.

8.6.43 Long-term drainage would be installed ahead of related construction works or excavations taking place, to ensure that site drainage can be controlled appropriately. For tracks, the required trackside drainage would be put in place ahead of access track construction, on a rolling basis as the track development progresses.

8.6.44 Any areas which have to be left unvegetated during the construction phase, such as turbine foundations, hardstanding areas and borrow pits, would have settlement ponds put in place to attenuate flow until vegetation can be re-established at the end of the construction period.

8.6.45 In line with best practice guidance, site runoff would not be greater than natural pre-development runoff. Details are provided in Technical Appendix 8.1.

8.6.46 The receptors, infrastructure and property downstream of the development, are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of any increased flood risk is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

8.6.47 The effect of increase in flood risk resulting from the construction works is assessed as **Negligible**.

Effects during operation

Physical changes to overland drainage and surface water flows

8.6.48 No additional changes to overland drainage and surface water flows are anticipated during the operational phase. Trackside and infrastructure drainage would remain in place during the site's operation. A monitoring and maintenance programme would be put in place for the drainage infrastructure, to include regular visual inspection of drainage ditches, crossing structures and cross-drains to check for blockages, debris or damage that might impede water flow. Any identified blockage, including build-up of sediment that may lead to future blockage, or damage to structures would be remediated immediately. Where practicable, routine maintenance would be undertaken during dry weather; where this is not practicable, additional sediment control measures may need to be established to manage silty water arising from the work.

8.6.49 The receptor, project area surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be of **Negligible** magnitude. The likelihood of effect is considered to be **Unlikely**.

8.6.50 The effect of physical changes to overland drainage from operational works is assessed as **Negligible**.

Particulates and suspended solids

8.6.51 The main operational phase work would involve track and hardstanding maintenance and repair. Regular monitoring of the track and hardstanding condition would be undertaken, particularly following periods of heavy of prolonged rainfall and after snowfall and clearance. Any sections of the track showing signs of excessive wear would be repaired as necessary with suitable rock from on-site borrow pits or external sources.

8.6.52 The drainage network would also be subject to regular monitoring to ensure that it remains fully operational, as water build-up can cause considerable damage to unbound track construction.

8.6.53 All bridge structures would have appropriate splash control measures as part of their design, to prevent silty water splashing into the watercourse from vehicle movements. These splash controls would be monitored regularly to ensure they remain effective and have not become damaged in any way.

8.6.54 The receptor, project area surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Possible**.

8.6.55 The effect of particulates or suspended solids from operational works is assessed as **Minor**, temporary and adverse.

Water contamination from fuels or oils

8.6.56 The risk of water contamination from fuels or oils is considerably lower during operation than during construction as there are significantly decreased levels of activity on site. The majority of potential pollutants would no longer be present on site. Lubricants for turbine gearboxes, transformer oils and maintenance vehicle fuels would remain present in small quantities.

8.6.57 The pollution prevention plan and site spillage and emergency procedures, as set out above, would remain in force throughout the operational phase. There would be no concrete batching or foul drainage provision on site.

8.6.58 The receptor, project area surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

8.6.59 The effect of water contamination from fuels or oils from operational works is assessed as **Negligible**.

Changes in or contamination of water supply to vulnerable receptors

8.6.60 No additional works within the Allt Giubhais Beag catchment are intended during the operational phase. Necessary drainage infrastructure around the base of Turbine 1 and associated hardstanding, to capture and divert water from the infrastructure away from the watercourse, would remain in place throughout the operational phase.

8.6.61 The receptor, Aultguish Inn surface water intake, is considered to be of **High** sensitivity. The magnitude of effect is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

8.6.62 The effect of changes in or contamination of water supply to vulnerable receptors, including private water supplies, from operational works is assessed as **Negligible**.

Increased flood risk

8.6.63 Infrastructure drainage would remain in place during the site’s operational phase. A regular monitoring and maintenance programme for the drainage infrastructure would be implemented to ensure that it remains fully operational and in good condition. Where practicable, routine maintenance would be undertaken during dry weather, to help ensure that drainage operation during wet weather is fully functional.

8.6.64 Post-development runoff would be designed such that there is no change from natural pre-development runoff.

8.6.65 The receptors, infrastructure and property downstream of the development, are considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of any increased flood risk is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

8.6.66 The effect of increase in flood risk resulting from the operational works is assessed as **Negligible**.

Effects during decommissioning

Physical changes to overland drainage and surface water flows

8.6.67 Decommissioning would require removal of all above-ground infrastructure associated with the wind farm site. This would include removal and reinstatement of the drainage network around the turbines and hardstanding areas as well as the trackside and cross-track drainage. Drainage associated with the currently existing section of the drover's track is anticipated to remain in place indefinitely.

8.6.68 Removal works would also include removal and reinstatement of all watercourse crossing structures. All necessary permissions associated with this work would be acquired prior to commencement of the removal process.

8.6.69 As far as is practicable, reinstatement of the site would aim to return the site to its pre-development condition.

8.6.70 The receptor, project area surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be of **Slight** magnitude. The likelihood of effect is considered to be **Likely**.

8.6.71 The effect of physical changes to overland drainage from decommissioning works is assessed as **Minor**, long-term and beneficial.

Particulates and suspended solids

8.6.72 Works to remove turbine foundations to 0.5 m below ground surface, hardstanding areas and access tracks would involve excavation and earthmoving activities and would generate loose sediment and potentially concrete dust. This material could potentially gain access to surface watercourses and waterbodies through entrainment in surface runoff. This could potentially have an adverse effect on the downstream watercourses through damage to fish spawning habitat, reduction in dissolved oxygen levels, changes to nutrient levels and natural pH of the watercourses and waterbodies.

8.6.73 Site drainage infrastructure would be retained in situ until the excavation and earthmoving activities are complete, in order to retain as much control over water movement as possible during this phase of work. Where necessary additional bunding and cut-off drains would be put in place to divert water around and away from excavations.

8.6.74 Silt control measures, such as silt fencing and straw bales, would be used to manage silty runoff from excavation works relating to turbines, hardstanding areas and tracks. These measures would be located such that any silty water arising from the works is captured and managed to prevent inadvertent discharge of silty water into any site watercourse.

8.6.75 All excavation activity adjacent to watercourses would have appropriate sediment control measures established prior to groundworks beginning. Where possible, vegetation cover would be retained between earthworks areas and any watercourse or waterbody to provide additional protection. Limited in-stream works to remove culverts from minor watercourses and drainage channels will be undertaken using temporary check-dams.

8.6.76 For areas of larger excavation, such as turbine foundations and crane pads, temporary water control measures may be used. These may include use of temporary settlement ponds or the use of proprietary treatment systems such as Siltbusters, as appropriate.

8.6.77 Decommissioning activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse, to minimise mobilisation of sediment in heavy rainfall. Recommended 'stop' conditions are provided in Table 8.8. Any water collecting within excavations would be pumped out prior to further work in the excavation. This water may require treatment to remove suspended solids prior to discharge to ground.

8.6.78 Vegetation cover would be re-established as quickly as possible on decommissioned areas by use of any excavated peat acrotelm material, use of hydroseeding and/or use of a biodegradeable geotextile as appropriate to help maintain slope stability and provide erosion protection whilst vegetation cover becomes re-established.

8.6.79 Shallow drainage infrastructure around turbines, hardstandings and access tracks would be removed and remaining ditches or trenches would be backfilled with suitable soil or peat material. For drainage trenches on sloping ground, temporary check dams constructed from untreated wood planks would be placed periodically to prevent reinstated soil and peat from washing away down the channel.

8.6.80 Should there be a requirement for permissions relating to decommissioning activity, all necessary documentation would be put in place prior to works commencing. This may require revised and updated pollution prevention plans or similar documents as necessary.

8.6.81 The receptor, project area surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

8.6.82 The effect of particulates and suspended solids from decommissioning works is assessed as **Minor**, temporary and adverse.

Water contamination from fuels, oils or foul drainage

8.6.83 The risk of water contamination from fuels or oils is somewhat lower during decommissioning than during construction as activity on site would different. Notably, there would be no wet concrete present on site, although fuels and oils would remain present through decommissioning operations.

8.6.84 The pollution prevention plan and site spillage and emergency procedures, as set out above, would remain in force throughout the decommissioning phase.

8.6.85 The site welfare facilities for decommissioning would include a suitably sized holding tank, which would be emptied by tanker and removed from site on an appropriate timescale for disposal at a suitably licensed facility.

8.6.86 The receptor, project area surface watercourses, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

8.6.87 The effect of water contamination from fuels, oils or foul drainage from decommissioning works is assessed as **Negligible**.

Changes in or contamination of water supply to vulnerable receptors

8.6.88 Works for removal of Turbine 1 and its associated foundation and hardstanding would be required to take place within the Allt Giubhais Beag catchment. Prior to the work beginning, the existing drainage infrastructure around the turbine would be checked to ensure its continued effective operation during decommissioning works.

8.6.89 The mitigation measures and monitoring programme set out in Paragraph 8.6.38 would be implemented during decommissioning.

8.6.90 The receptor, Aultguish Inn surface water intake, is considered to be of **High** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

8.6.91 The effect of changes in or contamination of water supply to vulnerable receptors, notably private water supplies, from decommissioning works is assessed as **Minor**, temporary and adverse.

Increased flood risk

8.6.92 Infrastructure drainage would remain in place throughout most of the decommissioning works and would be part of the last remaining infrastructure to be removed. Drainage infrastructure would be fully reinstated to as close to pre-construction natural conditions as is practicable.

8.6.93 Vegetation cover would be encouraged to re-establish through use of peat acrotelm turf where available, with use of hydroseeding and/or biodegradeable geotextile to promote vegetation growth in other areas as appropriate. Vegetation would be retained across as much of the site as is practicable, in order to control surface runoff rates and flow concentration.

8.6.94 Larger areas of bare ground, such as compound areas, former hardstandings and borrow pits, would have settlement ponds put in place to attenuate flow until vegetation can be re-established as part of the decommissioning and reinstatement programme.

8.6.95 The receptors, infrastructure and property downstream of the development, are considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of any increased flood risk is considered to be **Negligible**. The likelihood of effect is considered to be **Unlikely**.

8.6.96 The effect of increase in flood risk resulting from the construction works is assessed as **Negligible**.

Indirect and secondary effects

8.6.97 No indirect or secondary effects relating to the site hydrology have been identified.

Cumulative effects

8.6.98 One development in the nearby area has been identified as requiring consideration for cumulative effects. This is the proposed Lochluichart Wind Farm Extension II, currently in scoping.

8.6.99 Lochluichart Extension II is proposed for the area immediately north of the existing Lochluichart Extension I and north-west of the existing Corriemoillie Wind Farms. It is approximately 1.5 km from the proposed Kirkan Wind Farm boundary. The whole development proposal lies within the Glascarnoch/Black Water catchment, upstream of Kirkan Wind Farm.

8.6.100 Current proposals for the Lochluichart Extension II Wind Farm indicate that a small part of the extension are located within the Allt Giubhais Beag catchment area, comprising one turbine and a short section of access track. Approximately half of the footprint of Kirkan's Turbine 1 and associated hardstanding are also located within this catchment area.

8.6.101 The effects on hydrology are considered to be additive rather than synergistic.

Potential cumulative effects during construction

8.6.102 It is assumed that best practice construction methods would be used for the Lochluichart Extension II Wind Farm.

8.6.103 The footprint of works for both Kirkan and Lochluichart Extension II that lie within the Allt Giubhais Beag catchment is very small and in both cases is set over 100 m from the nearest watercourse. Although construction work for both developments may be undertaken in parallel, given the very small footprint of works within the Allt Giubhais Beag catchment for both developments it is considered unlikely that these two sections of two larger developments would be occurring simultaneously. Assuming that appropriate sediment management controls are used at both developments, cumulative effects on the private water supply intake are considered to be **Minor**, temporary and adverse.

Potential cumulative effects during operation

8.6.104 Operational activity at both Kirkan Wind Farm and neighbouring wind farms Corriemoillie, Lochluichart, Lochluichart Extension I and Lochluichart Extension II, would be very much reduced from the construction phase. The proposed footprint for both Kirkan and Lochluichart Extension II within the Allt Guibhais Beag catchment is very small. A short section (approximately 600 m) of the access route to Lochluichart, Lochluichart Extension I and Corriemoillie passes through the western corner of the catchment. Approximately half of the operational Corriemoillie Wind Farm is located within this watercourse catchment. Assuming that operation-phase monitoring and maintenance for all the wind farms are undertaken in line with best practice, the cumulative effects on the watercourse would be **Negligible**.

Potential cumulative effects during decommissioning

8.6.105 Decommissioning works within the shared watercourse catchment for Kirkan Wind Farm and Lochluichart Extension II would remain small in footprint, as for construction works. Cumulative effects, including changes to flow, particulates and suspended solids and water contamination, are considered to be **Minor**, temporary and adverse.

Mitigation

8.6.106 Whilst outlined and accounted for within the assessment above, this section provides a detailed summary of the mitigation that will be adopted for the proposed development in relation to hydrology.

8.6.107 All long-term and temporary drainage infrastructure would be established on a running-basis ahead of excavation works. This includes temporary bunding and cut-off drains around turbine bases, hardstanding areas and borrow pits. Where possible, trackside drainage would laid up to 100 m ahead of track construction works on a running basis.

8.6.108 All installed ‘hard’ infrastructure, including hardstanding areas and borrow pit excavations, would be designed and constructed with a slight gradient to encourage drainage into a filter drain or settlement pond, to allow infiltration into vegetated areas and as shallow through-flow into soils where appropriate.

8.6.109 Trackside drainage would be no longer or deeper than necessary to provide the required track drainage.

8.6.110 Cross-drains under tracks would be installed at an appropriate frequency to mimic natural drainage patterns and to minimise concentration of flows.

8.6.111 All drainage infrastructure would be designed with a capacity suitable for a rainfall intensity of a 1-in-200 year storm event plus allowance for climate change.

8.6.112 All required licences for watercourse crossings and construction site works would be in place prior to works on site beginning.

8.6.113 Silt fencing or appropriate alternative sediment control protection would be installed on the downhill side of excavations to prevent inadvertent discharge of silty water into or towards any site watercourse.

8.6.114 All engineering works adjacent to watercourses, including access tracks and watercourse crossing structures, would have appropriate sediment control measures established prior to any groundworks.

8.6.115 Vegetation would be retained along watercourse banks to act as additional protection to the watercourses.

8.6.116 Temporary water control measures would be implemented as necessary adjacent to areas of larger excavation. These would include borrow pit sites and may also include turbine base excavations and hardstanding areas. These measures would take the form of temporary settlement ponds, filter drains or proprietary treatment measures such as Silt Busters. Detail would be provided within the Pollution Prevention Plan(s) required for the Construction Site Licence and suitability would be determined following appropriate on-site soil tests.

8.6.117 All earthmoving activity would be restricted during periods of wet weather, particularly for work occurring within 20 m of a watercourse or within areas of peat deeper than 1.5 m, to minimise mobilisation of sediment in heavy rainfall. The ‘stop’ conditions provided in Table 8.8 are recommended to guide all earthmoving activity at all stages of the project.

8.6.118 Any water collecting within excavations would be pumped out prior to further work within the excavation. The water is likely to require treatment to remove suspended solids prior to discharge to ground.

8.6.119 Vegetation cover would be re-established as quickly as possible on all areas of stripped ground, once activity involving these areas is complete. This would include track verges, screening bunds, cut slopes and much of the site during decommissioning and restoration works. Where possible this would be achieved using excavated peat acrotelm. Additional measures including hydroseeding and/or use of a biodegradable geotextile would be considered if insufficient peat turf is available and for areas of particular sensitivity that require immediate protection.

8.6.120 Oil and fuel storage and handling on site would be undertaken in compliance with SEPA’s Guidance on Pollution Prevention 2 – Above ground oil storage tanks and with the Water Environment (Oil Storage) (Scotland) Regulations 2006.

8.6.121 Risk assessments would be undertaken and all Hazardous Substances and Non-Hazardous Pollutants that would be used and/or stored on site would be identified. Hazardous substances likely to be on site include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be used on site. Herbicides would not be used.

8.6.122 All deliveries of oils and fuels would be supervised.

8.6.123 All storage tanks would be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank's capacity. For areas containing more than one tank, the bund would be sufficient to contain 110% of the largest tank's capacity or 25% of the total capacity, whichever is the greater.

8.6.124 Any valve, filter, sight gauge, vent pipe or other ancillary equipment would be located within the containment area.

8.6.125 Waste oil would not be stored on site but would be removed to dedicated storage or disposal facilities.

8.6.126 Management procedures and physical measures would be put in place to deal with spillages, such as spill kits and booms.

8.6.127 Maintenance procedures and checks would ensure the minimisation of leakage of fuels or oils from plant.

8.6.128 Refuelling and servicing would be undertaken in a designated area or location with adequate precautions in place, such as a dedicated impermeable surface with lipped edgess to contain any contaminants.

8.6.129 Where vehicle maintenance is necessary in the field, owing to breakdown, additional precautions would be taken to contain contaminants, such as spill trays or absorbent mattresses.

8.6.130 The access track would be designed and constructed to promote good visibility where possible and two-way access where visibility is restricted, to minimise risk of vehicle collisions.

8.6.131 If required, concrete batching would take place in one designated location within the site construction compound. This location would be at least 250 m from the nearest watercourse. Protective bunding would be installed around the batching area to ensure that contaminated runoff is coontained. Dedicated drainage would be installed to ensure that water from the batching area can be suitably treated to reduce alkalinity and suspended sediment load prior to discharge, or removed from site by tanker for treatment and disposal offsite.

8.6.132 Site welfare facilities would include a suitably sized holding tank, which would be emptied by tanker and removed from site on an appropriate timescale for disposal at a suitably licensed facility.

8.6.133 The Site Spillage and Emergency Procedures would be prominently displayed at the site and staff would be trained in their application. The Procedures document would incorporate guidance from the relevant SEPA Guidance Notes.

8.6.134 In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water environment, all necessary measures would be taken to remedy the situation. These measures would include:

- Identifying and stopping the source of the spillage;
- Containing the spillage to prevent it spreading or entering watercourses by means of suitable material and equipment;
- Absorbent materials, including materials capable of absorbing oils, would be available on site to mop up spillages. These would be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials.

Sand bags would also be readily available for use to prevent spread of spillages and create dams if appropriate.

- Where an oil/fuel spillage may have soaked into the ground, the contaminated ground would be excavated and removed from site by a licensed waste carrier to a suitable landfill facility.
- The emergency contact telephone number of a specialist oil pollution control company would be displayed on site; and
- Sub-contractors would be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the site.

8.6.135 SEPA would be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident would be forwarded to SEPA no later than 14 days after the incident.

8.6.136 All works within the Allt Giubhais Beag catchment (Turbine 1 and ancillary infrastructure) would have the following mitigation applied, during both construction and decommissioning activity:

- No excavation works would begin until cut-off drains and sediment protection (silt fencing and/or pegged straw bales, as appropriate) have been installed between the turbine base and hardstanding area and the direct flow paths towards the Allt Giubhais Beag. These would require sign-off by the Environmental Clerk of Works prior to ground works beginning.
- Visual monitoring of the watercourse at its closest point downstream of the ground works and at the intake location would be undertaken on a twice-daily basis whilst works are ongoing at Turbine 1. Any signs of siltation of suspended sediment in the water would be recorded and reported to the Environmental Clerk of Works for appropriate follow-up.
- In-situ water quality monitoring would be undertaken as required, determined by the Environmental Clerk of Works.
- No maintenance of refuelling activities would take place within the watercourse catchment.
- Sediment protection measures would remain in place, with regular checks to ensure their continued effective operation, until all ground works are completed at Turbine 1 and vegetation has re-established on exposed soil areas.
- Should any concerns be raised that may be related to the wind farm works, ongoing activity at Turbine 1 would be restricted if possible to allow further investigation to be undertaken to identify the cause of the concerns and their validity. Works would remain restricted until the investigation has demonstrated that it was a false alarm and/or not related to the wind farm works, or until additional protection measures are installed to prevent a recurrence, to the Environmental Clerk of Works' satisfaction.
- Some activities, such as pouring of concrete, cannot be stopped prior to completion. If required, an alternative source of water, such as a water bowser, could be provided to the Aultguish Inn as contingency during such activities.

8.6.137 Long-term drainage infrastructure would have a monitoring and maintenance programme established, to include regular visual inspection of drainage infrastructure to check for blockages, debris or damage that may impede flow. Remediation would be undertaken immediately. Routine maintenance would be scheduled where possible for dry weather.

8.6.138 Tracks and hardstanding areas would be monitored on a regular basis, particularly following periods of heavy or prolonged rainfall or after snow clearance. Any sections of track or hardstanding showing signs of excessive wear would be repaired as necessary with suitable rock from the borrow pit or external sources.

8.6.139 All bridge structures would have appropriate splash control measures as part of their design, to prevent silty water splashing into the watercourse from vehicle movements. The splash controls would be monitored regularly to ensure they remain effective and have not become damaged in any way.

Water quality monitoring

8.6.140 A water quality monitoring programme would be established. Details would be agreed with SEPA but are anticipated to include at least the following:

- Visual checks for entrained sediment;
- *In situ* measurements of pH, temperature, specific conductivity.

8.6.141 *In situ* measurement of turbidity and dissolved oxygen may be recommended for locations with particular sensitivity, such as near private water supply intakes or locations with sensitive fish populations.

8.6.142 Pre-construction monitoring would be undertaken on a monthly basis for a period of at least four months prior to any work taking place within the project area.

8.6.143 During construction, the monitoring would be undertaken by the Environmental Clerk of Works or suitably experienced alternative individual. Any change from baseline conditions of pH and/or specific conductivity would potentially indicate an incident and additional investigation would be required in order to identify the origin of the change. Control locations (WQ1, 4, 6 and 8) are intended to help differentiate between incidents arising within the project area and incidents that are unrelated to the project. For example, a cloudburst upstream of the project area may cause changes to turbidity, pH, temperature and specific conductivity by a natural rise in entrained sediment levels.

8.6.144 Recommended frequency of monitoring for the different locations are provided in Table 8.10 below. Monitoring locations are shown in Figure 8.5.

Table 8.10 Water quality monitoring locations and recommended monitoring frequency by phase of development

<table>
<tr><th>ID</th><th>Location</th><th>Monitoring schedule</th></tr>
<tr><td>WQ1</td><td>Allt Giubhais Beag, upstream of T01 (control)</td><td rowspan="3">Baseline: Monthly, min. 4 months
Construction:Twice daily during all construction work at T01; otherwise monthly
Operation: Quarterly
Decommissioning:Twice daily during all decommissioning work at T01; otherwise monthly</td></tr>
<tr><td>WQ2</td><td>Allt Giubhais Beag, immediately downstream of T01</td></tr>
<tr><td>WQ3</td><td>Allt Giubhais Beag, at Aultguish Inn PWS intake</td></tr>
<tr><td>WQ4</td><td>Allt Glac an t-Sìthein, upstream of WC02 (control)</td><td>Baseline: Monthly, min. 4 months</td></tr>
</table>

<table>
<tr><th>ID</th><th>Location</th><th>Monitoring schedule</th></tr>
<tr><td>WQ5</td><td>Allt Glac an t-Sìthein, downstream of Drover's Track</td><td>Construction: Weekly once track construction diverges from Drovers' track
Operation: Quarterly
Decommissioning: Weekly</td></tr>
<tr><td>WQ6</td><td>Allt Bad an t-Seabhaig, upstream of T07/T11 (control)</td><td rowspan="2">Baseline: Monthly, min. 4 months
Construction: Weekly once track construction diverges from Drovers' track
Operation: Quarterly
Decommissioning: Weekly</td></tr>
<tr><td>WQ7</td><td>Allt Bad an t-Seabhaig, downstream of Drover's Track</td></tr>
<tr><td>WQ8</td><td>Glascarnoch River, between dam and Aultguish Inn (control)</td><td rowspan="3">Baseline: Monthly, min. 4 months
Construction: Weekly
Operation: Quarterly
Decommissioning: Weekly</td></tr>
<tr><td>WQ9</td><td>Glascarnoch River, opposite site entrance</td></tr>
<tr><td>WQ10</td><td>Black Water, downstream of Allt Bad an t-Seabhaig confluence</td></tr>
<tr><td>WQ11</td><td>Immediately downstream of watercourse crossing WC01</td><td rowspan="4">Baseline: No checks required.
Construction: Twice daily checks when watercourse crossing construction works are in progress.
Operation: Visual checks as part of routine track maintenance schedule.
Decommissioning: Twice daily checks when crossing decommissioning works are in progress.</td></tr>
<tr><td>WQ12</td><td>Immediately downstream of watercourse crossing WC02</td></tr>
<tr><td>WQ13</td><td>Immediately downstream of watercourse crossing WC03</td></tr>
<tr><td>WQ14</td><td>Immediately downstream of watercourse crossing WC04</td></tr>
</table>

Sediment control and drainage monitoring

8.6.145 Routine monitoring checks of project infrastructure, including track and hardstanding surfaces and all drainage infrastructure, would be undertaken on a quarterly basis throughout project operation. Monitoring would involve visiting all aspects of the infrastructure and undertaking a visual inspection to identify the following:

- areas where track surfaces or hardstanding areas were showing evidence of erosion or surface damage;
- any areas where surface water was ponding or collecting on tracks or hardstanding areas;
- any areas where drainage infrastructure was damaged, blocked or inadequate.

8.6.146 Any areas of track or hardstanding surface showing signs of damage, erosion or excessive wear would be repaired as necessary. Drainage features would be repaired, reinstated or replaced as necessary to ensure continued efficient operation.

8.7 Summary of effects

8.7.1 This assessment is based on a site-specific risk assessment method following recommended environmental impact assessment techniques. Potential effects, both positive and negative, long-term or temporary, adverse or beneficial, to the hydrological regime have been considered. These effects are summarised in Table 8.11.

Table 8.11 Summary of effects

Effect	Phase	Assessment consequence	Effect significance
Physical changes to overland drainage and surface water flows	Construction	Minor, long-term, adverse	Not Significant
	Operation	Negligible	Not Significant
	Decommissioning	Minor, long-term, beneficial	Not Significant
Particulates and suspended solids	Construction	Minor, temporary, adverse	Not significant
	Operation	Minor, temporary, adverse	Not significant
	Decommissioning	Minor, temporary, adverse	Not significant
Water contamination from fuels, oils, concrete batching and foul drainage	Construction	Minor, temporary, adverse	Not Significant
	Operation	Negligible	Not Significant
	Decommissioning	Negligible	Not Significant
Changes in or contamination of water supply to vulnerable receptors	Construction	Minor, temporary, adverse	Not Significant
	Operation	Negligible	Not Significant
	Decommissioning	Minor, temporary, adverse	Not significant
Increased flood risk	Construction	Negligible	Not Significant
	Operation	Negligible	Not Significant
	Decommissioning	Negligible	Not Significant

8.8 References

CEH (2018). Flood Estimation Handbook Web Service. Centre for Ecology and Hydrology. https://fehweb.ceh.ac.uk/ (subscription service), accessed July 2018.

CH2M & Fairhurst (2018). Outline Peat Management Plan. Appendix 10.6, A9 Dualling – Dalwhinnie to Crubenmore, DMRB Stage 3 Environmental Impact Assessment. https://www.transport.gov.scot/media/41104/appendix-a106-outline-peat-management-plan.pdf, accessed January 2019.

Met. Office (2018). UK Climate. https://www.metoffice.gov.uk/public/weather/climate, accessed July 2018.

SEPA (2018a). Water Classification Hub. Scottish Environment Protection Agency. https://www.sepa.org.uk/data-visualisation/water-classification-hub/, accessed September 2018.

SEPA (2018b). Water Environment Hub. Scottish Environment Protection Agency. https://www.sepa.org.uk/data-visualisation/water-environment-hub/, accessed September 2018.

SEPA (2018c). Flood Map. Scottish Environment Protection Agency. http://map.sepa.org.uk/floodmap/map.htm, accessed September 2018.

SNH (2018). SiteLink. Scottish Natural Heritage. https://sitelink.nature.scot/home, accessed September 2018.

SNH/HES (2018). Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland [v5]. Scottish Natural Heritage & Historic Environment Scotland. Available at: https://www.nature.scot/handbook-environmental-impact-assessment-guidance-competent-authorities-consultees-and-others.

9 GEOLOGY, HYDROGEOLOGY AND PEAT

9.1 Introduction

9.1.1 This section of the Environmental Impact Assessment Report (EIAR) describes the existing geological, hydrogeological and peat conditions within the project area, and identifies and assesses the potential impacts that may be caused by the proposed development. This includes site preparation, construction works, restoration of construction works, site operation and decommissioning. Mitigation measures that may be employed to ameliorate any adverse effects are set out.

9.1.2 This chapter is supported by a number of technical appendices which provide additional in-depth information on relevant aspects of the development. These appendices are:

- Technical Appendix 9.1: Peat Slide Risk Assessment
- Technical Appendix 9.2: Groundwater-Dependent Terrestrial Ecosystems Assessment
- Technical Appendix 9.3: Borrow Pit Assessment
- Technical Appendix 9.4: Peat Management Plan

9.1.3 Key findings are summarised within this chapter.

9.2 Scope and methodology

9.2.1 The assessment is undertaken through a desk study and site inspection of existing geological, hydrogeological and peat-related features on and surrounding the project area. The existing conditions are described and potential risks that may be associated with the proposed development are identified and assessed. This includes potential risks from rock extraction to form aggregate, damage to groundwater-dependent areas and natural or induced instability in peat.

9.2.2 A number of data sources were considered in writing this chapter; the main sources are detailed below:

- Ordnance Survey topographical mapping, current and historical;
- British Geological Survey geological mapping, superficial and bedrock;
- British Geological Survey online borehole database;
- Scotland's Soils mapping; and
- Scottish Environment Protection Agency's *A functional wetland typology for Scotland.*

Effects evaluation

9.2.3 The significance of potential effects has been classified taking into account three principal factors: the **sensitivity** of the receiving environment, the potential **magnitude** of the effect and the **likelihood** of that effect occurring. This approach is based on guidance contained within the joint Scottish Natural Heritage/Historic Environment Scotland publication *Environmental Impact Assessment Handbook v5* (SNH/HES, 2018).

Receptor sensitivity

9.2.4 The sensitivity of a receptor represents its ability to absorb the anticipated effect without resulting perceptible change. Four levels of sensitivity have been used, as defined in Table 9.1.

Table 9.1 Sensitivity ratings

Sensitivity	Definition
Very high	The receptor has very limited ability to absorb change without fundamentally altering its present character, is of very high environmental value and/or is of international importance.
High	The receptor has limited ability to absorb change without significantly altering its present character, is of high environmental value and/or is of national importance.
Moderate	The receptor has moderate capacity to absorb change without significantly altering its present character, has moderate environmental value and/or is of regional importance.
Low	The receptor is tolerant of change without detriment to its present character, is of low environmental value and/or of local importance.

Effect magnitude

9.2.5 The magnitude of effects includes the timing, scale, size and duration of the potential effect. Four levels of magnitude have been used, as defined in Table 9.2.

Table 9.2 Magnitude ratings

Magnitude	Definition
Substantial	Substantial changes, over a substantial area, to key characteristics or to the geological/hydrogeological/peatland classification or status for more than 2 years.
Moderate	Noticeable but not substantial changes for more than 2 years or substantial changes for more than 6 months but less than 2 years, over a substantial area, to key characteristics or to the geological/hydrogeological/peatland classification or status.
Slight	Noticeable changes for less than 2 years, substantial changes for less than 6 months, or barely discernible changes for any length of time.
Negligible or no change	Any change would be negligible, unnoticeable or there are no predicted changes.

Likelihood of effect

9.2.6 The likelihood of an effect occurring is evaluated to three levels: **unlikely**, **possible** or **likely**.

Effects significance

9.2.7 The findings in relation to the three criteria discussed above have been brought together to provide an assessment of significance for each potential effect (Table 9.3). Potential effects are concluded to be of **major**, **moderate**, **minor** or **negligible** significance. Potential effects are assessed taking into account the proposed mitigation measures.

The assessment concludes with a review of various effects to determine if they would be significant in terms of the *Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017*. Effects assessed as **major** or **moderate** are deemed to be significant; those assessed as **minor** or **negligible** are deemed to be not significant.

Table 9.3 Effects significance matrix

Sensitivity	Magnitude	Likelihood	Significance
Very High	Substantial	Likely	Major
		Possible	Major
		Unlikely	Moderate
	Moderate	Likely	Major
		Possible	Moderate
		Unlikely	Moderate
	Slight	Likely	Moderate
		Possible	Minor
		Unlikely	Minor
	Negligible/no change	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
High	Substantial	Likely	Major
		Possible	Major
		Unlikely	Moderate
	Moderate	Likely	Moderate
		Possible	Moderate
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor
		Unlikely	Minor
	Negligible/no change	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
Moderate	Substantial	Likely	Major
		Possible	Moderate
		Unlikely	Minor
	Moderate	Likely	Moderate
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Minor

Sensitivity	Magnitude	Likelihood	Significance
		Unlikely	Negligible
	Negligible/no change	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible
Low	Substantial	Likely	Moderate
		Possible	Minor
		Unlikely	Negligible
	Moderate	Likely	Minor
		Possible	Minor
		Unlikely	Minor
	Slight	Likely	Minor
		Possible	Negligible
		Unlikely	Negligible
	Negligible/no change	Likely	Negligible
		Possible	Negligible
		Unlikely	Negligible

Limitations and uncertainties

9.2.8 The site visit followed a standard ‘reconnaissance level’ walkover survey to obtain an overview of the project area conditions at the time of the visit. The information gathered has been combined with information from site visits for other disciplines, including surveys to map peat depths and vegetation classes, and available photography to give as full a picture of the project area conditions as possible.

9.2.9 The reconnaissance survey was undertaken on the 2nd, 3rd and 4th August 2018 following a prolonged dry period. It is likely that some site notes and photographs may not be representative of normal conditions, particularly in relation to the peat as the water content is likely to have been lower than normal for the time of year. Subsequent peat survey visits were undertaken in October and November 2018, during wetter conditions, which have helped to provide a better understanding of normal conditions for the region.

9.3 Consultation undertaken

9.3.1 Consultation was undertaken with a number of statutory and non-statutory consultees and interested parties, including the Scottish Government, The Highland Council, Scottish Environment Protection Agency, Scottish Natural Heritage, Scottish Water and local stakeholders. Responses with relevance to geology, hydrogeology and peat are provided in

9.3.2

9.3.3 Table 9.4

Table 9.4 Consultee responses relevant to geology, hydrogeology and peat

Name of Stakeholder/ Consultee	Key concerns	Response
The Highland Council	Note specific issues relating to the water environment, Groundwater Dependent Terrestrial Ecosystems (GWDTEs) and peat as raised by SEPA.	Please see details against SEPA's comments below.
Scottish Environment Protection Agency (SEPA)	The following information must be submitted in support of the application:	
	Map and assessment of impacts upon GWDTEs and buffers.	Please see Technical Appendix 9.2 for full assessment.
	Map and assessment of impacts upon groundwater abstractions and buffers.	Please see Chapter 8 for Private Water Supply assessment
	Peat depth survey and table detailing re-use proposals.	Please see Technical Appendices 9.1 and 9.4 for details
	Map and site layout of borrow pits, including details of any investigations and testing undertaken in order to ensure suitable grades and quantities of material will be available.	Please see Technical Appendix 9.3 for details.
	Site access options appraisal with alternative routes, overlain on peat and NVC mapping.	Detail of the site access options appraisal undertaken are provided in Section 2.6 above
	As much of the site is on peat, we would expect the layout to be designed to minimise the disturbance of peat and be supported by a full site-specific Peat Management Plan.	Please see Section 2.6 for design iterations and Technical Appendix 9.4 for the Peat Management Plan
	We note that an NVC Survey has already been undertaken. Much of the site is likely to be peatland and/or wetland and we will expect the layout to avoid Groundwater Dependent Terrestrial Ecosystems.	Please see Technical Appendix 9.2 for the GWDTE Assessment.
	SEPA is happy to provide advice on: engineering activities which may have adverse effects on the water environment; disturbance and reuse of excavated peat and other carbon-rich soils; disruption to GWDTE; existing groundwater abstractions; borrow pits.	
Scottish Natural Heritage (SNH)	Assessment of the impact on peat should be made, demonstrating that a wind farm can be built on the site without significant loss and damage. Mitigation measures are required.	Please see Technical Appendices 9.1 and 9.4 for details relating to peat, and relevant mitigation.

Name of Stakeholder/ Consultee	Key concerns	Response
	Groundwater Dependent Terrestrial Ecosystems (GWDTE) should be identified.	
Cromarty Firth District Salmon Fishery Board	The Board is concerned regarding potential impacts on habitats downstream of the development, including disturbance of deep peat. The Board would like to see mitigations put in place and a monitoring programme established to check their effectiveness.	

9.4 Statutory and planning context

9.4.1 In preparing this section of the EIAR, consideration has been given to relevant planning guidance at all levels. This includes, but is not limited to, the following:

- The European Water Framework Directive (2000/60/EC) and associated daughter Directives including the Groundwater Daughter Directive (Protection of Groundwater Against Pollution, 2006/118/EC);
- The European Mining Waste Directive (2006/21/EC);
- The Environmental Protection Act 1990 (as amended);
- The Water Environment and Water Services (Scotland) Act 2003;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended;
- The Pollution Prevention and Control (Scotland) Regulations 2012;
- The Water Environment (Oil Storage) (Scotland) Regulations 2006;
- Scottish Planning Policy 2014, with particular respect to the section on the Low Carbon Economy;
- Scottish Government's Planning Advice Note 51: planning, environmental protection and regulation;
- SEPA's Position Statement WAT-PS-10-01: Assigning Groundwater Assessment Criteria for Pollutant Inputs;
- SEPA's Guidance for Pollution Prevention, with particular reference to:
- PPG 1: Understanding your environmental responsibilities – good environmental practice;
- PPG 6: Working at construction and demolition sites.

9.5 Existing environment

Geology

9.5.1 Geological information is derived from the BGS GeoIndex online geological mapping (BGS, 2018) and the Ben Wyvis Geological Map (BGS, 2004) with supporting information from Trewin (2002) and Johnstone and Mykura (1989).

Bedrock geology

9.5.2 The bedrock in the Kirkan area is largely Pre-Cambrian in age. The western part belongs to the Crom Psammite Formation, part of the Moine Supergroup. This is described as a well-bedded, flaggy to massive, white to pale grey or buff psammite. The lower sections include garnet-bearing semipelite bands and the upper part is locally pebbly.

9.5.3 The eastern part of the project area is underlain by the Inchbae augen gneiss, a granitic gneiss forming part of the Carn Chuinneag Complex. This distinctive rock is described as a coarse biotite-granite gneiss with abundant feldspar augen (‘eyes’).

9.5.4 A small area around Beinn nan Cabag, in the south of the project area, is underlain by the Ousdale Arkose Formation, part of the Devonian-age Old Red Sandstone system. The rock is described as a red feldspar-rich conglomerate.

9.5.5 A major regional fault, the Strathconon Fault, runs through the project area access from just west of Beinn nan Cabag to Black Bridge (BGS, 2018; Johnstone and Mykura, 1989). There are no records of recent or historical activity along the fault within the project area and immediate surroundings (BGS, 2019).

Superficial geology

9.5.6 Much of the project area is overlain by a blanket of glacial deposits, described as diamicton, gravel, sand and silt. Diamicton is a very variable glacial sediment consisting of unsorted material ranging in size from clay to boulders, usually with a matrix of clay to sand. It was formerly known as till or boulder clay.

9.5.7 The river valleys have deposits of alluvium, a mixture of clay, silt, sand and gravel. These are confined to the River Glascarnoch/Black Water channel and the lower reaches of the main project area watercourses and tend to be ribbon-like in form.

9.5.8 The south-western part of the project area is shown to have peat deposits. These extend from the upper reaches of Allt Giubhais Beag, skirting the western and southern slopes of Sìthean nan Cearc, to the upper reaches of Allt Bad an t-Seabhaig. Some outlying areas are indicated along the Allt Glac an t-Sìthein.

Soils

9.5.9 The Soil Survey of Scotland digital soils mapping shows eight soil types within the project area. Details are provided in Table 9.5.

9.5.10 The Soil Survey mapping does not identify extensive blanket peat within the project area, although almost all the project area soils are noted to include peat or peaty components. Several phases of peat depth surveying have been undertaken, by Quadrat Scotland Ltd, Avian Ecology Ltd and RSKW Ltd, and details are provided in Technical Appendix 9.1.

9.5.11 The peat depth survey confirms that peat is present in the area and has fairly extensive coverage. Much of the peat is shallow, although some areas of deeper peat are present. These areas are typically well-defined and usually form small basins between the hill crests and around the headwater areas of the watercourses.

Table 9.5 Soil types within the project area

Soil Assoc.	Parent Material	Component Soils	Landforms	Vegetation	Area %
Countess-wells	Drifts derived from granites	Peaty gleys, peat; some peaty podzols	Hills and undulating lowlands with gentle and	Bog and northern bog heather moor; blanket and northern blanket bog; moist	41.1%

Soil Assoc.	Parent Material	Component Soils	Landforms	Vegetation	Area %
	and granitic rocks	and peaty rankers	strong slopes; moderately rocky	Atlantic heather moor	
		Peaty podzols, peat, peaty gleys	Hummocky valley and slope moraines, often bouldery	Moist Atlantic heather moor; blanket bog; bog heather moor	23.2%
		Peaty gleys, peat; some peaty podzols	Undulating uplands and hills with gentle and strong slopes; non- and slightly rocky	Bog and northern bog heather moor; blanket and northern blanket bog; moist Atlantic heather moor	9.4%
Hatton	Drifts derived from Middle & Lower Old Red Sandstone conglomerates	Peaty and humous-iron podzols; some rankers and peaty gleys	Hills and valley sides with strong and steep slopes; moderately rocky	Dry and moist Atlantic heather moor; acid bent-fescue grassland	9.3%
Organic	Organic deposits	Blanket peat	Uplands and northern lowlandswith gentle and strong slopes	Blanket and northern blanket bog; upland and flying bent bog; deer-grass bog; sedge mires	8.0%
Arkaig	Drifts derived from schists, gneisses, granulites and quartzites, principally of the Moine Series	Peat, peaty gleys, peaty podzols	Undulating lowlands and uplands, with gentle and strong slopes; non-rocky	Bog and northern bog heather moor; blanket and northern blanket bog; moist Atlantic heather moor	4.9%
		Peaty podzols, peat, peaty gleys	Hummocky valley and slope moraines, often bouldery	Bog and northern bog heather moor; blanket and northern blanket bog; moist Atlantic heather moor	3.4%
		Peaty gleys, peat; some peaty podzols and peaty rankers	Undulating hills with gentle and strong slopes; moderately rocky	Bog and northern bog heather moor; moist Atlantic heather moor; blanket and northern blanket bog	0.8%

9.5.12 During the project area walkover, particular attention was given to the identified peat areas. No signs of instability within the peat deposits were observed at any point. There was no evidence of tension cracking or development of compression ridges within any of the peat areas.

9.5.13 A number of relatively recent shallow slope failures were apparent on the steep east-facing slope of Beinn nan Cabag, approximately 200 m from the south-western project area boundary. Although direct measurements are not available, the steepness of the slopes would suggest that these areas have no peat cover.

9.5.14 Minor evidence of peat pipe development was identified, notably within the col area between the northern end of Beinn nan Cabag and Sìthean nan Cearc. Part of the pipe had collapsed, but there were no other indications of instability within the immediate area. This section is outwith the project area.

9.5.15 Some areas of peat showed development of minor peat hagging and formation of erosion channels. These are relatively localised, with the main section within the project area present around Turbine 4.

Hydrogeology

9.5.16 The Moine psammites and granitic gneisses present in the project area are generally classed as a very low productivity aquifer. The Old Red Sandstone strata in the project area are classed as a low productivity aquifer. This means that natural groundwater flow within the project area bedrock is limited. Groundwater flow is concentrated principally within the near-surface weathered zone, which typically extends to around 1-2 m below ground surface. Groundwater storage and flow at deeper levels requires the presence of a network of fractures within the bedrock, which are infrequent and often isolated in these strata.

9.5.17 Regional groundwater flow will tend to mimic the natural topography, flowing north and east towards the Glascarnoch River/Black Water in the project area. It is likely that natural groundwater discharges will be partly via small flows to springs and streams on the hill slope and partly to the Glascarnoch River/Black Water system. A small number of minor springs were identified in the upper (south-western) part of the project area, around the outcrop of the Ousdale Arkose, which forms Beinn nan Cabag. The springs are mainly located along or slightly below the boundary between the Ousdale Arkose and the underlying Inchbae augen gneiss, indicating that the augen gneiss is effectively impermeable in areas away from significant fracturing. The springs are indicated on Figure 9.2.4 in Technical Appendix 9.2.

9.5.18 The overlying glacial deposits are also classed as a low productivity aquifer. The larger areas of alluvial and river terrace deposits along the Glascarnoch River/Black Water are indicated to be a high productivity aquifer; however, their areal extent means that their productivity would be restricted by the small area and thickness of the alluvial bodies.

9.5.19 The peat bodies will also hold some groundwater. Flow within peat is known to be extremely slow, although it can contribute some limited baseflow to local burns. The main areas of peat in the project area are located on saddle areas and will provide some input to watercourse headwaters, in particular helping to maintain flow during dry periods.

Groundwater vulnerability

9.5.20 The groundwater in the project area has been assigned vulnerability classes 3, 4a and 4b.

9.5.21 Groundwater vulnerability classes range from 1 (vulnerable only to persistent activity; very slow travel time) to 5 (vulnerable to individual events; rapid travel time). Class 4 is subdivided into a (more vulnerable) and b (less vulnerable).

9.5.22 Class 3 is defined as ‘Vulnerable to some pollutants; many others significantly attenuated’. Class 4 is defined as ‘Vulnerable to those pollutants not readily adsorbed or transformed’. 4a may have low permeability soil and is less likely to have clay present in superficial deposits; 4b is more likely to have clay present in superficial deposits.

9.5.23 The lower-vulnerability groundwater is located along the south-western part of the project area, with the vulnerability class increasing towards the north-eastern corner.

Groundwater dependent terrestrial ecosystems

9.5.24 Groundwater dependent terrestrial ecosystems (GWDTE) are defined by UKTAG (2004) as:

> *"A terrestrial ecosystem of importance at Member State level that is directly dependent on the water level in or flow of water from a groundwater body (that is, in or from the saturated zone). Such an ecosystem may also be dependent on the concentrations of substances (and potentially pollutants) within that groundwater body, but there must be a direct hydraulic connection with the groundwater body."*

9.5.25 In line with the guidance provided in UKTAG (2004), a dual approach to identifying GWDTE has been used. This involves detailed study of vegetation communities in order to determine the potential level of groundwater dependency, combined with detailed hydrogeological study in order to identify locations where groundwater reaches the surface and is able therefore to provide a source of water to associated habitats.

9.5.26 National Vegetation Classification (NVC) communities identified by SEPA as potentially highly or moderately groundwater dependent, depending on the hydrogeological setting, are listed in SEPA's publication "*Planning guidance on on-shore windfarm developments*" (SEPA, 2017). At Kirkan, the potentially groundwater dependent NVC communities identified in the project area are:

- M6 – *Carex echinata – Sphagnum recurvum/auriculatum* mire
- M15 – *Scirpus cespitosus – Erica tetralix* wet heath

9.5.27 Community M6 is described as having a high dependency on groundwater; M15 is described as having a moderate dependency on groundwater. NVC mapping for the project area is shown on Figure 6.3.

9.5.28 GWDTE have been assessed separately; details are provided in Technical Appendix 9.2.

Designated sites

9.5.29 One site designated for features relating to geology, groundwater, soils or peat is present within 5 km of the project area boundary. The site is detailed in Table 9.6.

Table 9.6 Designated sites relevant to geology, hydrogeology, soils or peat

Site Name	Qualifying Features Relating to Geology, Hydrogeology & Peat	Distance From Project Area	Linkage?
Ben Wyvis SAC, SSSI, NNR, GCR	Quaternary of Scotland; blanket bog; acidic scree	2.8 km east	None, site is geographically separated from the development

Groundwater resources

9.5.30 A number of private water supplies (PWS) are known to be present near the project area. Information provided by the Highland Council's Environmental Health Department and by local residents and property owners indicates that some of these rely on groundwater sources.

9.5.31 The PWS risk assessment is contained within Chapter 8 and all known PWS have been assessed, including supplies known or believed to be reliant on a groundwater source. PWS will not therefore be further considered within this Chapter.

9.6 Predicted impacts

Development characteristics

9.6.1 The construction phase of the proposed development would involve a number of different elements. Chapter 2 of the EIAR describes the scheme elements in detail. The elements with particular relevance to geology, hydrogeology and peat are as follows:

- Construction of access routes;
- Excavation and construction of turbine foundations and associated crane pads;
- Creation of construction compounds, laydown areas and a substation;
- Excavation of borrow pits and processing of excavated rock;
- Installation of permanent met masts;
- Installation of drainage features around permanent infrastructure; and
- Removal, handling and temporary storage of peat and soils.

9.6.2 During operation of the proposed development, activities with particular relevance to geology, hydrogeology and peat are as follows:

- Long-term drainage around permanent infrastructure;
- Additional extraction and processing of rock for necessary maintenance.

9.6.3 During decommissioning of the proposed development and restoration of the project area, activities with particular relevance to geology, hydrogeology and peat are as follows:

- Peat and soil management during decommissioning and removal of project infrastructure;
- Restoration works.

Effects during construction

Physical removal of bedrock

9.6.4 Bedrock and superficial materials would require to be removed to form turbine foundations, platforms for construction of hardstanding areas and, particularly, to facilitate development of borrow pits in order to provide aggregate for the project construction works.

9.6.5 These works would require permanent modification to the natural geology at the site. As the footprint of the works within the overall site area is small, overall changes to the geological character of the area would be limited. There are no areas designated for geological characteristics within or adjacent to the development area.

9.6.6 Rock testing would be undertaken on appropriate samples from the two borrow pit areas to determine its suitability for unbound track and hardstanding construction. This would include testing to determine likely degradation patterns during the lifespan of the development. Should the tests identify problems with parts of the rock within the borrow pit footprints, care would be taken to ensure that unsuitable material is not used for construction but would be retained for use in borrow pit restoration.

9.6.7 The project area bedrock receptor is considered to be of **Low** sensitivity. The magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

9.6.8 The effect of physical removal of bedrock from construction works is assessed as **Minor**, long-term and adverse.

Modification to groundwater flow paths

9.6.9 Physical changes to the shallow subsurface as a result of all excavation work has potential to interrupt shallow groundwater flow paths. This would include cut-and-fill track sections, turbine foundations, hardstanding areas, met masts, substation, laydown area, construction compounds and cable trenches.

9.6.10 Physical changes to the deeper subsurface (>5 m below ground surface) has potential to interrupt deeper groundwater flow paths. This would include borrow pit excavations and some turbine foundation areas.

9.6.11 Although the bedrock and superficial deposits at the site are noted to be largely without groundwater, there remains the possibility that groundwater flow is present within open fractures and fracture networks in the uppermost few metres.

9.6.12 Groundwater monitoring boreholes would be established within the two borrow pit areas prior to any construction work beginning, to a depth at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken to determine whether groundwater is present within the borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit area would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing.

9.6.13 Spring points were identified along the east-facing slope of Beinn nan Cabag. These were all within the Ousdale Arkose bedrock outcrop, in some cases close to the boundary with the Inchbae augen gneiss and in others at the foot of the very steep east-facing slope of Beinn nan Cabag. No other evidence of groundwater presence was observed, whether within the Inchbae augen gneiss, the Crom Psammite or within the glacial deposits where exposed.

9.6.14 The only construction within the footprint of the Ousdale Arkose bedrock is the area of Turbine 1, its associated hardstanding and the access track link to these infrastructure elements. The nature of the ground conditions is such that excavation work would be very limited in volume and footprint.

9.6.15 The introduction of hard engineered surfaces would have some effect on local rainfall recharge in the immediate area. Long-term drainage infrastructure within this area would take the form of shallow filter drains, in order to promote recharge to the bedrock around the infrastructure footprint.

9.6.16 Excavation of cable trenches could lead to groundwater flow between catchments if the trenches act as preferential flow paths. This can be avoided by laying cables in disturbed ground adjacent to access tracks. In areas where cable routes cross up or down steep slopes, clay bunds or alternative impermeable barrier would be placed for every 0.5 m change in elevation along the length of the trench to minimise in-trench groundwater flow.

9.6.17 The project area groundwater receptor is considered to be of **Moderate** sensitivity. With appropriate design constraints and mitigation measures in place, as described, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

9.6.18 The effect of modification to groundwater flow paths from construction works is assessed as **Minor**, long-term and adverse.

Changes in water supply to vulnerable groundwater receptors

9.6.19 Vulnerable groundwater receptors that have the potential to be affected by project works have been identified. These include a number of private water supplies (PWS) and groundwater-dependent wetland habitats. All the PWS within the area have been assessed in detail in Chapter 8 and will not be further considered here.

9.6.20 NVC mapping of the project area indicates that there are potentially groundwater-dependent terrestrial ecosystems (GWDTE) present within the project area. These have been assessed separately and details can be found in Technical Appendix 9.2. The key effects assessment findings are provided below.

9.6.21 The receptor, vulnerable groundwater receptors including GWDTE, is considered to be of **High** sensitivity. With appropriate design constraints and mitigation measures in place, as described in Technical Appendix 9.2, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Possible**.

9.6.22 The effect of changes in water supply to vulnerable groundwater receptors from construction works is considered to be **Minor**, long-term and adverse.

Soil erosion and compaction

9.6.23 Construction activity, particularly plant and vehicle movements, soil stripping and stockpiling, would affect the nature of the site soils. Plant movements would act to compact soils through movements over unstripped ground. All activity requiring removal, transport and stockpiling of soils would have potential to lead to soil erosion and loss of structure, resulting in overall soil degradation.

9.6.24 All traffic routes would be clearly demarcated and vehicles would not be permitted access outwith these areas.

9.6.25 Only tracked or low ground pressure vehicles would be permitted access to unstripped ground.

9.6.26 Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2 m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate stockpiles for separate soil types in order to preserve the soil quality.

9.6.27 For work within areas of peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging. The underlying catotelmic peat would be stored in bunds up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelmic peat has been limited by careful infrastructure design.

9.6.28 Limited smoothing or 'blading' of stockpiled soils and catotelmic peat would be undertaken to help shed rainwater and prevent ponding of water on the stockpile. Bunds on sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall.

9.6.29 Excavated soil and peat would be used in site restoration and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare soil or peat that are not required for the operational phase of the development. Some of the excavated peat would be reserved for peatland restoration in parts of the development area and in identified areas of Strathvaich Estate. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.

9.6.30 Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat bunds. This would help to maintain vegetation growth in the turves and to retain the soil structure.

9.6.31 The receptor, project area soils and peat, is considered to be of **Moderate** sensitivity. The magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Likely**.

9.6.32 The effect of soil erosion and compaction from construction works is considered to be **Minor**, temporary and adverse.

Peat instability

9.6.33 Construction activity on peatland can affect the natural stability of the peat deposits in areas near to or associated with construction works. Particular risk areas are associated with works at or near breaks in slope, areas where natural peat instability has been recorded and locations where the peat has degraded through, for example, erosion processes, drying out or overgrazing.

9.6.34 A detailed Peat Slide Risk Assessment (PSRA) has been undertaken for the Kirkan site and is provided in Technical Appendix 9.1. The key effects assessment findings are provided below.

9.6.35 The PRSA found that the majority of the project area has a negligible or low risk of natural or induced peat landslide. Two areas within the project area were identified as potentially having a moderate risk of peat instability. Both areas were appraised in greater detail, taking into account location-specific details including information gathered from the reconnaissance survey. Mitigation measures have been recommended to control the peat landslide hazard. For both areas, the peat landslide hazard can be controlled by use of good construction practice and micrositing.

9.6.36 The receptors for peat landslide hazard are the peatland habitat, the water environment including surface water and groundwater, the development infrastructure, and the construction personnel.

9.6.37 The peatland habitat, water environment and development infrastructure receptors are considered to be of **High** sensitivity. Construction personnel are considered to be a **Very High** sensitivity receptor.

9.6.38 With appropriate design constraints and mitigation measures in place, as described in Technical Appendix 9.1, the magnitude of works is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

9.6.39 For all receptors, the effect of peat instability is assessed as **Minor**, long-term and adverse.

Effects during operation

Physical removal of bedrock

9.6.40 Although most physical removal of bedrock would have occurred during construction, the ongoing requirement for track and hardstanding maintenance would require some extraction of rock from the borrow pit sites during the operational phase of the development. These operations would be very limited in nature.

9.6.41 The bedrock receptor is considered to be of **Low** sensitivity. The magnitude of the works is considered to be **Negligible**. The likelihood of effect is considered to be **Likely**.

9.6.42 The effect of physical removal of bedrock from operational works is assessed as **Negligible**.

Modification to groundwater flow paths

9.6.43 There is a minor ongoing requirement for additional rock extraction at the borrow pit sites during operation, for track and hardstanding maintenance. These operations would be very limited in nature.

9.6.44 As the augen gneiss bedrock is described as largely without groundwater, the effect of modification to groundwater flow paths from operational works is assessed as **No change**.

Changes in water supply to vulnerable receptors

9.6.45 No changes to the infrastructure are anticipated during the operational phase of works. Therefore, the effect of changes in water supply to vulnerable receptors from operational works is assessed as **No change**.

Soil erosion and compaction

9.6.46 There are no soil stripping or stockpiling activities planned for the operational phase.

9.6.47 Ongoing monitoring and maintenance work at the development would require vehicle activity on site. This would be much reduced from the construction phase and would mostly involve significantly lighter vehicles than heavy construction plant. The ongoing vehicle activity would have some effect on soil and peat compaction below access tracks, although at a significantly lower level than during construction.

9.6.48 The receptor, project area soils and peat, is considered to be of **Moderate** sensitivity. The magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Possible**.

9.6.49 The effect of soil erosion and compaction from operational works is considered to be **Minor**, temporary and adverse.

Peat instability

9.6.50 No changes to the infrastructure are anticipated during the operational phase of works. Therefore, the effect of natural or induced peat instability during the operational works is assessed as **No change**.

Effects during decommissioning

Physical removal of bedrock

9.6.51 No additional removal of bedrock is anticipated during decommissioning. Therefore, the effect of physical removal of bedrock during decommissioning is assessed as **No change**.

Modification to groundwater flow paths

9.6.52 Decommissioning of the wind farm would require removal of all hard (concrete) infrastructure to a depth of 0.5 m below ground surface. Following removal of rock layers and underlying geotextile, the substrate below track and hardstanding areas would be ripped or routed and would be covered with a sufficient depth of soil or peat to blend into the adjacent vegetated ground.

9.6.53 Borrow pit floors would be ripped or routed. Any remaining unused or unsuitable aggregate material, plus any spare rock material arising from hardstanding or track reinstatement, may be used to reinstate the borrow pits to a suitable profile, and capped with soil or turf to promote re-establishment of natural vegetation cover.

9.6.54 Subsurface electrical cables would be left in situ.

9.6.55 The receptor, project area groundwater, is considered to be of **Moderate** sensitivity. With appropriate mitigation measures in place, as described, the magnitude of the works is considered to be **Slight** and beneficial. The likelihood of effect is considered to be **Likely**.

9.6.56 The effect of modification to groundwater flow paths from decommissioning works is assessed as **Minor**, long-term and beneficial.

Changes in water supply to vulnerable groundwater receptors

9.6.57 Removal and reinstatement of infrastructure upgradient from the identified GWDTE would have potential to affect the GWDTE areas. Details of the assessment and mitigation measures are provided in Technical Appendix 9.2.

9.6.58 The receptor, vulnerable groundwater receptors including GWDTE, is considered to be of **High** sensitivity. With appropriate design constraints and mitigation measures in place, as described in Technical Appendix 9.2, the magnitude of the works is considered to be **Slight**. The likelihood of effect is considered to be **Unlikely**.

9.6.59 The effect of changes in water supply to vulnerable groundwater receptors from decommissioning works is considered to be **Minor**, long-term and adverse.

Soil erosion and compaction

9.6.60 Decommissioning activity would have a similar level of plant and vehicle movement to construction and would also involve soil stripping, ripping or routing of substrate and some stockpiling of materials. As with construction, these activities have potential to lead to soil erosion, loss of structure and soil compaction particularly under vehicle track routes.

9.6.61 Traffic routes would follow established access tracks. Decommissioning would be phased such that more distant infrastructure is removed first, in order to avoid vehicle movement across unaffected ground.

9.6.62 Soil stripping would be restricted to as small a footprint as necessary to allow the required decommissioning works. Soil and peat storage, handling and reinstatement would follow the same guidelines as provided under ‘Effects during construction’ above.

9.6.63 All areas that have been subject to heavy trafficking at any stage of the development, notably hardstandings and access tracks, would have the exposed subsurface carefully ripped to restore a more natural structure to the underlying subsoils that have been compacted over the lifetime of the development.

9.6.64 The receptor, project area soils and peat, is considered to be of **Moderate** sensitivity. The magnitude of the works is considered to be **Slight** and beneficial. The likelihood of effect is considered to be **Likely**.

9.6.65 The effect of soil erosion and compaction from decommissioning works is considered to be **Minor**, temporary and beneficial.

Peat instability

9.6.66 The risk of induced peat instability relating to decommissioning is considerably lower than during construction, as the project works would be taking place in areas already affected by construction and operation. No activity in previously unaffected peatland areas would be undertaken during decommissioning works.

9.6.67 Peatland reinstatement and restoration as part of the decommissioning works would help to improve the ground conditions for the longer term.

9.6.68 The receptors for peat landslide hazard are the peatland habitat, the water environment including surface water and groundwater, the development infrastructure, and the construction personnel.

9.6.69 The peatland habitat, water environment and development infrastructure receptors are considered to be of **High** sensitivity. Decommissioning personnel are considered to be a **Very High** sensitivity receptor.

9.6.70 With appropriate design constraints and mitigation measures in place, as described in Technical Appendix 9.1, the magnitude of works is considered to be **Slight** and beneficial. The likelihood of effect is considered to be **Unlikely**.

9.6.71 For all receptors, the effect of peat instability is assessed as **Minor**, long-term and beneficial.

Indirect and secondary effects

9.6.72 No indirect or secondary effects relating to site geology, hydrogeology or peat have been identified.

Cumulative effects

9.6.73 One development in the nearby area has been identified as requiring consideration for cumulative effects. This is the proposed Lochluichart Wind Farm Extension II, currently in scoping.

9.6.74 Lochluichart Extension II is proposed for the area immediately north of the existing Lochluichart Extension I and north-west of the existing Corriemoillie Wind Farms. It is approximately 1.5 km from the proposed Kirkan Wind Farm boundary.

9.6.75 The effects on geology, hydrogeology and peat are considered to be additive rather than synergistic.

9.6.76 Effects on geology are very localised. As a result, there are no cumulative effects relating to geology from this development.

9.6.77 Current proposals for the Lochluichart Extension II indicate that a small part of the extension are located within the Allt Giubhais Beag catchment area, comprising one turbine and a short section of access track. All works are located on the opposite side of the watercourse, which acts as a groundwater flow boundary. As a result, there are no cumulative effects relating to hydrogeology from this development.

9.6.78 Effects on soils and peat are fairly localised and rarely extend much beyond the development footprint. Assuming that all construction, operation and decommissioning works at both developments abide by good works practices with relation to soil and peat handling and storage, there are no cumulative effects relating to soils and peat.

9.7 Mitigation

Mitigation by design

9.7.1 All excavation works requiring removal of bedrock or superficial deposits have been kept to a practical minimum by good site design.

9.7.2 The total infrastructure footprint within the Ousdale Arkose bedrock outcrop has been restricted by careful design. Owing to local ground conditions, effects on groundwater flow are not anticipated from construction over this rock type.

9.7.3 Careful and informed infrastructure design forms a key measure for prevention of induced instability in peat. The collated peat depth information has been used to inform the proposed infrastructure layout throughout the design process. Incursion into areas of deeper peat has been kept to a practical minimum by careful design and would be further reduced by local micrositing, in order to minimise disruption to peatland ecosystems and hydrology, and to avoid the risk of induced peat instability.

9.7.4 Access tracks are anticipated to be constructed using established cut-and-fill construction methods. Any peat present along the route would be excavated and stored for use in reinstatement of trackside verges and other elements of project infrastructure where appropriate.

Mitigation commitments

9.7.5 Rock testing would be undertaken on appropriate samples from the two borrow pit areas to determine its suitability for unbound track and hardstanding construction. This would include testing to determine likely degradation patterns during the lifespan of the development. Should the tests identify problems with parts of the rock within the borrow pit footprints, care would be taken to ensure that unsuitable material is not used for construction but would be retained for use in borrow pit restoration.

9.7.6 Groundwater monitoring boreholes would be established within the two borrow pit areas prior to any construction work beginning, to a depth at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken to determine whether groundwater is present within the borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit area would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing.

9.7.7 Shallow filter drains would be installed around Turbine 1 to facilitate rainfall recharge into the bedrock at this location, to minimise changes caused by introduction of hard engineering in the area.

9.7.8 Cable trenches would be laid in disturbed trackside material. In areas where cable routes cross up or down steep slopes, clay bunds or alternative impermeable barrier would be placed for every 0.5 m change in elevation along the length of the trench to minimise in-trench groundwater flow.

9.7.9 Any unused or remaining unsuitable aggregate material, plus any spare rock material arising from hardstanding or track reinstatement, may be used to reinstate the borrow pits to a suitable profile, and capped with soil or turf to promote re-establishment of natural vegetation cover.

9.7.10 Subsurface electrical cables would be left *in situ*.

9.7.11 Where track sections cross wetland or bog areas, cross-drainage will be provided within the track construction to ensure continuity of flow. This may take the form of a drainage layer within the track, suitably closely-spaced drainage pipes, or both as appropriate. These will be determined on a case-by-case basis to suit each individual area.

9.7.12 All works through and adjacent to wetland areas will be supervised by the Environmental Clerk of Worksm with particular respect to works near identified GWDTE.

9.7.13 Site-specific mitigation, including track drainage segregation to avoid ‘flushing’ from excavation works, and micrositing to avoid specific higher sensitivity areas, will be identified and established where appropriate.

9.7.14 All traffic routes would be clearly demarcated and vehicles would not be permitted access outwith these areas.

9.7.15 During decommissioning, traffic routes would follow established access tracks. Decommissioning would be phased such that more distant infrastructure is removed first, in order to avoid vehicle movement across unaffected ground.

9.7.16 Site areas under former infrastructure (hardstandings, access tracks and borrow pit floors) would be ripped or routed to remove effects of ground compaction prior to reinstatement.

9.7.17 Only tracked or low ground pressure vehicles would be permitted access to unstripped ground.

9.7.18 Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2 m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate bunds for separate soil types in order to preserve the soil quality.

9.7.19 For work within areas of peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging. The underlying catotelmic peat would be stored bunds up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelmic peat has been limited by careful infrastructure design.

9.7.20 All soil and peat storage bunds would be left with rough, unsmoothed surfaces to minimise soil loss from rainfall erosion. Bunds on sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall.

9.7.21 Excavated soil and peat would be used in site restoration and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare soil or peat that are not required for the operational phase of the development. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation.

9.7.22 Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat bunds. This would help to maintain vegetation growth in the turfs and to retain the soil structure.

9.7.23 Construction work would make use of current best practice guidance relating to developments in peatland areas. A risk management system, such as a geotechnical risk register, would be compiled and maintained at all stages of the project and developed as part of the post-consent detailed design works, and would be updated as new information becomes available.

9.7.24 During construction, and decommissioning as required, members of project staff would undertake advance inspections and carry out regular monitoring for signs of peat landslide indicators. A geotechnical specialist would be on call to provide advice if required by project area conditions.

9.7.25 Micrositing would be used to avoid possible problem areas. This would be assisted by additional verification of peat depths, to full depth, in any highlighted areas where construction work is required. Track drainage would be installed in accordance with published good practice documentation and would be minimised in terms of length and depth in order to minimise concentration of flows.

9.7.26 Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of identified deeper peat. Careful track design would ensure that the volume and storage timescale for excavated materials would be minimised as far as practicable during construction works.

9.7.27 Vegetation cover would be re-established as quickly as possible on track and infrastructure verges and cut slopes, by re-laying of excavated peat acrotelm, to improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradable geotextile, would be considered if necessary in specific areas.

9.7.28 Construction staff would be made aware of peat slide indicators and emergency procedures. Emergency procedures would include measures to be taken in the event that an incipient peat slide is detected.

9.8 Summary of effects

9.8.1 This assessment is based on a site-specific risk assessment method following recommended environmental impact assessment techniques. Potential effects, both positive and negative, long-term or temporary, adverse or beneficial, to the geological, hydrogeological and peat regime have been considered. These effects are summarised in Table 9.7.

Table 9.7 Summary of effects

Effect	Phase	Assessment consequence	Effect significance
Physical removal of bedrock	Construction	Minor, long-term, adverse	Not Significant
	Operation	Negligible	Not Significant
	Decommissioning	No change	Not Significant
Modification to groundwater flow paths	Construction	Minor, long-term, adverse	Not Significant
	Operation	No change	Not Significant
	Decommissioning	Minor, long-term, beneficial	Not Significant
Changes in water supply to vulnerable groundwater receptors	Construction	Minor, long-term, adverse	Not Significant
	Operation	No change	Not Significant
	Decommissioning	Minor, long-term, adverse	Not Significant
Soil erosion and compaction	Construction	Minor, temporary, adverse	Not Significant
	Operation	Minor, temporary, adverse	Not Significant
	Decommissioning	Minor, temporary, beneficial	Not Significant
Peat instability	Construction	Minor, long-term, adverse	Not Significant
	Operation	No change	Not Significant
	Decommissioning	Minor, long-term, beneficial	Not Significant

9.9 References

BGS (2004). Ben Wyvis: Bedrock and superficial geology. British Geological Survey, Geological Survey of Scotland 1:63,360/1:50,000 geological map series. Available to view at http://www.bgs.ac.uk/data/maps/maps.cfc?method=viewRecord&mapId=11135, accessed December 2018.

BGS (2018). GeoIndex online geological mapping. British Geological Survey. http://mapapps2.bgs.ac.uk/geoindex/home.html, accessed December 2018.

Johnstone, G.S., & Mykura, W. (1989). *The Northern Highlands of Scotland*, 4th Edition. Volume 2 of British Regional Geology Guides. British Geological Survey, Nottingham.

SEPA (2017). Planning guidance on on-shore windfarm developments. Scottish Environment Protection Agency, Land Use Planning System Guidance Note 4 (LUPS-GU4). Available at: https://www.sepa.org.uk/media/136117/planning-guidance-on-on-shore-windfarms-developments.pdf, accessed December 2018.

SNH/HES (2018). Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland [v5]. Scottish Natural Heritage & Historic Environment Scotland. Available at: https://www.nature.scot/handbook-environmental-impact-assessment-guidance-competent-authorities-consultees-and-others.

Trewin, N.H. (2002). *The Geology of Scotland*, 4th Edition. The Geological Society, London.

UKTAG (2004). Guidance on the identification and risk assessment of groundwater dependent terrestrial ecosystems. UK Technical Advisory Group on the Water Framework Directive. Available at: https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Risk%20assessment%20of%20terrestrial%20ecosystems%20groundwater_Draft_210104.pdf, accessed December 2018.

10 NOISE AND VIBRATION

10.1 Introduction

10.1.1 This chapter summarises the assessment of the potential noise effects of the proposed development on the residents of nearby dwellings. Full details of the noise assessment can be found in the Hoare Lea Technical Report, included as Appendix 10.1. The assessment considers both the proposed wind farm's construction and its operation. It also considers the likely effects of its eventual decommissioning.

10.1.2 Assessment of the operational noise effects accounts for the cumulative effect of the proposed wind farm with other wind farms nearby including the Corriemoillie Windfarm and the Lochluichart Windfarm and Extensions. The potential effects of the proposed Lochluichart Windfarm Extension II (LWFE2) have been considered separately as the proposal was still at pre-application stage prior to finalisation of this assessment. Other, more distant wind farms were not considered because as their potential noise contribution was considered negligible.

10.2 Scope and methodology

Scope

10.2.1 Noise and vibration which arises from the construction of a wind farm is a factor which should be taken into account when considering the total effect of the proposed development. However, in assessing the effects of construction noise, it is accepted that the associated works are of a temporary nature. The main work locations for construction of the proposed turbines are distant from the nearest noise sensitive residences and are unlikely to cause significant effects. The construction and use of access tracks and some of the required infrastructure may, however, occur at lesser separation distances. Assessment of the temporary effects of construction noise is primarily aimed at understanding the need for dedicated management measures and, if so, the types of measures that are required. Further details of relevant working practices, traffic routes, and proposed working hours are described in Chapter 2.

10.2.2 Once constructed and operating, wind turbines may emit two types of noise. Firstly, aerodynamic noise is a 'broad band' noise, sometimes described as having a characteristic modulation, or 'swish', which is produced by the movement of the rotating blades through the air. Secondly, mechanical noise may emanate from components within the nacelle of a wind turbine. This is a less natural sounding noise which is generally characterised by its tonal content. Traditional sources of mechanical noise comprise gearboxes or generators. Due to the acknowledged lower acceptability of tonal noise in otherwise 'natural' noise settings such as rural areas, modern turbine designs have evolved to minimise mechanical noise radiation from wind turbines. Aerodynamic noise tends to be perceived when the wind speeds are low, although at very low wind speeds the blades do not rotate or rotate very slowly and so, at these wind speeds, negligible aerodynamic noise is generated. In higher winds, aerodynamic noise is generally masked by the normal sound of wind blowing through trees and around buildings. The level of this natural 'masking' noise relative to the level of wind turbine noise determines the subjective audibility of the wind farm. The relationship between wind turbine noise and the naturally occurring masking noise at residential dwellings lying around the project area will therefore generally form the basis of the assessment of the levels of noise against accepted standards.

10.2.3 The proposed development will also include a substation and battery storage facility which will emit some noise during operation.

10.2.4 The following effects have been assessed in full:

- the potential effect of noise and vibration during construction and decommission of the proposed development (including construction and forestry extraction traffic noise and potential cumulative effects); and
- the potential effect of noise during operation of the proposed development, including cumulative effects.

10.2.5 On the basis of the desk-based work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, the following effects have been 'scoped out':

10.2.6 The results of previous research detailed in Annex A of Appendix 10.1 has demonstrated that vibration resulting from the operation of wind farms is imperceptible at typical separation distances. Therefore, vibration effects during operation do not warrant detailed assessment and have not been considered further as part of this chapter;

Data sources

10.2.7 The following data sources have informed the assessment:

- Ordnance Survey information concerning the locations of all noise sensitive receptors in the vicinity of the site;
- British Standard (BS) reference material for the sound emission characteristics of various construction activities associated with proposed development;
- manufacturer data for the candidate and operating turbines considered, as set out in Appendix 10.1; and
- Environmental Statements and consent conditions for the different wind farms considered in the cumulative assessment.

Study area

10.2.8 The study area for the assessment of operational noise comprises the noise-sensitive residential properties nearest to the proposed turbines, located at approximate distances of up to 3 km from the turbines of the proposed development.

10.2.9 The assessment of construction noise has considered the same residential properties as the operational assessment, as well as dwellings located alongside the construction traffic route.

Assessment methods

Methodology for Assessing Construction Noise Impacts

10.2.10 Detailed guidance on construction noise and its control is provided by British Standard BS 5228-1 'Code of practice for noise and vibration control on construction and open sites' (2009). Analysis of construction noise impacts has been undertaken in accordance with the methodologies outlined in this standard, which provides methods for predicting construction noise levels on the basis of reference data for the emissions of typical construction plant and activities. These methods include the calculation of construction traffic along access tracks and haul routes, and construction activities at fixed locations including the bases of turbines, temporary construction compounds, and the substation. The construction noise assessment has been based on indicative data for the types of plant likely to be used during the construction works, as presented in BS 5228-1.

10.2.11 BS 5228-1 provides guidance on a range of considerations relating to construction noise including the legislative framework, general control measures, example methods for estimating construction noise levels and example criteria which may be considered when assessing effect significance. Similarly, BS 5228-2 provides general guidance on legislation, prediction, control and assessment criteria for construction vibration. Changes in the predicted traffic noise level on existing roads can be calculated using the Calculation of Road Traffic Noise (CRTN) methodology.

10.2.12 Planning Advice Note PAN50 ‘Controlling the Environmental Effects of Surface Mineral Workings’ gives guidance on the environmental effects of mineral working. The main document summarises the key issues with regard to various environmental impacts relating to surface mineral extraction and processing such as road traffic, blasting, noise, dust, visual intrusion etc. In addition, several annexes to the main document have been published which consider specific aspects in more detail: Annex A, ‘The Control of Noise at Surface Mineral Workings’ and Annex D ‘The Control of Blasting at Surface Mineral Workings’. BS 5228-1 and BS 5228-2 also provide guidance relating to surface mineral extraction including the assessment of noise and vibration effects associated with quarry blasting.

10.2.13 BS 5228-1 indicates that a number of factors are likely to affect the acceptability of construction noise including site location, existing ambient noise levels, duration of site operations, hours of work, attitude of the site operator and the noise characteristics of the work being undertaken.

10.2.14 Based on the range of guidance values set out in BS 5228 Annex E, and other reference criteria provided by the World Health Organization (WHO), the significance criteria presented in Table 10.1 have been derived. The values have been chosen in recognition of the relatively low ambient noise typically observed in rural environments. The presented criteria have been normalised to free-field day time noise levels occurring over a time period, T, equal to the duration of a working day onsite. Specifically, the criteria relate to day time hours from 07:00 to 19:00 on weekdays, and 07:00 to 16:00 on Saturdays.

Table 10.1 Significance criteria for construction noise

Impact Significance	Definition
Major	Construction noise is greater than 72dB LAeq,T for any part of the construction works or exceeds 65dB LAeq,T for more than 4 weeks in any 12 month period.
Moderate	Construction noise is generally less than or equal to 65dB LAeq,T the construction period, with periods of up to 72dB LAeq,T lasting not more than 4 weeks in any 12 month period.

Impact Significance	Definition
Slight	Construction noise is generally less than or equal to 60dB LAeq,T, with periods of up to 65dB LAeq,T lasting not more than 4 weeks in any 12 month period.
Negligible	Construction noise is generally less than or equal to 55dB LAeq,T, with periods of up to 60dB LAeq,T lasting not more than 4 weeks in any 12 month period.

10.2.15 When considering the impact of short-term changes in traffic, associated with the construction activities, on existing roads in the vicinity of the project area, reference can be made to the criteria set out in the Design Manual for Roads and Bridges (DMRB). A classification of magnitudes of changes in the predicted traffic noise level for short-term changes, such as those associated with construction activities, is set out in Table 10.2. This classification can be considered in addition to the criteria of Table 10.1.

Table 10.2 Significance criteria for changes in traffic noise associated with Construction traffic

Impact Significance	Definition
Major	More than 5dB
Moderate	3 to 5dB
Slight	1 to 3dB
Negligible	Less than 1dB

10.2.16 BS 5228-2 provides general guidance on legislation, prediction, control and assessment criteria for construction vibration. The nature of works and distances involved in the construction of the proposed development are such that the risk of significant effects relating to ground borne vibration are very low (excluding blasting, see below). Occasional momentary vibration can arise when heavy vehicles pass dwellings at very short separation distances, as is the case with the existing traffic in the area, but again this is not sufficient to constitute a risk of significant effects in this instance.

10.2.17 Because of the difficulties in predicting noise and air overpressure resulting from blasting operations at the proposed borrow pits, these activities are best controlled following the use of good practice during the setting and detonation of charges.

10.2.18 The transmission and magnitude of ground vibrations associated with blasting operations at borrow pits are subject to many complex influences including charge type and position, and importantly, the precise nature of the ground conditions (material composition, compaction, discontinuities) at the source, receiver, and at every point along all potential ground transmission paths. Clearly any estimation of such conditions is subject to considerable uncertainty, thus limiting the utility of predictive exercises. Mitigation of potential effects of these activities is best achieved through on-site testing processes carried out in consultation with THC.

10.2.19 In accordance with the guidance in PAN50 Annex D, ground vibration caused by blasting operations will be considered acceptable if peak particle velocity (PPV) levels, at the nearest sensitive locations, do not exceed 6 mm/s for 95% of all blasts measured over any 6-month period, and no individual blast exceeds a PPV of 12 mm/s.

Methodology for Assessing Operational Noise Impacts

10.2.20 The assessment of operational noise impacts has been carried out in accordance with the methodology set out in ETSU-R-97. ETSU-R-97 has become the accepted standard for such developments within the UK, and is specified as the appropriate assessment and rating guidance for wind farms in current Scottish planning policy. It is described in more detail in Appendix 10.1.

10.2.21 Technical guidance on current good practice in the application of the ETSU-R-97 methodology, as described in the Institute of Acoustics (IOA) Good Practice Guide (GPG) has also been referenced, as is recommended in the Scottish Government's Online Renewables Planning Advice on Onshore wind turbines.

10.2.22 To undertake the assessment of noise impact in accordance with the methodology in ETSU-R-97, the following steps are required:

- specify the number and locations of the wind turbines and other wind farms to be included in the assessment;
- identify the locations of the nearest, or most noise sensitive, neighbours;
- determine the background noise levels as a function of site wind speed at the nearest neighbours, or at least at a representative sample of the nearest neighbours, either through direct measurement or by reference to data already obtained during previous surveys in the area;
- determine the day time and night time noise limits from the measured background noise levels at the nearest neighbours;
- specify the type and noise emission characteristics of the wind turbines;
- calculate noise immission levels from the operation of the turbines associated with the proposed wind farm as well as the contribution to cumulative noise immission levels from other nearby wind farms as a function of site wind speed at the nearest neighbours; and
- compare the calculated wind farm noise immission levels with the derived noise limits and assess in the light of planning requirements in consultation with the local planning authority.

10.2.23 Note the term 'noise emission' relates to the sound power level actually radiated from each wind turbine, whereas the term 'noise immission' relates to the sound pressure level (the perceived noise) at any receptor location due to the combined operation of all wind turbines on a wind farm.

10.2.24 Full details of the operational noise assessment, including details of the noise output of the candidate turbine for this scheme and the calculation parameters on which predictions have been based, can be found in Appendix 10.1.

10.2.25 The acceptable limits for wind turbine operational noise are clearly defined in ETSU-R-97. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise immission levels at nearby noise sensitive properties lie below the noise limits derived in accordance with ETSU-R-97.

10.2.26 In addition, the noise limits defined in ETSU-R-97 relate to the total noise occurring at a dwelling due to the combined noise of all operational wind turbines. The assessment will therefore need to consider the combined operational noise of the proposed development with other wind farms in the area to be satisfied that the combined cumulative noise levels are within the relevant ETSU-R-97 criteria.

10.2.27 The day time noise limit is derived from background noise data measured during so called 'quiet periods of the day', comprising weekday evenings (18:00 to 23:00), Saturday afternoons and evenings (13:00 to 23:00) and all day and evening on Sundays (07:00 to 23:00). Multiple samples of ten-minute background noise levels using the $L_{A90,10min}$ measurement index are measured contiguously over a wide range of wind speed conditions (a definition of the $L_{A90,10min}$ index is given in Annex A of Appendix 10.1). The measured noise levels are then plotted against the simultaneously measured wind speed data and a 'best fit' curve is fitted to the data to establish the background noise level as a function of wind speed. The ETSU-R-97 day-time noise limit is then set at a level 5dB(A) above the derived background noise levels over a 0-12m/s wind speed range.

10.2.28 For day-time periods, the limit is set at a fixed minimum lower level in the range 35dB(A) to 40dB(A): this applies when the level 5dB above the derived background noise value drops below this fixed level. The precise choice of fixed limit within the range 35dB(A) to 40dB(A) according to ETSU-R-97 depends on a number of factors: the number of noise affected properties, the likely duration and level of exposure and the consequences of the choice on the potential power generating capability of the wind farm. During the consultation, THC have highlighted that they have a preference for this lower limit to be set at 35dB(A), the lowest end of the range of 35 to 40dB(A) prescribed in ETSU-R-97 This topic is discussed in paragraph 10.5.5.

10.2.29 The night time noise limit is derived from background noise data measured during the night time periods (23:00 to 07:00) with no differentiation being made between weekdays and weekends. The ten minute $L_{A90,10min}$ noise levels measured over these night time periods are again plotted against the concurrent wind speed data and a 'best fit' correlation is established. As with the day time limit, the night time noise limit is also based on a level 5dB(A) above the derived background noise levels over the 0-12m/s wind speed range. Where the resulting night time noise limit is found to be below 43dB(A) it is fixed at 43dB(A). THC have suggested that a fixed level of 38dB(A) should be used instead of 43dB(A) set out in ETSU-R-97.

10.2.30 Where a property occupier has a financial involvement in the wind farm development, the lower fixed portion of the noise limit at that property may be increased to 45dB(A) during both the day time and the night time periods.

10.2.31 ETSU-R-97 also offers an alternative simplified assessment methodology: if predicted noise levels do not exceed 35dB(A) up to 10m/s, then they are considered acceptable and background noise surveys are not considered necessary.

Statement of significance

10.2.32 Major or moderate construction impacts are considered 'significant' in the context of the EIA Regulations.

10.2.33 If predicted noise levels are within the ETSU-R-97 derived noise limits, operational noise is considered acceptable, and therefore not significant in EIA terms. If predicted noise levels are above the ETSU-R-97 noise limits, operational noise is considered unacceptable and significant in EIA terms.

Low Frequency Noise, Vibration and Amplitude Modulation

10.2.34 Low-frequency noise and vibration resulting from the operation of wind farms are all issues that have been discussed in detail over the past 20 years. Consequently, Annex A of Appendix 10.1 includes a detailed discussion of these topics. In summary of the information provided therein, the current recommendation is that ETSU-R-97 should continue to be used for the assessment and rating of operational noise from wind farms.

10.2.35 Annex A of Appendix 10.1 also discusses the most recently published research on the subject of wind turbine blade swish or Amplitude Modulation (or AM). The IOA has recently published an objective technique developed for quantifying AM noise. The UK Government also commissioned a review on subjective responses to AM noise which outlines considerations for the control of this feature based on the IOA methodology. The Scottish Government is currently reviewing this recommendation in the context of the Scottish planning system.

Noise predictions

10.2.36 The predictions of construction noise were made using the methodology of BS 5228 and representative emission levels based on the types and number of equipment typically associated with key phases of constructing a wind farm. The predictions used conservative assumptions, such as considering when each activity would be closest to the neighbouring properties, and assuming the plant would operate for between 75% and 100% of the working day, on a conservative basis. This would represent the upper sound emission level during the day and actual noise levels are likely to be lower. Furthermore, the calculation has assumed there were no screening effects and the ground cover was 50% hard.

10.2.37 The level of construction noise that occurs at the surrounding properties would be highly dependent on a number of factors such as the final site programme, equipment types used for each process, and the operating conditions that prevail during construction. It is not practically feasible to specify each and every element of the factors that may affect noise levels, therefore it is necessary to make reasonable allowance for the level of noise emissions that may be associated with key phases of the construction. The types and number of equipment usually associated with the key phases of constructing a wind farm have been based on experience of similar sites. The conservative assumptions made would likely offset the uncertainty in the exact details of the construction activities.

10.2.38 For operational noise, the exact model of turbine to be used for the proposed development would be the result of a future tendering process and therefore an indicative turbine model has been assumed for the operational noise assessment. Specifically, the operational noise assessment is based upon the noise specification of the Nordex N133 4.8 MW wind turbine. 17 turbines have been modelled using the layout as indicated on the map in Figure 10.1.

10.2.39 Assessment of the operational noise effects accounts for the cumulative effect of the proposed wind farm with other existing wind farms nearby including the Corriemoillie Windfarm and the Lochluichart Windfarm and Extension. A second extension to the Lochluichart Windfarm is also being considered and this potential development will also be considered in the present chapter. Other, more distant wind farms were not considered because as their potential noise contribution was considered negligible.

10.2.40 Section 5.4 of Appendix 10.1 details the assumptions made for each of the cumulative sites considered. In summary, for each operational site, the actual installed turbine model was modelled. In each case, robust emission data was first assumed, in line with the requirements of the IOA GPG guidance. Firstly, all assumed noise emission data included an allowance for measurement uncertainty in line with IOA GPG requirements. Furthermore, if the individual consent for each of the sites allowed the site to produce additional noise and still meet its noise limit at the closest relevant property (a "controlling property"), then an additional uplift, of between +3 and +4dB, was also applied.

10.2.41 The approach used is considered robust and consistent with relevant guidance on good practice set out in the IOA GPG and subsequent publications on the subject (see Bowdler *et. al.,* 2016). This approach was discussed in consultation with THC and no adverse comments received in response.

10.2.42 Operational noise predictions were made in accordance with the methodology recommended in the IOA GPG, which is based on the ISO 9631-2 standard, and assumes robust emission levels for the candidate turbine. The predictions are made assuming downwind propagation from every turbine, which will be over-stating noise levels in some cases, particularly in cases in which receptors are situated in between two sets of turbines and could not be downwind of both simultaneously.

Field survey

10.2.43 A survey was undertaken at a total of three noise monitoring locations, to help characterise the baseline background noise environment around the site. These locations were determined in consultation with THC.

10.2.44 The background noise monitoring exercise was conducted in May and June 2018, over a period of approximately four weeks. The total survey period was in excess of the minimum of one week required by ETSU-R-97 and the extent of the data collected and range of wind conditions obtained are compliant with the IOA GPG requirements, as detailed in Appendix 10.1.

10.2.45 The measured noise levels were related to wind speed measurements at a temporary 80m mast currently located on the site, which were processed to determine wind speeds at heights representative of the hub height of the proposed turbines. The derived hub height wind speeds were then expressed at 10m height as required in ETSU-R-97, to provide a suitable reference to determine the prevailing background noise level during the quiet daytime and night-time periods. This therefore incorporates site-specific wind shear effects, as set out in detail in Annex F of Appendix 10.1.

10.2.46 ETSU-R-97 requires that background noise measurements are not influenced by the contribution from existing turbine noise. As some of the measurement properties were located near existing operating wind farms, their influence was minimised by excluding from the analysis wind directions in which the property could be downwind of these turbines.

10.2.47 Data from all survey locations was also inspected to identify periods which may have been influenced by rainfall or atypical sources. This analysis was undertaken in accordance with the preferred method described in the IOA GPG, as detailed in Appendix 10.1.

10.2.48 The main locations considered in the operational noise assessment are set out below in Table 10.3. The list of receptor locations is not intended to be exhaustive but sufficient to be representative of noise levels typical of those receptors closest to the site. Figure 10.1 shows these assessment locations as well as all baseline measurement locations referenced. The survey results obtained at Hydro House were used at the neighbouring dwelling at Black Bridge: this represents a conservative assumption and is in accordance with the guidance provided by ETSU-R-97 and current good practice as set out in the IOA GPG.

Table 10.3 Operational Noise Assessment Locations

Property	Easting	Northing	Approximate Distance to Closest Turbine (m)	Survey undertaken?
Aultguish Inn	235139	870408	2290	Y
Black Bridge	237187	870996	2670	N (Hydro House survey used)
Hydro House	237322	871064	2760	Y
Lubfearn	238454	870182	2320	Y

10.3 Consultation undertaken

10.3.1 Prior to undertaking the background surveys, and as recommended in The Highland Council's (THC) scoping response, the survey approach was discussed with THC representatives. A summary of the proposed monitoring locations and of the proposed approach was forwarded to the Environmental Health Department of THC for comment, and were agreed to be representative for the purpose of an ETSU-R-97 assessment. An officer from the Environmental Health Department of THC was invited to site when the equipment was deployed but declined the invitation. The final survey locations are described above.

10.3.2 In response to the initial scoping request, THC also expressed a preference for following noise limits as set out above. In November 2018, an outline of the cumulative noise assessment method set out in the present chapter was sent to a representative of the Environmental Health Department of THC for comment, and no adverse comment was received in response.

10.4 Statutory and planning context

10.4.1 Scottish Planning Policy (SPP) provides advice on how the planning system should manage the process of encouraging, approving and implementing renewable energy proposals including onshore wind farms. Whilst SPP suggests noise impacts are one of the aspects that will need to be considered it provides no specific advice with regards to noise.

10.4.2 Planning Advice Note PAN1/2011 provides general advice on the role of the planning system in preventing and limiting the adverse effects of noise without prejudicing investment in enterprise, development and transport. PAN1/2011 provides general advice on a range of noise related planning matters, including references to noise associated with both construction activities and operational wind farms. In relation to operational noise from wind farms, Paragraph 29 states that:

10.4.3 'There are two sources of noise from wind turbines - the mechanical noise from the turbines and the aerodynamic noise from the blades. Mechanical noise is related to engineering design. Aerodynamic noise varies with rotor design and wind speed, and is generally greatest at low speeds. Good acoustical design and siting of turbines is essential to minimise the potential to generate noise. Web based planning advice on renewable technologies for Onshore wind turbines provides advice on 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) published by the former Department of Trade and Industry [DTI] and the findings of the Salford University report into Aerodynamic Modulation of Wind Turbine Noise.'

10.4.4 The Scottish Government's Online Renewables Planning Advice on Onshore wind turbines provides further advice on noise, and confirms that the recommendations of 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) "should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments".

10.4.5 Guidance on good practice on the application of ETSU-R-97 has been provided by the Institute of Acoustics (IOA Good Practice Guide or GPG). This was subsequently endorsed by the Scottish Government which advised in the Online Renewables Planning Advice note that the GPG 'should be used by all IOA members and those undertaking assessments to ETSU-R-97'.

10.4.6 PAN1/2011 and the Technical Advice Note accompanying PAN1/2011 note that construction noise control can be achieved through planning conditions that limit noise from temporary construction sites, or by means of the Control of Pollution Act (CoPA).

10.4.7 The Control of Pollution Act (CoPA) 1974 provides two means of controlling construction noise and vibration. Section 60 provides the Local Authority with the power to impose at any time operating conditions on the development site. Section 61 allows the developer to negotiate a prior consent for a set of operating procedures with the Local Authority before commencement of site works.

10.4.8 The Highland-wide Local Development Plan (April 2012) includes policy 67 (Renewable Energy Developments) explains that THC will support proposal if it satisfied that they will not be significantly detrimental, either in isolation or cumulatively, with regards to a number of effects which include noise on occupied residential buildings.

10.4.9 THC's Onshore Wind Energy Supplementary Guidance (Nov 2016) makes reference to the ETSU-R-97 guidance but notes (as discussed above) that the Council will seek to achieve noise limits at the lower end of the range associated in this national guidance and encourages early engagement with THC. It advises that consideration of cumulative impacts should have regard to current best practice.

10.5 Existing environment

10.5.1 The baseline noise environment was typically dominated by 'natural' noise sources such as wind disturbed vegetation or water courses, with limited road traffic noise also noted to varying degrees. Therefore, the measured baseline noise levels are considered consistent with those that would be expected in a rural environment. Existing operating wind farms are also potentially audible at some of the properties, and this was taken into account by excluding wind directions in which the properties were downwind from the turbines. This therefore minimised the influence of these sources, a requirement of the ETSU-R-97 methodology, as agreed in consultation with THC.

10.5.2 Existing noise conditions at all three survey locations (see Table 10.3) are represented in Charts E1 to E6 of Annex E in Appendix 10.1. Descriptions of the noise environment at each of these survey locations can be found in Annex C of Appendix 10.1.

10.5.3 The background levels at all four locations typically varied, during quiet day-time periods, between 25 to 35dB $L_{A90,10min}$ at low wind speeds (up to 5m/s) and 40-50dB $L_{A90,10min}$ at the highest wind speeds in the range of up to 12m/s considered under ETSU-R-97. For night-time periods, a similar range of levels was generally observed between low and high wind speeds.

Noise limits

10.5.4 Following exclusion of spurious periods, typical background levels were derived using a best-fit curve. ETSU-R-97 noise limits were determined on the basis of these background levels at all properties: this results in the limits set out in Tables 4 and 5 of Appendix 10.1. For the avoidance of doubt, these limits have been derived as follows:

- the ETSU-R-97 daytime limit of 38dB(A), or 5dB above the prevailing background noise level, whichever is the higher; and
- the minimum ETSU-R-97 night-time fixed lower limit of 43dB(A), or 5dB above the prevailing background noise level, whichever is the higher.

10.5.5 The derivation of the 40dB(A) fixed limit for day-time periods, based on the criteria specified in ETSU-R-97, is considered in detail in section 5.7 of Appendix 10.1. In summary, the very low number of dwellings potentially affected relative to the scale of the proposed development, limited duration/level of exposure of turbine noise above baseline noise levels, mean that it is considered wholly appropriate to set the limit towards the middle of the range of 35 to 40dB(A) specified in ETSU-R-97.

10.5.6 Nevertheless, the more stringent alternative limits determined in accordance with THC preferences discussed above are also set out in Tables 6 and 7 of Appendix 10.1.

10.5.7 The property Lubfearn belongs to the turbine development landowner. Other receptors might also stand to benefit from financial involvement in the proposed development in due course. ETSU-R-97 allows an increase of the applicable noise limits to a minimum of 45dB for dwellings whose occupants are financially involved with a wind farm development, but no such increase was assumed for the purpose of the current assessment.

10.6 Predicted impacts

Construction Impacts

10.6.1 Predicted noise levels at the closest noise sensitive receptors (Table 10.3) for each of the key activities during construction of the proposed development are presented in Table 8 of Appendix 10.1.

10.6.2 The proposed construction activities within the project area and around the turbines would occur at relatively large distances from nearby residential properties, such that the resulting predicted noise levels would not exceed 55dB L_{Aeq}. With reference to the derived criteria of Table 10.1, the noise effects from these activities would therefore be negligible, based on the proposed construction working hours set out in Chapter 2.

10.6.3 Given the separation distances between the location of borrow pits and the nearest noise sensitive receptors (approximately 3 kilometres as a minimum) it is considered very unlikely that vibration and air overpressure resulting from blasting operations activities would cause significant adverse impacts.

10.6.4 The assessment of noise from onsite construction activities is based on the period when each potential activity would occur closest to each of the nearest noise-sensitive locations. Therefore, onsite construction activities from other sites are considered unlikely to produce any additional noise impacts, even if the construction periods were to coincide, given the conservative nature of this approach.

10.6.5 In addition to on site activities, construction traffic passing to and from the site will also represent a potential source of noise to surrounding properties.

10.6.6 The potential construction traffic movements on existing local surrounding roads have been assessed on the basis of the assumptions set out in Chapter 11, Traffic and Transportation, using the CRTN methodology. This included a worst-case scenario in which 100% of stone is imported to site, and a more realistic scenario in which on-site borrow pits are used instead. Details are set out in Appendix 10.1.

10.6.7 Under worst-case assumptions (prior to mitigation), a maximum potential increase of 2 to 5dB(A) in the day time average noise level was predicted months 6 to 8 of the construction programme at locations adjoining the A835. Based on the criteria set out in the DMRB, this would correspond to a slight impact generally but represent a moderate impact for locations along the A835 between the Site and Garve. Along the A9, the predicted increase is less than 0.1 dB(A): this would represent a negligible impact. For the realistic case, the predicted increase would reduce to 1 to 2 dB along the A835, corresponding to a slight impact at most, with a negligible impact for receptors along the A9.

10.6.8 The separating distances between the construction activities and the nearest residential locations are such that no significant vibration effects are considered likely based on available guidance. Occasional momentary vibration can arise when heavy vehicles pass dwellings at very short separation distances, but again this is not sufficient to constitute a risk of significant effects.

10.6.9 In conclusion, noise from construction activities has been assessed and is generally predicted to result in temporary negligible effects, with the exception of traffic associated with the construction which is predicted to result in a slight to moderate impact under a worst-case scenario (prior to mitigation), which would represent a significant temporary adverse effect for some receptors located along the A835. However, under a more realistic scenario, the temporary impact would be slight adverse at most which would not be significant.

Decommission impacts

10.6.10 Decommissioning is likely to result in less noise than during construction of the Development. The construction phase has been considered to generally have negligible noise effects, therefore most decommissioning activities will, in the worst case, also have negligible noise effects. The potential exception would be the associated traffic, but as no rock import would be required for the decommissioning, it is likely that traffic volumes would be closer to the “realistic” scenario and therefore the impact would be slight at most and therefore not significant.

Operational noise

10.6.11 The predictions of operational noise for the proposed development in isolation are detailed in Table 13 of Appendix 10.1 and are also illustrated on Figure 10.1. The predicted noise immission levels at the assessment locations of Table 10.3 typically varied between 19- 20dB(A) at low wind speeds and 30-32dB(A) at high wind speeds, over the range of 4 to 12 m/s over which predictions were made.

10.6.12 These predictions are therefore below the simplified criterion of 35dB L_{A90} specified in ETSU-R-97. This means that the operational noise levels from the proposed development in isolation are considered acceptable in line with relevant noise limits (including the stringent alternative requirements of THC) and therefore not significant.

Substation and battery storage

10.6.13 The main noise sources associated with the substation are likely to be the power transformers and the cooling fans. Operational noise associated with any battery energy storage facility would arise from HVAC systems, modular inverters and lower-voltage transformers (forming combined the ‘power conversion systems’) and higher-voltage transformers associated with grid connection (were this not to be shared with the main wind farm substation).

10.6.14 Given the large separation distances of around 3 km or more between the substation and battery storage area and the nearest residential properties, experience of similar installations and professional judgement, the associated levels of operational noise would be negligible and not significant. Therefore, no specific mitigation is required in this instance.

Cumulative effects

10.6.15 Predicted cumulative noise immission levels for the proposed development at each of the assessment locations of Table 10.3 are detailed in Table 14 of Appendix 10.1. They are also illustrated in Figures E1 to E6 of Annex E in Appendix 10.1.

10.6.16 These predictions initially assume that all receptors are downwind of all wind turbines, which is conservative in many cases. Furthermore, as detailed above, they incorporate conservative uplifts based on potential increases above the likely emissions of the installed turbines as installed on each of the other cumulative sites considered.

10.6.17 The detailed assessment set out in Table 15 and 16 of Appendix 10.1 compares these predicted cumulative noise levels with the derived ETSU-R-97 noise limits. The assessment demonstrates that the derived noise limits are predicted to be achieved at all wind speeds and locations in combination with all operational neighbouring schemes.

10.6.18 In addition, Tables 17 and 18 of Appendix 10.1 compare the predicted cumulative noise levels with the more stringent alternative noise limits preferred by THC, based on a lower limit of 35 and 38dB(A) for day and night-time respectively. This shows that the more stringent alternative noise limit is also complied, with a marginal exception at Aultguish Inn which is not considered significant: this is because the predicted excess is of less than 0.5 dB which is acoustically negligible and would not be perceptible. Furthermore, as illustrated in Figures E1/E2 of Annex E in Appendix 10.1, the cumulative noise predictions at the relevant property are dominated by noise from the other wind farms considered in the cumulative assessment, to which uplifts of between +3 to +4 dB were applied as set out above. Finally, the relevant predictions are made on a conservative basis, with limited screening and assuming downwind propagation from all turbines, and it is therefore unlikely that even this negligible excess above the Council preferred limits would occur in reality.

10.6.19 In any case, the assessment above demonstrated that the ETSU-R-97 noise limits for non-financially involved properties, applicable under Scottish Planning Guidance, would be comfortably met.

10.6.20 In conclusion, cumulative operational noise levels including all operational neighbouring schemes are considered acceptable in line with relevant noise limits and are therefore not significant.

10.6.21 In addition, the potential effect of the proposed Lochluichart Windfarm Extension II (LWE2) has been considered on the basis of a 9-turbine layout and assuming the same turbine model as installed on the Lochluichart Windfarm, in the absence of more definitive information at this stage.

10.6.22 This assessment is set out in detail in section 5.8 of Appendix 10.1. This shows that the potential cumulative levels including the LWE2 scheme are predicted to exceed the stringent alternative noise limits preferred by THC for day-time and night-time periods at Aultguish Inn. This is the case even in the absence of the proposed development and therefore these potentially significant effects relate mainly to LWFE2.

10.6.23 The predicted cumulative levels are however generally compliant (with negligible exceptions) with ETSU-R-97 noise limits at the upper end of the range of 35 to 40 dB allowed in ETSU-R-97.

10.6.24 In summary, the proposed Lochluichart Windfarm Extension II could potentially result in significant cumulative operational noise impacts, particularly in relation to the stringent alternative noise limits preferred by THC. This would however be the case even in the absence of the proposed development.

10.7 Mitigation

10.7.1 Specific noise limits which should apply for the proposed development have been determined to maintain the conclusion of the cumulative assessment and result in cumulative levels which do not exceed the derived ETSU-R-97 noise criteria (without accounting for financial involvement) as well as the proposed more stringent alternative THC noise limits (with negligible exceptions in the cumulative case as discussed above), in line with current good practice. These specific partial limits are set in Tables 20 and 21 of Appendix 10.1, reproduced below in Tables 10.4 and 10.5.

Table 10.4 Specific day-time noise limits (L_{A90}, dB) proposed for the proposed development in isolation

	Standardised 10 m Wind Speed (m/s)								
Property	4	5	6	7	8	9	10	11	12
Aultguish Inn	29.5	30.6	31.4	32.1	32.5	32.6	32.6	32.6	32.6
Black Bridge	27.5	27.5	27.5	29.1	31.2	33.6	33.6	33.6	33.6
Hydro House	27.4	27.4	27.4	29.0	31.0	33.4	33.4	33.4	33.4
Lubfearn	29.8	30.7	31.7	32.9	34.2	35.6	35.6	35.6	35.6

Table 10.5 Specific night-time noise limits (L_{A90}, dB) proposed for the proposed development in isolation

	Standardised 10 m Wind Speed (m/s)								
Property	4	5	6	7	8	9	10	11	12
Aultguish Inn	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Black Bridge	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5
Hydro House	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4
Lubfearn	29.8	29.8	30.6	31.2	31.4	31.4	31.4	31.4	31.4

10.7.2 The selection of the final turbine to be installed for the proposed development would be made on the basis of enabling the relevant noise limits, as set out in Tables 10.3 and 10.4, to be achieved at surrounding properties, including any relevant tonality corrections. Satisfactory control of cumulative noise immission levels would be achieved through enforcement of the individual consent limits for each of the individual wind farms.

10.7.3 To reduce the potential effects of construction noise, the following mitigation measures are proposed:

- as proposed in Chapter 3, those activities that may give rise to audible noise at the surrounding properties and heavy goods vehicle deliveries to the site would be limited to the hours 07:00 to 19:00 Monday to Friday and 08:00 to 17:00 on Saturdays and Sundays unless otherwise approved in advance by THC (except in case of an emergency). Those activities that are unlikely to give rise to noise audible at the project area boundary, or light vehicle traffic accessing the project area such as that involved with staff mobilisation, may continue outside of the stated hours;
- all construction activities shall adhere to good practice as set out in BS 5228;
- all equipment would be maintained in good working order and any associated noise attenuation such as engine casing and exhaust silencers shall remain fitted at all times;
- where flexibility exists, activities would be undertaken away from residential properties, set back by the maximum possible distances;
- A Construction Traffic Management Plan (CTMP) will be developed and secured through planning condition to control the movement of vehicles to and from the Development site. The CTMP will include measures to reduce daily construction

traffic volumes if a high percentage of stone import to site is required, through traffic management and programme design, including potentially extending the construction period; and

- construction plant capable of generating high noise and vibration levels would be operated in a manner to restrict the duration of the higher magnitude levels.

10.7.4 The CTMP will reduce peak daily generated traffic values to levels closer to the realistic case assessed above. Therefore, following implementation of these mitigation measures, the temporary impact would be slight adverse at most which would not be significant.

10.8 Summary of effects

10.8.1 The adoption of the identified mitigation measures would reduce the potential noise and vibration effects during construction. The effects associated with most construction activities would be negligible and temporary, and therefore not significant. The effect of the predicted construction traffic, under a worst-case unmitigated scenario, could represent a slight to moderate impact which would represent a temporary adverse significant effect for some receptors along the A835: between the project area and Garve. Under a more realistic and/or mitigated scenario, the temporary impact would be slight adverse at most which would not be significant.

10.8.2 Decommissioning is likely to result in less noise than during construction of the proposed development. Decommissioning would, in the worst-case, have slight temporary adverse noise effects which are not significant.

10.8.3 Operational noise levels from the proposed development, including the cumulative effects of other existing wind farms in the area, were predicted to be compliant with noise limits derived in accordance with the ETSU-R-97 guidance. The noise levels were also compliant with more stringent alternative noise limits derived in accordance with THC preferences (with negligible exceptions). This could be secured in practice through appropriate planning conditions.

10.8.4 Depending on the levels of background noise, the satisfaction of the ETSU-R-97 derived limits could lead to a situation whereby, at some locations under some wind conditions and for a certain proportion of the time, the wind farm noise may be audible. However, noise levels at the properties in the vicinity of the wind farm would still be within levels considered acceptable under the ETSU-R-97 assessment method and therefore not significant.

10.8.5 The potential cumulative levels of operational noise including the Lochluichart Windfarm Extension II could exceed the derived stringent alternative THC or ETSU-R-97 noise limits, but this would be the case regardless of the proposed development.

10.9 References

British Standard BS 5228-1:2009-A:2014 (2009). ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise’.

British Standard BS 5228-2:2009-A:2014 (2009). ‘Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration’.

British Standard BS 6472-2:2008 (2008). ‘Guide to evaluation of human exposure to vibration in buildings - Part 2: Blast-induced vibration’

British Standard 4142: 2014 Method for rating and assessing industrial and commercial sound. British Standards Institution (2014).

Department of Transport (1988). 'Calculation of Road Traffic Noise'.

M. Cand et al (2013). 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'. Institute of Acoustics

D. Bowdler et. al. (2016). 'Wind Farms Cumulative Impact Assessment', Institute of Acoustics Bulletin, Jan/Feb 2016.

International Standards Organisation (1996). 'ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation'.

The Highways Agency, Transport Scotland, Transport Wales and The Department for Regional Development (Northern Ireland) (2011). 'Design Manual for Roads and Bridges, Volume 11, section 3, Part 7, Traffic Noise and Vibration'

The Scottish Office (1996). 'Planning Advice Note 50: Controlling the Environmental Effects of Surface Mineral Workings'

Scottish Government (2014). 'Scottish Planning Policy (SPP)'

Scottish Government (2011). Planning Advice Note 1/2011: Planning & Noise.

Scottish Government (2014). Web Based Renewables Planning Advice: 'Onshore Wind Turbines'

The Working Group on Noise from Wind Turbines (1996). 'The Assessment and Rating of Noise from Wind Farms, Final ETSU-R-97 Report for the Department of Trade & Industry'.

UK Government (1974). 'Control of Pollution Act, Part III'.

11 TRAFFIC AND TRANSPORTATION

11.1 Introduction

11.1.1 This chapter assesses the potential effects of the proposed development on the road network (in transport terms) and its users. This chapter should be read in conjunction with the proposed development description in Chapter 2 of this EIAR.

11.1.2 This chapter describes the assessment methodology that has been adopted in the traffic impact assessment and identifies how baseline conditions have been established. An assessment has been made of the potential effects of the proposed development, primarily during the construction phase on the local transport network.

11.2 Scope and methodology

11.2.1 The approach taken to the assessment is based upon the IEA guidelines (Institute of Environmental Assessment. Guidance note no.1: Guidelines for the environmental assessment of road traffic 1993), referring to the varying criteria depending on the type of impact being assessed. The IEA guidelines present the following rules which have been used as threshold impacts to define the scale and extent of this assessment:

- Include highway links where traffic flows are predicted to increase by more than 30% (or where the number of Heavy Goods Vehicles (HGVs) is predicted to increase by more than 30%);
- Include any other specifically sensitive areas where traffic flows are predicted to increase by 10% or more.

11.2.2 Based on the above rules, the assessment is primarily based upon the change in traffic flows along a specific section of road. Professional judgement must also be considered, particularly where the baseline traffic flow may be low and therefore a small increase in traffic may result in a high proportional increase. However, once the proposed development has been constructed, there will be very little traffic effect, due to the site having no permanent staffing. Only very occasional access for planned maintenance will be required and so operational effects are not considered any further within the assessment.

11.2.3 The study area for the assessment of traffic and transport are the key construction routes from Inverness, Invergordon, Dingwall and Alness. These are the A9, A862, B817 and A835.

11.2.4 Although the timescales for this project are not yet known, for the purposes of this assessment, it is assumed that construction will commence in mid-2020 and continue throughout 2021. This is considered to represent a realistic worst-case scenario.

11.2.5 The following impacts associated with construction traffic have been assessed, particularly with respect to HGV and abnormal load movements:

- Severance;
- Driver stress and delay;
- Pedestrian amenity and delay;
- Fear and intimidation; and
- Road safety.

11.2.6 In addition to the above impacts, traffic also has environmental effects on the following associated areas:

- Air quality – This potential impact has been scoped out of the ES, as per the EIA Scoping Report. Noise (Chapter 10) – Deals with increased traffic flows due to construction vehicles on the local road network.

Value of receptors

11.2.7 Table 11.1 below provides the general approach to determine the value and sensitivity of a receptor. The IEA Guidelines do not provide definitive criteria upon which to base the assessment, indicating that professional judgement should be applied. This approach has been adopted here, using criteria commonly used in environmental assessments.

Table 11.1: Receptor value and sensitivity

Value and sensitivity	Description
High	Traffic flows on road network near schools, colleges, playgrounds, accident blackspots, retirement homes, residential properties in close proximity to the road and roads without footways that are used by pedestrians.
Medium	Traffic flows at congested junctions and on road network near doctors' surgeries, hospitals, shopping areas with roadside frontage, roads with narrow footways, unsegregated cycleways, community centres, parks, recreation facilities.
Low	Traffic flows near places of worship, public open space, nature conservation areas, listed buildings, tourist attractions and residential areas with adequate footway provision and/or low pedestrian volumes.
Negligible	Receptors with low sensitivity to traffic flows and those sufficiently distant from affected roads and junctions.

11.2.8 Based on the above criteria, the key routes to the proposed development within the study area are considered to be of low or negligible sensitivity due to their low traffic flows, very low pedestrian traffic and few properties in proximity to the carriageway.

Magnitude of impact

11.2.9 The following are examples of the magnitude of impact criteria that will be used to inform the assessment of the significance of an effect:

- The location, physical /geographical scale of the impact (distance from the receptor, potential for direct/ indirect impacts);
- The duration/ frequency of the impact (i.e. temporary/ permanent);
- The reversibility of the impact.

11.2.10 The assessed impacts have been derived from the IEA guidelines, which set the standard and identifies these as key concerns for road users. Each impact has a varying magnitude depending on the type of user affected. Table 11.2 presents the general approach adopted for classifying the magnitude of impacts.

Table 11.2: Definition of Impact Magnitude

Impact type	Magnitude of Impact			
	Large	Medium	Small	Negligible
Severance	Change in total traffic flow over 90%	Change in total traffic flow of 60-90%	Change in total traffic flow of 30-60%	Change in total traffic flow less than 30%
Driver stress and delay	Likely change in vehicle delay >40 seconds	Likely change in vehicle delay 20 to 40 seconds	Likely change in vehicle delay 10 to 20 seconds	Likely change in vehicle delay < 10 seconds
Pedestrian amenity and delay	Change in total traffic or HGV flows over 200%	Change in total traffic or HGV flows of 100-200%	Change in total traffic or HGV flows of 50-100%	Change in total traffic or HGV less than 50%
Fear and intimidation	AADT hourly flow (all vehs) >1,800 or AADT flow (HGVs) >3,000	AADT hourly flow (all vehs) 1,200 to 1,800 or AADT flow (HGVs) 2,000 to 3,000	AADT hourly flow (all vehs) 600 to 1,200 or AADT flow (HGVs) 1,000 to 2,000	AADT hourly flow (all vehs) < 600 or AADT flow (HGVs) < 1,000
Road Safety	Ten or more collisions in a three year period or ten or more collisions per 100m lengths in a three year period.	Eight to ten or more collisions in a three year period or eight to ten collisions per 100m lengths in a three year period.	Five to eight collisions in a three year period or five to eight collisions per 100m lengths in a three year period.	Less than five collisions in a three year period or less than five collisions per 100m lengths in a three year period

Determination of significance

11.2.11 The approach to determine the significance of effects has been as follows:

- identify the relevant receptors
- derive their value (sensitivity) based on the criteria set out in Table 11.1
- identify and consider the likely impacts from each activity
- determine the magnitude of change likely as a result of the impacts (Table 11.2)
- present the significant effects, where relevant, and then consider how mitigation may reduce negative effects.

11.2.12 In addition to determining the significance of the effect, the assessment process also includes a qualitative description regarding the nature of the effect. These terms add additional information about how the effect would affect receptors.

Table 11.3: Assessment descriptors

Term	Nature of effect descriptors
Adverse	An effect which has the potential to decrease receptor value or status relative to baseline conditions.
Beneficial	An effect which has the potential to increase receptor value or status relative to baseline conditions.
Short-term	Effects that persist only for a short time, e.g. during the construction (or decommissioning) phase only; includes reversible effects.
Medium-term	Effects that may persist until additional mitigation measures have been implemented and become effective.
Long-term	Effects that persist for a much longer time, e.g. for the duration of the operational phase (essentially until the development ceases or is removed/ reinstated); includes effects which are permanent (irreversible) or which may decline over longer timescales.
Temporary	A reversible effect where recovery is possible and for which effects would persist only for a short or medium-term.
Frequent	Refers to a recurring effect that occurs repeatedly; in some cases, a lower level of impact may occur with sufficient frequency to reduce the ability of a receptor to recover effectively.

11.2.13 Environmental mitigation measures are necessary to address potentially *significant* adverse environmental effects. The environmental effects of impacts can be referred to as either being before, or following establishment of, environmental mitigation.

11.2.14 The significance of an environmental effect has been established by way of reference to the importance/value of affected resources; the number and sensitivity of affected receptors; impact magnitude; duration, frequency and extent of effect; and the reversibility of effect.

11.2.15 In terms of traffic and transport, a significant effect, requiring mitigation, would be where the effect is considered to be moderate or major, as defined by Table 11.4. This matrices approach is a tool supported by professional judgement as the IEA Guidelines do not specify a definitive set of criteria.

Table 11.4: Significance criteria

Sensitivity	Magnitude			
	Large	**Medium**	**Small**	**Negligible**
High	Major	Major	Moderate	Negligible/minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Minor	Negligible/minor	Negligible	Negligible
Negligible	Negligible/minor	Negligible	Negligible	Negligible

Assessment assumptions and limitations

11.2.16 Traffic movements would be at their greatest during construction works. For the purposes of the assessment, it has been assumed that construction and thus the peak construction movements would predominantly occur during 2020 and that the overall phase would take approximately 18 months to complete. Given that the environmental effects of traffic are largely based on proportional changes to traffic flows, the effects of traffic growth on background volumes over a larger number of years will lessen the scale of any impact. Therefore, using 2020 is considered the basis of a robust assessment.

11.2.17 All construction and operational traffic will access the site from the A835 where a car parking area in the vicinity of several former borrow pits currently exists, providing access to a pair of telecommunications masts as well as estate vehicular access. This will be widened to accommodate heavy goods vehicles while a temporary wider sweep will accommodate the delivery of abnormal loads. The details of the access are illustrated Figure 11.1.

11.2.18 On-site borrow pits are planned to supply aggregate for the majority of the project, thereby significantly reducing the transport mileage for construction materials compared to importing all materials. This assessment therefore assumes that only the aggregate needed to construct the access tracks up to the first borrow pit will be imported. This represents a realistic case. However, a 'worst case' assessment, assuming complete import of stone volumes, has also been presented for completeness.

11.2.19 The delivery of major turbine components (blades, tower sections and nacelles) to the site would be undertaken as abnormal loads. The calculation of vehicle movements includes police escorts at the front and rear to ensure a robust assessment. It is important to consider the impact of these specialist vehicles in isolation from general construction traffic as the impacts are quite different due to the need for police escorts and may require rolling road closures. This could occur overnight and would at least be programmed to avoid peak hours.

11.2.20 It is anticipated that a labour peak of up to 60 personnel on-site will occur during the busiest period of construction, including all contractors and sub-contractors.

11.2.21 Table 11.5 provides a robust summary of the predicted vehicle movements based on conservative assumptions around payloads and vehicle capacity. Therefore, the actual number of vehicles could be lower than predicted.

Table 11.5: Estimated vehicle numbers

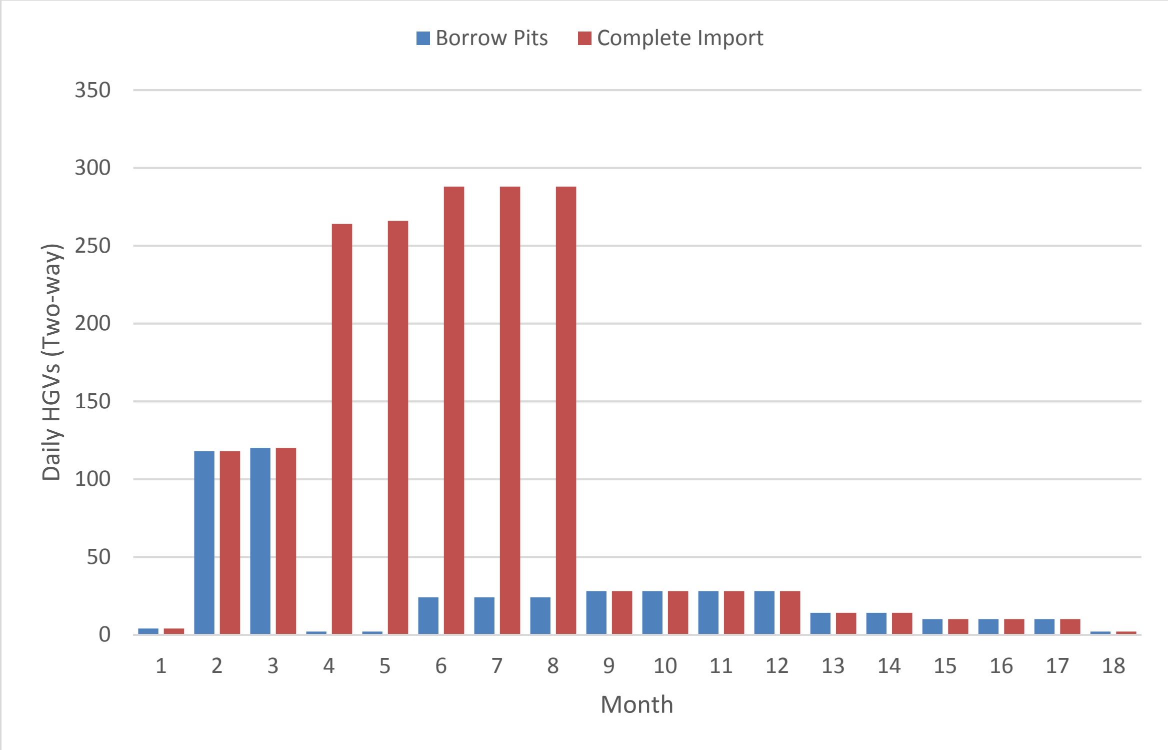
Tasks	Journeys per turbine	Average journeys (no. of turbines x journeys per turbine)	Average journeys per day
Site clearance / timber felling	N/A	N/A	1
Access track construction Partial import of stone	N/A	N/A	58
Access track construction *100% imported stone*	*N/A*	*N/A*	*131*
Turbine foundations	97	1650	11
Other traffic e.g. site huts, substation, cables, met mast, excavators, fencing	N/A	Approx.180	1
Construction workers	N/A		40
Abnormal Loads			
Turbine delivery	8	136	4

11.2.22 The volumes summarised in Table 11.5 do not necessarily occur at the same time, although some tasks do coincide. Table 2.3 provides a breakdown of the anticipated programme, which when referenced to the above volumes indicates that peak construction will occur when stone is being imported. For the realistic scenario, this will occur in months 2 and 3 of the programme with a combined peak of 120 HGVs per day (two-way movement). For the worst case scenario, this will occur when stone import coincides with timber felling and import of concrete materials, during months 6 to 8. These movements are illustrated in Figure 11.2 below.

11.2.23 In terms of routing strategy, for construction materials a large proportion of the journey would be north west on the A835 and into the proposed development site access, 1.3 km east of Loch Glascarnoch. The general traffic assignment principles, prior to this common section, are outlined below:

- Traffic arriving from Invergordon (East) - The wind turbine units will arrive at the port of Invergordon. They will then be transported along the B817 and A9, before joining the A835 at Tore, north west to the site of the proposed development.
- Traffic arriving from Inverness (South East) – It is anticipated that the most likely source for the required materials for road construction (within the proposed development) will be Inverness. From here the A9 would be utilised before connecting to the A835 at Tore.
- Traffic arriving from the South – Traffic from the south would pass through Muir of Ord. Here the A832 travels north west to join on to the A835, 2.5 km east of Contin.

Figure 11.2 – Comparison of HGV movements for realistic and 'worst case' scenarios



11.2.24 In addition, whilst a route that is not expected to be used to any great degree, traffic arriving from the west from Ullapool would take the A835 before turning right into the site entrance.

11.2.25 It has been assumed for the purposes of the assessment that the construction traffic associated with the proposed development will come from Invergordon (port-related traffic) and Inverness (all other materials and workers).

11.2.26 Although detailed calculations have been undertaken on the number of anticipated vehicles required for the proposed development, these are only estimates and may be subject to variations when a contractor is appointed and the excavation/construction methodology is refined further. These variations however are unlikely to be such that the conclusions of this assessment would alter. Furthermore, the calculations have used the upper limits of estimates to ensure a reasonable worst-case assessment is used.

11.3 Consultation undertaken

11.3.1 The scoping phase of the Environmental Impact Assessment (EIA) (May 2016) set out the proposed approach to undertaking the EIA in respect of the proposed development, including the identification of assessment methodologies for each of the assessment topic areas to be assessed. The information and advice received during the scoping process with regard to Traffic and Transport is summarised in Table 11.6 below.

Table 11.6: Consultation Responses

Date	Consultee	Summary of Issues	Section where comment addressed
Scoping opinion consultation responses			
2 August 2018	Highland Council	A Transport Statement is required Report should take account of construction and post construction traffic Proposed access to the site should be detailed on dimensioned drawings Port of entry shall be identified Routes for goods vehicles and abnormal roads shall be identified	An assessment of impacts has been undertaken within this chapter, meeting the requirements of a Transport Statement. This includes construction traffic while post-construction traffic has been scoped out of the assessment. Figure 11.1 contains a drawing illustrating the site access proposals. The construction details of this will be secured through a planning condition, as is the typical route. An assessment has been undertaken and potential constraints identified for further investigation or resolution prior to construction.
18 June 2018	Transport Scotland	Amendments to trunk road junctions should be designed in accordance with DMRB. Routes for abnormal roads shall be identified The EIA should determine the baseline traffic conditions, sensitivity of the site and any receptors, review of the proposals to determine the construction and operational requirements, and assessment of the significance of predicted impacts.	Figure 11.1 contains a drawing illustrating the site access proposals. The construction details of this will be secured through a planning condition, as is the typical route. An assessment has been undertaken and potential constraints identified for further investigation or resolution prior to construction. An assessment of impacts has been undertaken within this chapter, meeting the requirements of GEART for construction traffic, while operational traffic has been scoped out of the assessment.

11.4 Statutory and planning context

11.4.1 A summary of the statutory and planning policy context relevant to traffic and transport is identified below:-

11.4.2 Institute of Environmental Management and Assessment (IEMA) (1993). Guidelines for the Environmental Assessment of Road Traffic

- Highways Agency, (2011). Design Manual for Roads and Bridges (DMRB), Volume 11, Section 2 (Part 5, HA 205/08). Also published by: Transport Scotland, Transport Wales, The Department for Regional Development (Northern Ireland);
- Highland Council's Roads and Transport Guidelines for New Developments; and
- Transport Scotland (2012) Transport Assessment Guidance.

11.5 Existing environment

11.5.1 This section describes the baseline conditions relevant to the traffic and transport assessment, including outlining the data used and analysis undertaken.

Data Sources

11.5.2 Data sources used to inform this traffic impact assessment include:

- Ordnance Survey Base mapping
- Traffic flows taken from Department for Transport road traffic statistics for Highland Council area (2017).

Site location

11.5.3 The proposed wind farm development is located 5.8 km northwest of Garve, Highlands, on the southern side of the A835 trunk road, with the access road 600 m southeast of Aultguish Inn. The site currently forms a small part of the Strathvaich Estate.

Road network

11.5.4 The local road network consists of A roads, which link the local villages with larger towns and serve as primary routes across the region.

11.5.5 The A835 is the main road to the proposed development access; it carries around 1,300 vehicles per day in the vicinity of the site as a single carriageway trunk road, which is flanked by grass verges, with no street lighting in the vicinity of the access. The speed limit as the road passes the proposed development is National Speed Limit of 60 mph. The A835 intersects with the A9, 30 km south of the site at Tore. To the north west, the A835 continues as a trunk road to Ullapool and beyond to Ledmore.

11.5.6 As the A835 runs to the east and south of the proposed development it passes through several villages where the speed limit is reduced. At Garve the speed limit is reduced to 40 mph, and 8 km south east through Contin this is reduced to 30 mph. Here there are street lights and residential properties fronting onto the A835. From Contin the road continues as an unlit 60 mph road up to the roundabout junction with the A9 at Tore.

11.5.7 The A9 is a trunk road, which between Inverness and Tore is a dual two lane 70 mph carriageway. From here it heads north west up the coast as a single carriageway to connect to Invergordon, with a speed limit of 60 mph, and northwards to Thurso and Scrabster.

Baseline Traffic Flows

11.5.8 The baseline traffic data has been obtained from published data for Highland Council on the road sections within the study area for 2017 (source outlined in 11.5.2). The baseline traffic flows are presented in Table 11.7 and are representative of the traffic volumes along that section of road.

Table 11.7: Baseline Traffic Flows

Link Description		Annual Average Daily Flow (AADF- 24 hour flows)			
		2017 Base			
	Direction	Cars/ LGVs	HGVs	Total	%HGV
Site01 - A835 (600m west of site entrance, adjacent Aultguish Inn) E235100, N870400	Eastbound Westbound	609 581	77 82	**686** **663**	***11.2*** ***12.4***
Site02 - A835, west Tarvie E241800, N858980	Eastbound Westbound	1256 1225	116 104	**1372** **1329**	***8.5*** ***7.9***
Site03 - A835, Wester Moy E247600, N855000	Eastbound Westbound	1450 1322	187 191	**1637** **1513**	***11.4*** ***12.6***
Site04 – A9, Knockbain E260000, N855130	Northbound Southbound	4309 4348	474 481	**4783** **4829**	***9.9*** ***10.0***
Site05 – A9, Evanton E241800, N858980	Eastbound Westbound	5423 5904	485 474	**5908** **6378**	***8.2*** ***7.4***

Public Transport Accessibility

11.5.9 Given the locality of the proposed development and its primary proposed use as a wind farm, public transport is not a viable option for travelling to the site. The nearest bus stop is at Aultguish Hotel, 600 m from the site entrance, but there are only 2 buses a day running between Ullapool and Inverness. The nearest railway station is in Garve, 6.0 km away from the proposed development.

Accident and Safety

11.5.10 Accident data for the existing car park access and surrounding A835 road network to the proposed development has been obtained from Department for Transport (DfT). This accident data shows that two accidents have occurred within 1 km of the car park access since 2013. The first road traffic collision (RTC) occurred as one vehicle was hit whilst turning into the layby that will be used as the proposed development access. The other collision occurred 400 m west of the proposed development as one vehicle overtook another to the nearside and collided with that vehicle plus one further vehicle.

11.5.11 Across the wider network, construction traffic will be using existing major junctions that have been designed to appropriate standards and it is therefore unnecessary to review the road safety record of the entire route.

11.5.12 Given that there were only two accidents within a kilometre of the study area over a period of five years, the baseline accident and safety level has been assessed as 'very low'.

Future baseline

Traffic flows

11.5.13 Considering that the peak traffic generation associated with the proposed development is predicted to occur in the first year of construction, a forecast year of 2020 has been assumed. A growth factor has been obtained from TEMPro v7.2 to estimate this. The derived growth factor for daily flows equates to 1.0251, which has been applied to the recorded traffic flows to estimate forecast flows from 2017 to 2020.

Table 11.8: Future baseline (2020) traffic flows

Link Description		Annual Average Daily Flow (AADF- 24 hour flows)		
		Future 2020 Base		
	Direction	Cars/ LGVs	HGVs	Total
A835: between Site and Garve	Eastbound Westbound	624 596	79 84	**703** **680**
A835: between Garve and Contin	Eastbound Westbound	1288 1256	119 107	**1407** **1363**
A835: between Contin and Maryburgh	Eastbound Westbound	1486 1355	192 196	**1678** **1551**
A9: between Tore and Cromarty Bridge	Northbound Southbound	4417 4457	486 493	**4903** **4950**
A9: between Cromarty Bridge and Alness	Eastbound Westbound	5559 6052	497 486	**6056** **6538**

11.5.14 There are no anticipated changes to the road network, public transport services or the walking and cycling network in the future baseline scenario.

11.6 Predicted impacts

11.6.1 Analysis within this section focuses on understanding the future changes in traffic demand levels and their related environmental effects.

11.6.2 Transport related environmental effects vary over the different stages of the life of the proposed development. This section will provide the details regarding the trip generation from the proposed development during construction to enable the extent of the impact from the worst case scenario to be considered.

11.6.3 The net change in traffic on the road sections within the study area has been estimated for the construction traffic to determine the need for detailed assessment of the traffic impacts.

Impacts during construction

11.6.4 Table 11.9 compares the '2020 baseline traffic' with the '2020 baseline + peak construction traffic' for the realistic scenario by testing the net increase in total flows and

HGV flows against the IEA criteria. The figures in brackets provide a comparison of the impacts for the worst case scenario.

Table 11.9: Comparison of '2020 base' with '2020 base + construction' traffic flows

Link Description	AADT Total Vehicles			AADT HGVs			Assess Link
	2020 Base	2020 Base + const. traffic	Change	2020 Base	2020 Base + const. traffic	Change	
A835: between Site and Garve	1383	1583 (1951)	15% (23%)	163	283 (571)	74% (102%)	Yes
A835: between Garve and Contin	2769	2969 (3337)	7% (12%)	226	346 (634)	53% (83%)	Yes
A835: between Contin and Maryburgh	3229	3429 (3797)	6% (11%)	387	507 (795)	31% (57%)	Yes
A9: between Tore and Cromarty Bridge	9853	9863 (9886)	0.1% (0.2%)	979	989 (1012)	1% (2%)	No
A9: between Cromarty Bridge and Alness	12594	12604 (12627)	0.1% (0.2%)	983	993 (1016)	1% (2%)	No

11.6.5 As demonstrated by Table 11.9, all three sections of the A835 would need to be assessed in greater detail since the HGV flows on each of these road sections exceed the 30% threshold set out by the IEA guidelines for both the realistic and worst case scenarios. However, since the net change in vehicle flows on the two sections of the A9 is less than 1%, with only a 2% change in HGV flow, no further assessment of these links has been carried out.

11.6.6 The assessment of significance in relation to the three sections of the A835 is addressed further below in respect of the key environmental effects identified in Table 11.2 above.

Severance

11.6.7 Pedestrian severance has been assessed by reviewing the change in net traffic flows. Table 11.10 summarises the magnitude of change, sensitivity of the road sections under consideration and the significance of the effect during construction for the realistic scenario. The figures and results in brackets represent where these differ for the worst case scenario.

11.6.8 The three road sections assessed were adjudged to have negligible sensitivity to changes in severance, due to the very low pedestrian demand.

Table 11.10: Assessment of severance – peak construction 2020

Link Reference						2020 Assessment	
	Baseline (2020) AADT	2020 With const. AADT	2020 %age Change	2020 magnitude of change	2020 Sensitivity Level	Criteria / Comments	Significance
A835: between Site and Garve	1383	1583 (1951)	15% (23%)	Negligible	Negligible	Very low pedestrian demand	Negligible
A835: between Garve and Contin	2769	2969 (3337)	7% (12%)	Negligible	Negligible	Very low pedestrian demand	Negligible
A835: between Contin and Maryburgh	3229	3429 (3797)	6% (11%)	Negligible	Negligible	Very low pedestrian demand	Negligible

11.6.9 The potential changes in the volume, composition and speed of traffic as a result of additional traffic from the proposed development are such that they are very unlikely to affect the ability of people to cross roads that will be used by project traffic.

11.6.10 In terms of an overall assessment, there is likely to be a **negligible** significance on all links identified.

Driver stress and delay

11.6.11 Table 11.11 summarises the predicted driver stress and delay magnitude of change, sensitivity of the road sections under consideration and the significance of the effect for the realistic scenario. The figures and results in brackets represent where these differ for the worst case scenario.

11.6.12 The traffic assessment represents a worst-case scenario of the likely effects of traffic upon the local road network. Applying the trip distribution, described above, to the maximum predicted daily two-way traffic identified in Table 11.8, could potentially result in the following development related hourly two-way trips on the local road network during the construction of the proposed development.

Table 11.11: Assessment of driver stress and delay

Link Description	Average hourly Construction Traffic (Two way*)			2020 Sensitivity	2020 Assessment
	LGVs	HGVs	Total	Level	Significance
A835: between Site and Garve	8 (8)	12 (29)	20 (37)	Negligible	Negligible
A835: between Garve and Contin	8 (8)	12 (29)	20 (37)	Negligible	Negligible

Link Description	Average hourly Construction Traffic (Two way*)			2020 Sensitivity	2020 Assessment
	LGVs	HGVs	Total	Level	Significance
A835: between Contin and Maryburgh	8 (8)	12 (29)	20 (37)	Negligible	Negligible
* The figures have been approximated to the nearest even number to account for rounding up/down					

11.6.13 The average hourly construction related two-way trips set out in Table 11.9 demonstrates that the scale of magnitude of these trips is not significant enough to have any material impact on the operational capacity of the local road network. The capacities of all roads in this routeing strategy have been visually observed and are considered to be operating comfortably within their theoretical capacity. Therefore, a small increase in traffic volumes due to general construction traffic is unlikely to add any material delay to existing drivers and will be of negligible magnitude. However, it is acknowledged that during delivery of abnormal loads, which will occur infrequently, be planned and advance warning given, these movements are likely to cause reasonable delay to drivers and will be of large magnitude.

11.6.14 The sensitivity of these two road sections is considered to be negligible on account of their lightly trafficked nature. In terms of an overall assessment, there is likely to be a very temporary effect on driver stress and delay of **negligible adverse** significance.

Pedestrian delay and amenity

11.6.15 Table 11.12 summarises the predicted magnitude of change, sensitivity of the roads under consideration and the significance of the effect for the realistic scenario. The figures and results in brackets represent where these differ for the worst-case scenario.

11.6.16 The table demonstrates that the magnitude of change in HGVs is small or negligible for the realistic scenario, increasing to medium closest to the site for the worst-case scenario. The sensitivity of each road section is considered to be low on account of them being lightly trafficked local access roads with little or no pedestrian demand.

Table 11.12: Assessment of pedestrian amenity and delay

Link Reference	2020 Percentage Change (AADT)		2020 magnitude of change (HGVs)	2020 Sensitivity	2020 Assessment
	Total Vehicles	HGVs		Level	Significance
A835: between Site and Garve	15%	74% (102%)	Small (Medium)	Low	Negligible (Minor)
A835: between Garve and Contin	7%	53% (83%)	Small (Small)	Low	Negligible
A835: between	6%	31% (57%)	Negligible (Small)	Low	Negligible

Link Reference	2020 Percentage Change (AADT)		2020 magnitude of change (HGVs)	2020 Sensitivity	2020 Assessment
	Total Vehicles	HGVs		Level	Significance
Contin and Maryburgh					

11.6.17 In terms of an overall assessment, there is likely to be a temporary effect on pedestrian amenity and delay of **negligible adverse** significance on all links identified for the realistic scenario while the section of the A835 closest to the site access will experience a **minor adverse** significance for the worst case scenario.

Fear and intimidation

11.6.18 Table 11.13 summarises the magnitude, sensitivity of the roads under consideration and the significance of the effect.

11.6.19 The table demonstrates that the magnitude of all vehicles is negligible (less than 600 per hour) and of HGVs is negligible (less than 1,000 per day) on all three sections considered. The sensitivity of each site is considered to be low on account of them being lightly trafficked local access roads with little or no pedestrian demand.

Table 11.13: Assessment of fear and intimidation

Link Reference	2020 Vehicle Flows (AADT)		2020 magnitude	2020 Sensitivity	2020 Assessment
	Total Vehicles	HGVs		Level	Significance
A835: between Site and Garve	156 (195) (hourly)	283 (571) (daily)	Negligible	Low	Negligible
A835: between Garve and Contin	297 (334) (hourly)	346 (634) (daily)	Negligible	Low	Negligible
A835: between Contin and Maryburgh	343 (380) (hourly)	507 (795) (daily)	Negligible	Low	Negligible

11.6.20 In terms of an overall assessment, there is likely to be a temporary effect on fear and intimidation of **negligible adverse** significance on all links identified.

Accidents and road safety

11.6.21 An increase, or decrease, in accidents may result from changes in traffic flows and the composition of traffic on the local road network. However, analysis has shown that existing levels of Personal Injury Accidents (PIAs) recorded during the last five years is low on the traffic routes to the proposed development. It is unlikely that the number of PIAs will increase as a result of the construction of the proposed development as the access has been designed to appropriate standards and achieves visibility splays in excess of the minimum requirements. Therefore, the effect of the predicted levels in construction traffic on accidents and road safety would be **negligible adverse**.

11.7 Mitigation

11.7.1 A Traffic Management Plan (TMP) identifying how traffic will be managed throughout the duration of the construction period, including potential mitigation measures, will be produced pre-commencement of the development by the Contractor operating the site.

11.7.2 The TMP will define and secure the prescribed routes for HGV access, as outlined above, to ensure that such vehicles only use approved routes to arrive at and leave the site. The TMP would also include measures adopted by the Contractor, such as signage, wheel washing facilities and any temporary access arrangements.

11.8 Summary of effects

11.8.1 Following mitigation measures, there are only negligible residual effects remaining.

11.9 Cumulative effects

11.9.1 The only other project identified likely to have a cumulative effect with the proposed development is the Western Isles Interconnector. This project proposes to construct an HVDC cable route along the route of the A835 in proximity to the proposed site access. The current proposals are to bury the cable within the carriageway and will therefore require the closure of one lane for a section at a time with associated traffic management.

11.9.2 There are no details available in relation to the likely traffic movements associated with these works, although based on the author's experience of such projects, it is unlikely that the construction traffic volumes will result in a significant effect on roads outside of the works. Therefore, the cumulative effect of the Western Isles project on the A9 is expected to have negligible significance.

11.9.3 Along the A835 where carriageway works are being undertaken, the proposed traffic management is expected to have a minor (assuming a single working front) or moderate (assuming multiple working fronts) significance on existing users due to the additional delay incurred. The timing of these works is likely to have a cumulative effect with the proposed development as construction traffic is likely to have to travel through the traffic management area to reach the site access.

11.10 References

Highland Council area 2017 AADF. Available at: <https://www.dft.gov.uk/traffic-counts/area.php?region=Scotland&la=Highland>

12 AVIATION, RADAR AND TELECOMMUNICATIONS

12.1 Introduction

12.1.1 The assessments of potential effects on aviation, radar and telecommunications consider technical and operational acceptability rather than following a strict EIA process of assessing the significance of effects based upon a scaled quantification of magnitude and sensitivity and their interaction. Such effects may require the implementation of operational and/or technical mitigation solutions to ensure continued operation in the presence of a wind farm. The assessment of effects on these receptors is therefore one of technical and operational analysis and consultation.

12.2 Scope and methodology

Obtaining Baseline Information

Aviation and radar

12.2.1 Information on potentially affected aviation and radar facilities has been gathered from the UK Aeronautical Information Publication and the UK Military Aeronautical Information Publication, radar visibility maps published by NERL (NATS En Route) Ltd and on the RESTATS website, and published aeronautical charts and airfield guides.

12.2.2 The study areas selected for this assessment have been based on identifying:

- Air traffic control and air defence radars within 125km of the project area;
- Meteorological Office radars within 30km of the project area;
- Licensed and government aerodromes within 30km of the project area;
- Unlicensed aerodromes within 10km of the project area;
- Aeronautical radio navigation and radio communication facilities within 20km of the project area; and
- The features of the military low flying system in the vicinity of the project area.

Telecommunications

12.2.3 Information on potentially affected microwave fixed links has been gathered through consultations with Spectrum Licensing (Ofcom) and through following correspondence with identified link operators.

Assessing Potential Effects

Aviation and radar

12.2.4 The approach outlined below has been followed to assess likely significant effects, identify mitigation measures, and assess likely residual effects:

- Identification of potential aviation receptors
- For potentially affected radars, assessment of whether the proposed turbines would be within radar line of sight

- Where radars are predicted to have line of sight, assessment of the operational significance of the appearance of the turbines on that radar, taking account of airspace structure and classification, traffic mix and density, types of air traffic services provided and availability of other radar services
- For aerodromes in the vicinity, assessment of whether the turbines would infringe any obstacle limitation surfaces, affect instrument flight procedures or pose a hazard to aircraft operations, and the operational significance of any such impacts
- For aeronautical radio navigation and communications systems, assessment of the likelihood of signals being degraded by the proposed development
- Assessment of the location of the proposed development relative to features of the military low flying system that might lead to constraints on low flying aircraft
- Consultation with all relevant aviation stakeholders
- Identification of appropriate mitigation measures
- Prediction of residual effects based on baseline information, proposed development details and mitigation measures
- Assessment of potential cumulative effects

Telecommunications

12.2.5 For assessment of impacts on microwave fixed links, the methodology established by Bacon (2002) has been applied.

Significance Criteria

Aviation and radar

12.2.6 Specific significance criteria for the assessment of aviation impacts have not been adopted. The assessment follows the CAA guidance in CAP 764 and professional judgement to determine whether the residual impacts are considered to be significant in terms of the EIA Regulations.

Telecommunications

12.2.7 Specific significance criteria for the assessment of telecommunication impacts have not been adopted. The Applicant has been led in terms of acceptability of impacts (and mitigation) by individual link operators.

12.3 Consultation undertaken

12.3.1 Details of consultation undertaken are included in the Consultation Matrix in Appendix 3.3. A summary is provided below.

Aviation and radar

12.3.2 Initial project information was submitted to Highlands and Islands Airports Limited's (HIAL's) Operations Manager on 19th February 2018. A pro-forma pre-planning consultation was also submitted to the Defence Infrastructure Organisation ('DIO'), on behalf of the MOD, on 16th February 2018.

12.3.3 HIAL, DIO and NERL were all consulted as part of the formal EIA Scoping Request carried out by the Energy Consents Unit (ECU) of the Scottish Government, each returning a conclusion of “no objection” to the proposal, subject to the inclusion of an aviation lighting scheme (to be agreed).

12.3.4 DIO also state the following that, if planning permission is granted, they would require to be advised prior to the commencement of construction of:

- The date construction starts and ends;
- The maximum height of construction equipment; and
- The latitude and longitude of every turbine.

Telecommunications

12.3.5 Further to consultation to identify potentially affected operators with Ofcom, the applicant has had ongoing correspondence with the relevant organisations.

12.4 Statutory and planning context

Aviation and radar

12.4.1 Scottish Planning Policy (SPP) indicates that impacts on aviation and defence interests should be taken into account by proposals for energy infrastructure. The Onshore Wind Policy Statement (OWPS) highlights civil and military aviation radar as ‘potential barriers to deployment’ where the Scottish Government is committed to working with aviation interests to facilitate mitigation and acceptance of further development.

12.4.2 Article 223 of Air Navigation Order 2016 (CAP 363) specifies the requirement for lighting of wind turbine generators in the United Kingdom. CAA policy statements (April 2010, June 2017) detail the application of the CAP 363 requirement. More recent International Civil Aviation Organization (‘ICAO’) Annex 14: Volume 1 (8^{th} Edition, November 2018) provides international standards for visual aids for denoting obstacles, including wind turbines, at its chapter 6.

12.4.3 Highland-wide Local Development Plan (HwLDP) policy 67 (‘Renewable Energy Developments’) establishes that the Council will have regard to any significant effects on “*the safe use of airport, defence or emergency service operations, including flight activity, navigation and surveillance systems and associated infrastructure, or on aircraft flight paths or MoD low-flying areas*”.

12.4.4 The Council’s Onshore Wind Supplementary Guidance (OWSG) states that “all proposals should seek to avoid significant adverse effects, individually and cumulative, on airport, defence or emergency service operations”, with reference to be given to a range of published safeguarding information sources.

Telecommunications

12.4.5 SPP indicates that impacts on telecommunications and broadcasting installations should be taken into account by proposals for energy infrastructure.

12.4.6 Planning Advice Note (PAN) 62 considers disruption to radio systems caused by large structures due to the obstruction and reflection of signals. It advises that planning permission can be granted for such structures subject to a planning condition that, prior to development, the developers proposes measures to maintain the quality of reception by systems potentially affected by the proposal.

12.4.7 HwLDP policy 67 establishes that the Council will have regard to "*other communication installations or the quality of radio of TV reception*". OWSG states that developments shall be assessed by consultation with relevant operators, and that planning conditions or legal agreements may require developers to correct any electromagnetic interference at their own expense.

12.5 Existing environment

Aviation and radar

12.5.1 The following section outlines the baseline information obtained through desk studies and consultation.

12.5.2 The following aviation and radar facilities have been identified within the study areas set out in para 12.2.2 above:

- Inverness Airport (primary surveillance radar)
- RAF Lossiemouth (primary surveillance radar)
- Low Flying Area 14(T) (low flying system)

12.5.3 Radar visibility analysis, shared with HIAL in consultation, indicates that Inverness Airports radar's base of visibility over the project area would be significantly above the maximum elevation of turbines.

12.5.4 MoD published radar visibility maps indicate no visibility above the project area.

12.5.5 Whilst the project area lies within the extents of a 'High Priority' low flying area, DIO's consultation response confirms that they would have no objections to the proposed development, subject to the inclusion of aviation lighting.

Telecommunications

12.5.6 Two operating fixed communication links pass on the same route through the development site between two existing masts: one end on the north side of Loch Glascarnoch, the other at Meall Ruighe an Fhirich to the east of Garve.

12.6 Predicted impacts

Aviation and radar

12.6.1 The DIO's consultation response indicates their primary safeguarding concern to relate to the potential to create a physical obstruction to air traffic movements.

Telecommunications

12.6.2 Based on the final turbine layout and dimensions, both identified links would be operationally adversely impacted.

12.7 Mitigation

Aviation and radar

12.7.1 The application of an Aviation Lighting Scheme, to be agreed by planning condition with all relevant aviation stakeholders including the CAA, DIO and Highland Council, is considered likely to remove all concerns. Visual impacts arising from such lighting are addressed separately in Chapter 4: Landscape and Visual Impacts, in relation to which an indicative Cardinal Lighting Scheme is illustrated at Figure 12.1.

12.7.2 Pre-construction notifications will also be made to all relevant aviation stakeholders, including DIO and CAA.

Telecommunications

12.7.3 Agreement has been reached with the two relevant fixed-link operators to mitigate via re-routing. Due to the sensitive operational and commercial nature, further information can only be provided confidentially and by express agreement by the relevant operators.

12.8 Summary of effects

12.8.1 In view of the identified mitigation measures, there would be no residual significant effects in EIA terms in respect of either aviation and radar or telecommunication interest from the proposed development.

12.9 References

Bacon, DF (2002), 'A proposed method for establishing an exclusion zone around a terrestrial fixed radio link outside of which a wind turbine will cause negligible degradation of the radio link performance', accessed from https://www.ofcom.org.uk/__data/assets/pdf_file/0031/68827/windfarmdavidbacon.pdf 20 December 2018

13 CLIMATE CHANGE MITIGATION

13.1 Introduction

13.1.1 This chapter quantifies and assesses the significance of greenhouse gas (GHG) emissions and GHG savings that will result from the construction, operation and subsequent decommissioning and site restoration work associated with the proposed development.

13.1.2 A key benefit of wind energy (in common with other renewable energy technologies) is the generation of zero carbon electricity. This contrasts with electricity generated from fossil fuels such as gas which gives rise to significant GHG emissions.

13.1.3 Operating wind farms achieve GHG savings by reducing the consumption of fossil fuel generated mains electricity. During their construction and decommissioning, however, wind farms can themselves result in GHG emissions, for example from turbine manufacture and site preparation. This is particularly the case where natural carbon stores such as forestry and/or peat are present and potentially impacted by the development.

13.1.4 An area of slow growing mixed plantation woodland is located along the eastern fringe of the project area, and peat surveys have established the presence of peat deposits within the project area. Where peat or carbon-rich soils are present, Scottish Environmental Protection Agency (SEPA) requires planning applications for onshore wind farms to include a systematic assessment of the likely effects to these features.

13.1.5 This requirement accords with the EIA Directive (as amended) which requires direct and indirect effects of development projects on climate (Article 3) and climatic factors (Annex IV) to be considered.

13.2 Scope and methodology

13.2.1 A detailed assessment of the proposals will be carried out using the latest version (currently v1.4.0) of SEPA's web-based Carbon Calculator Tool. This tool calculates payback time for onshore windfarms sited on peatlands using methods given in Nayak *et al* (2008) and revised equations for GHG emissions (Nayak *et al,* 2010). It enables carbon losses and carbon savings to be quantified across the project lifecycle stages (construction, operation and decommissioning / site restoration). Such losses and savings are combined to establish the overall (net) carbon effect of the proposals, as well as the *'carbon payback period'* - being the period of time from the commencement of windfarm operations at which carbon losses during construction are offset by operational carbon savings.

13.2.2 Results from the above assessment are reported in this Climate Change Mitigation chapter of the EIA report in accordance with IEMA's 2017 guidance publication Assessing Greenhouse Gas Emissions and Evaluating their Significance in EIA.

13.3 Consultation undertaken

13.3.1 No consultation has been undertaken in relation to potential climate change mitigation issues beyond the Pre-Application Advice and EIA Scoping process as summarised below.

The Highland Council Pre-Application Advice Pack (Ref. No: 18/00618/PREAPP) 1st May 2018

Impacts on peat, peatland habitats and carbon-rich soils

13.3.2 The Pre-application Advice Pack issued on the proposals by The Highland Council includes sections on potential carbon / peat impacts from the development proposals, as follows:

13.3.3 "The proposed development site includes these areas, the importance of which has been identified in Scottish Planning Policy (SPP). An assessment of the impact of this proposal on this resource should be made and the EIA Report should contain details of any mitigation measures which have been incorporated to ensure the protection of the carbon rich soils, deep peat and priority peatland habitats. The assessment should consider and if necessary quantify any loss of this resource and any impacts on the functioning of the habitats associated with it. In addition an assessment of the impacts should be made using a carbon calculator details of which can be found on Scottish Government website at *http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings*."

Scoping Opinion

13.3.4 The Scottish Government Energy Consents Unit's Kirkan Wind Scoping Opinion restates the above Pre-Application Advice recommendations in respect of that the EIA report contains a detailed assessment of potential carbon impacts from the peatland, including carrying out a peat depth survey and peat stability assessment to determine the location of infrastructure.

13.4 Statutory and planning context

National

The Climate Change (Scotland) Act 2009

13.4.1 The Climate Change (Scotland) Act 2009 sets a target of reducing GHG emissions by at least 80% by 2050 relative to the baseline year of 1990, and with an interim target of reducing emissions by at least 42% by 2020.

Scottish Planning Policy (SPP)

13.4.2 The Scottish Planning Policy (SPP) sets out how The Climate Change (Scotland) Act 2009 should be delivered on the ground. The SPP states that, "By seizing opportunities to encourage mitigation and adaptation measures, planning can support the transformational change required to meet emission reduction targets and influence climate change." (para 19, SPP).

13.4.3 SPP states (para 205) that, where peat and other carbon rich soils are present, applicants should assess the likely effects of development on carbon dioxide (CO_2) emissions. Where peatland is drained or otherwise disturbed, there is liable to be a release of CO_2 to the atmosphere. Developments should aim to minimise this release.

Good Practice During Wind Farm Construction, Scottish Natural Heritage (2015)

13.4.4 Scottish Natural Heritage's Good Practice During Wind Farm Construction guidance recognises that one of the key aims of wind farm development is to reduce carbon emissions, but that wind farm developments, through the materials used, the construction processes employed and the potential emissions from disturbed soils and habitats, do result in carbon emissions.

13.4.5 The guidance recognises that, in some circumstances, the carbon payback of wind farm development could be significantly affected by the construction methods used and the degree of restoration of the site. This guidance seeks to ensure that good practice is adopted to reduce the carbon emissions associated with wind farm development.

13.4.6 The Good Practice approach to development on peat and carbon savings recommended by this guidance can be summarised as follows:

- Conduct a detailed peat survey;
- Where possible position site infrastructure in areas of shallower peat or design an appropriate engineering solution to avoid and/or minimise excavation of peat (for example floating roads and piling solutions);
- Minimise the detriment to peat if excavation cannot be fully avoided;
- Avoid or reduce peat displacement from the development of borrow pits;
- Excavations should be prevented from drying out or desiccating as far as possible. Consideration should also be given to spraying with water;
- If stockpiling peat assess the potential loading effects for peat slide risk;
- The peat should be restored as soon as possible after disturbance;
- Consider cable trenching operations and timings;
- Floating roads should be used in areas of deeper peat;
- Minimise plant movements and haul distances in relation to any earthworks activities including peat management; and
- Developers should take ancillary opportunities to improve habitats.

Local

Highland-Wide Local Development Plan (April 2012)

13.4.7 The Highland-Wide Local Development Plan (April 2012) recognises (para 20.27.2) the importance of the conservation of peat lands as carbon sinks in addition to their nature conservation and archaeological interests.

13.4.8 Local Plan Policy 55 "Peat and Soils" states "Development proposals should demonstrate how they have avoided unnecessary disturbance, degradation or erosion of peat and soils. Unacceptable disturbance of peat will not be permitted unless it is shown that the adverse effects of such disturbance are clearly outweighed by social, environmental or economic benefits arising from the development proposal. Where development on peat is clearly demonstrated to be unavoidable then The Council may ask for a peatland management plan to be submitted which clearly demonstrates how impacts have been minimised and mitigated. New areas of commercial peat extraction will not be supported unless it can be shown that it is an area of degraded peatland which is clearly demonstrated to have been significantly damaged by human activity and has low conservation value and as a result restoration is not possible. Proposals must also demonstrate to the Council's satisfaction that extraction would not adversely affect the integrity of nearby Natura sites containing areas of peatland."

Onshore Wind Energy Supplementary Guidance

13.4.9 The Highland Council's Onshore Wind Energy Supplementary Guidance (November 2016) sets out how Highland Council will manage onshore wind energy development proposals in line with Section 22 of the Town and Country Planning (Scotland) Act 1997 as amended by the Planning etc. (Scotland) Act 2006.

13.5 Existing environment

13.5.1 Baseline environment conditions in relation to potential climate change impacts from the proposed development include existing carbon stores in the project area (such as peat and forestry) that could be impacted by the proposed development, resulting in greenhouse gas (GHG) emissions.

Peat

13.5.2 The proposed development is a 17 turbine wind farm, with a total generating capacity in excess of 50 MW. Each turbine will be able to generate approximately up to 4.8 MW of electricity. The project area is located on Strathvaich Estate, which sits within the Garve District of the Ross & Cromarty region of the Highlands. The project area comprises of moorland, areas of wet heath, and areas of poorly established woodland.

13.5.3 Initial peat depth surveying was undertaken by Quadrat Scotland Ltd in 2014 and 2016, with additional surveying carried out by Avian Ecology in July 2018. A subsequent phase of peat depth surveying was undertaken by RSK In October and November 2018, as seen in Appendix 9.1. The survey focussed on likely development areas and included proposed turbine locations, access tracks, proposed borrow pit, hardstanding areas, and cable runs.

13.5.4 The survey has established that the project area has varied peat depths. Most areas of deep peat (>2m depth) are small confined pockets with occasional larger bowl areas and are not extensive. The peat depth survey indicated that just over half of the scoping area has no peat, with 57% of the measured locations having topsoil or peaty soil cover up to 0.5 m deep.

13.5.5 The proposed locations for the turbines and associated infrastructure takes cognisance of peat depth, ensuring that areas of deep peat have been avoided where possible. Borrow pits would be located on areas which are currently craggy outcrops, thus avoiding areas of peat.

13.5.6 The main sources of past and current impacts regarding carbon balance in the proposed development arise from drainage by watercourses and erosion gullies.

Forestry

13.5.7 As described within the Forestry Technical Appendix (Appendix 2.1), the north-east part of the project area contains a 52.53 hectare area of forest planting, established in 1990. The land has been ploughed to facilitate planting and appropriate drainage for the trees. However, growth has been slow with trees rarely exceeding 5m in height.

13.5.8 Seven of the proposed turbines, as well as one permanent met mast, the substation compound and prospective battery energy storage facility area, and one borrow pit are located within the area of forestry. A total area of 16.6 hectares will be felled to facilitate construction. Where required, however, sufficient land will be made available within the wider Strathvaich Estate for compensatory planting.

Summary

13.5.9 Regarding the existing environment, the greatest potential for carbon emissions will relate to direct or indirect impacts to the peat and forestry that are present during the installation of the wind turbines and associated infrastructure such as foundations, access tracks, borrow pits, and hardstanding areas.

13.6 Predicted impacts

13.6.1 The results of the carbon balance assessment carried out for the proposed development are presented below for each project stage.

Construction and decommissioning

13.6.2 Table 13.1 presents the results of the carbon balance assessment for the construction and decommissioning stages of the proposed development. Any post-decommissioning site restoration and enhancement work, such as blocking of drainage ditches to promote re-wetting or tree planting will be agreed with Scottish Natural Heritage in due course (see Appendix 6.6 Outline Habitat Management Plan). These kinds of activities have the potential for significant carbon savings by promoting the growth of natural carbon stores such as forestry and peat.

Table 13.1 Predicted GHG losses and savings from wind farm construction and decommissioning

Source of GHG Emissions/Savings	GHG Emissions (tCO2e)
Construction	
Turbine manufacture, construction and decommissioning	71,777
Back-up	49,322
Reduced carbon fixing potential	769
Loss of soil organic matter	14,701
Leaching of Dissolved Oxygen Content (DOC) and Portable Oxygen Content (POC)	26
Forestry felling	6,574
GHG Emissions Sub Total	143,169
Decommissioning	

Source of GHG Emissions/Savings	GHG Emissions (tCO2e)
Improvement of degraded bogs	-313
Improvement of felled forestry	-111
Restoration of borrow pits	0
Removal of drainage from foundations and hardstanding	-18
GHG Savings Sub-total	-442
Total	**142,727**

13.6.3 Table 13.1 shows that total carbon emissions of 142,727 tCO_2e are predicted from construction of the proposed development, with the manufacture of the turbines themselves being the single largest source of emissions.

13.6.4 The project is committed to undertaking compensatory planting within the wider Strathvaich Estate (see Appendix 2.1 Forestry) as required under the FCS *Control of Woodland Removal Policy* (2009) in order to achieve no net loss of forestry. The location and type of planting will be agreed with Scottish Natural Heritage and Forestry Commission Scotland in due course. As there is no agreement yet in place, the carbon balance assessment takes a worst-case assumption in that no planting work will be undertaken. Therefore, minimal carbon savings are predicted from the decommissioning phase.

13.6.5 The project is also committed to undertaking post-construction habitat restoration and enhancement work (see Appendix 6.6 Outline Habitat Management Plan. Minimum, maximum and expected areas have been identified and calculated (see Figure 1 in Appendix 6.6) and included in the Carbon Calculator in Appendix 13.1.

Operation

13.6.6 The operational stage of the proposed development has the greatest potential for GHG savings, and therefore for beneficial climate change impacts. At this stage GHG emissions from construction activities have ceased, and the operation of turbines will generate zero carbon electricity for their 30-year lifespan.

13.6.7 Table 13.2 presents the annual carbon savings that are predicted for the proposed development, as measures against the 'fossil fuel mix' of grid electricity.

Table 13.2: Expected annual GHG savings from wind farm operation (against a 'fossil fuel mix' of electricity)

Source of GHG Savings	GHG Savings (tCO_2e)
Wind farm operation	101,933
Total CO_2 savings per year	101,933

Carbon Payback Period

13.6.8 Dividing the net carbon emissions predicted for the construction and decommissioning stages (142,727 tCO_2e) by the predicted annual carbon savings from wind farm operation (101,933 tCO_2e) gives a predicted carbon payback period of 1.4 years. Therefore, net carbon emissions from the construction and decommissioning are predicted to be offset by carbon savings from the proposed development's development within 1.4 years of it becoming operational.

13.6.9 As stated above, should be noted that the carbon savings from post-decommissioning compensatory tree planting have been excluded from the calculations.

Net GHG Effect

13.6.10 The proposed wind farm has an operational life span of 30 years and will, therefore, continue to deliver GHG emissions savings once the 1.4 year carbon payback period is reached. Total carbon emissions savings over the proposed development's lifetime of circa 3,057,990 tCO_2eq may be expected.

Cumulative effects

13.6.11 Cumulative effects have been described as "the incremental effects of an action when added to the effect of past, present and reasonably foreseeable future actions. Cumulative effects result from individually minor but collectively significant actions taking place over a period of time." (European Commission, 2013).

13.6.12 Inter-project effects are the impacts from other planned or potential developments, together with the proposed development which individually may be insignificant, but when considered together could be considered to have a significant cumulative impact.

13.6.13 The proposed development is adjacent to two existing wind farm developments – Corriemoillie Wind Farm, Lochluichart Wind Farm and its operational extension.

13.6.14 A further extension to Lochluichart Wind Farm has been proposed (the Lochluichart Wind Farm Extension II). The proposal would see the erection of a further 8 wind turbines and associated infrastructure to the west of the proposed Kirkan Wind Farm development.

13.6.15 The cumulative effects from these existing and potential surrounding wind farm developments would be positive relating to climate change and carbon emissions. Although carbon rich peat will be lost from the area, the nature of the developments sees a total carbon emissions savings from offsetting a 'fossil fuel mix' of electricity. Therefore, the GHG savings would outweigh losses from construction, including the disturbance and removal of peat and forestry.

13.7 Mitigation

13.7.1 A key form of embedded mitigation is avoiding construction activities within areas of deep peat. A peat stability assessment and peat depth survey have been undertaken to identify the areas of deep and/or unstable peat (Appendix 9.1). The location of turbines and associated infrastructure takes cognisance of these studies, resulting in appropriate positioning in areas of shallow peat where possible.

13.7.2 Management of excavated peat is also an important mitigation method. Any excavated peat would be carefully handled and treated in order to minimise drying and the loss of carbon to the atmosphere. Peat handling would comply with SEPA's Regulatory Position Statement for Developments on Peat (2010), as well as current good practice prepared by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland and Historic Environment Scotland (2015).

13.7.3 Beyond the compensatory tree planting committed to (see Appendix 2.1) further mitigation measures will also be incorporated as part of post-construction peatland habitat restoration and enhancement of the project area (see Appendix 6.6). These additional measures are to be developed and agreed with Scottish Natural Heritage in due course, meaning that they have not been factored into this carbon balance assessment.

13.7.4 The substantial carbon savings that are predicted from operating the proposed development represents a climate change mitigation method itself. This is one of the key benefits of the proposed development.

Mitigating cumulative effects

13.7.5 The cumulative impacts relating to climate change and GHG emissions would be positive over a long-term time frame, as indicated in section 13.6.8. As such, cumulative effects do not require any additional mitigation.

13.8 Summary of effects

13.8.1 Carbon emissions are predicted to arise from the construction and decommissioning activities, particularly turbine manufacturing, loss of peat, and loss of forestry from the construction of turbines and associated infrastructure.

13.8.2 GHG savings are predicted from post-construction project area restoration, including the restoration of borrow pits, blocking gullies and compensatory planting. However, these restoration methods are not taken into account in the carbon assessment as they are yet to be agreed, resulting in a worst-case scenario being calculated in terms of carbon payback.

13.8.3 However, these GHG emissions are predicted to be offset 1.4 years after the proposed development becomes operational (against a 'fossil fuel' grid mix of electricity). The development is predicted to deliver total GHG savings of 3,057,990 tonnes CO_2e over its lifespan.

13.8.4 The overall GHG impact is considered to represent a significant beneficial and long-term climate change impact.

13.9 References

A new approach to calculate the impact of wind farm developments on the soil carbon stocks held in peats; Nayak et al; Institute of Biological & Environmental Sciences, University of Aberdeen and Macaulay Land Use Research Institute; June 2008 [http://www.gov.scot/Publications/2008/06/25114657/0].

Assessing Greenhouse Gas Emissions and Evaluating their Significance in EIA; Institute of Environmental Management & Assessment; May 2017.

Good Practice during Wind Farm Construction; A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland, and Historic Environment Scotland. 2015. <Available online at: https://www.nature.scot/sites/default/files/2017-07/A1168678%20-%20Good%20Practice%20during%20Wind%20Farm%20construction%20-%20Sept%202015.pdf>

Good Practice During Wind Farm Construction; Scottish Natural Heritage; Version 3 September 2015.

Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment; European Commission, European Union, 2013. <Available online at: http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf>

The Highland-Wide Local Development Plan; The Highland Council; April 2012

Onshore Wind Energy Supplementary Guidance; The Highland Council; November 2016.

Pre-Application Advice Pack (Reference 18/00618/PREAPP); The Highland Council; 1st May 2018.

Scoping Opinion On Behalf Of Scottish Ministers Under Part 4 Of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; Kirkan Wind Farm Electricity Generating Station – Kirkan Wind Farm Limited; The Scottish Government Energy Consents Unit; 10th July 2018

The Scottish Government's Policy on Control of Woodland Removal; Forestry Commission Scotland; 2009. <Available online at: https://www.forestry.gov.uk/PDF/fcfc125.pdf/$FILE/fcfc125.pdf>

Scottish Planning Policy; Scottish Government; 2014.

SEPA Regulatory Position Statement – Developments on Peat; SEPA National Waste Policy Unit; 2010. <Available online at: https://www.sepa.org.uk/media/143822/peat_position_statement.pdf>

The Climate Change (Scotland) Act 2009; HMSO; 2010.

Town and Country Planning (Scotland) Act 1997.

Volume 4 Special Volume: Wind Farms on Peatland (2008-2010): Article 9; Calculating carbon budgets of wind farms on Scottish peatlands; Nayak et al; published online: 29th April 2010 [http://mires-and-peat.net/pages/volumes/map04/map0409.php].

14 SUMMARY OF ENVIRONMENTAL COMMITMENTS

14.1 Introduction

14.1.1 The assessment of the proposed development has identified a number of impacts that would arise as a result of progression of the proposed development. Mitigation measures have accordingly been identified and developed to counter adverse impacts and reduce the significance of residual effects on the receiving environment.

14.1.2 Environmental mitigation measures identified during the EIA process are reported in Sections 4 to 13 of this EIA report, with additional measures proposed in Appendix 2.1 Forestry. Subject to the granting of planning consent, these measures will form a mandatory schedule of commitments under the terms of any contract(s) for the construction and future maintenance of the proposed development.

14.1.3 Environmental commitments are scheduled in Table 14.1 below. Responsibility for the delivery of the programme of mitigation will sit with Kirkan Wind Farm Ltd as developer. The division of responsibility for discharging the mitigation between the developer and appointed contractor will be decided based upon a number of factors but is anticipated to be as indicated in Table 14.1.

Table 14.1 Summary of Environmental Commitments

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
02 Forestry				
2.1	Forestry operations	• All forestry operations will be carried out in accordance with FCS and industry best practice. • All forestry plans and operations will fully comply with the UK Forestry Standard (2017). • The plan to carry out keyhole felling rather than clear felling would minimise the amount of felling required. (Section 10 of Appendix 2.1)	Construction	Contractor
2.2	Extracting timber from site	• The extraction of the timber will be carried out after the road has been installed, so as all the felled trees will be very close to the road most of the timber extraction will be carried out on the hard road and not over the bare ground. This will avoid/minimize any damage to the soil. • All timber (above 7 cms) will be removed from the site and stacked for sale at roadside. (Section 10 of Appendix 2.1)	Construction	Contractor
2.3	Lop and top	Lop and top will be left on the ground and kept clear of actively managed drains and streams including drains that may be blocked under the HMP/PMP plans. If necessary, brash mats will be used to minimize rutting. (Section 10 of Appendix 2.1)	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
2.4	Compensatory planting	If required, an area of compensatory new planting equivalent to the area felled will be established elsewhere on the wider Strathvaich estate. (Section 10 of Appendix 2.1)	Construction	Contractor
2.5	Timing of felling operations	All felling will be carried out outside the bird nesting season which is normally March – August, except where otherwise approved by the Ecological Clerk of Works. (Section 10 of Appendix 2.1)	Construction	Contractor
04 Landscape Character and Visual Assessment				
4.1	Material storage	Material storage/temporary stockpiles would be retained for the shortest duration practicable and would be sited to avoid visual intrusion to neighbouring receptor locations, with particular regard to avoidance of sky-lining such features in views from the A835 carriageway. (Section 4.5.21 of the EIAR)	Construction	Contractor
4.2	Storage of peat	Peat materials would be placed directly wherever practicable to avoid double handling, reduce vehicle movements, and to reduce potential drying and oxidisation of the peat. Where this is not possible the peat shall be stored in accordance with the EIAR Volume 2: Technical Appendix 9.4: Peat Management Plan. (Section 4.5.21 of the EIAR)	Construction	Contractor
4.3	Reinstatement	• Temporary site compounds and temporary mineral extraction areas would be reinstated prior to the commencement of the operational phase of the site to avoid the necessity of	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		retaining restoration materials on site over the operational period and to avoid sustained effects on landscape fabric character and visual amenity. • The surface of lay-down areas would be reinstated to replicate the appearance of adjoining moorland. • Excavations for turbines foundations, laydown areas and underground cables would be reinstated prior to commencement of the operational phase of the proposed development and all track sides, would be reinstated with translocated turves to ensure they would blend in with the adjoining (undisturbed) ground in the site (Section 4.5.21 of the EIAR)		
4.4	Concrete batching plant	If a concrete batching plant is required, it would be located within the temporary construction compound north of Turbine 3. This would be screened from a large proportion of external receptors along key transportation routes and settlements. (Section 4.5.24 of the EIAR)	Construction	Contractor
4.5	Substation and control building external finish	Agreement on external finishing for the substation and control building are to be agreed with THC in advance of the commencement of construction. (Section 4.5.18 and 4.5.19 of the EIAR)	Pre-construction	Developer
4.6	Energy storage	Agreement on full details of energy storage facility, within the maximum 75m x 45m area identified. (Section 4.5.19 of the EIAR)	Pre-construction	Developer

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
4.7	Borrow pit restoration	In order to avoid the establishment of anomalous cut faces on the upper part of the excavation the softening of sharp edges of the mineral extraction areas by restoration blasting are proposed, the resultant slopes to be covered in restoration substrate and turf to ensure that the pit blends in with the adjoining landscape. (Section 4.5.3 of the EIAR)	Post-construction and decommissioning	Developer
4.6	Turbine aviation lighting – impacts mitigation	Subject to agreement by CAA/DIO. Potential for a reduction in turbine lighting (i.e. to cardinal lighting only) and/or adoption of a radar activated lighting system. (Section 4.7.109 of the EIAR)	Pre-construction and construction	Developer
05 Archaeology and Cultural Heritage				
5.1	Potential for the discovery of unidentified archaeological remains	To address the potential for impacts on previously unknown archaeological remains, an archaeological watching brief and appropriate archiving, reporting, analysis and publication (as necessary) can be undertaken on ground works undertaken during the construction phase. (Section 5.8.4 of EIAR)	Construction	Contractor or Developer
5.2	Ullapool to Contin former drovers' road (NDA36)	• The route of the former Ullapool to Contin road (NDA36) is marked out with appropriate signage during the operational phase of the proposed development; • Opportunities for promoting the project area's wider heritage (e.g. information boards [at the Aultguish Inn and] where NDA36 is accessed from the A835, at Kirkan township and the site of a nearby illicit whisky still, NDA39) form part	Operational	Developer

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		of the operational phase of the proposed development; and • Appropriate measures are put in place to ensure that recreational public access through the project area broadly following the drovers' road (NDA36) is secured after completion of the construction phase of the development. (Section 5.8.6 of EIAR)		
06 Ecology				
6.1	Compliance with relevant protected species legislation	A suitably qualified and experienced Ecological Clerk of Works (ECoW) will be appointed prior to the commencement of construction and decommissioning activities and through whom appropriate ecological advice will be provided throughout. The ECoW will be responsible for undertaking and/or co-ordinating checks for protected species before construction and decommissioning activities commence. The ECoW (or appointed 'clerks' on behalf of the ECoW) will also maintain a watching brief as necessary throughout the construction and decommissioning phase to ensure compliance with relevant legislation. (Section 6.11.3 and 6.11.4 of the EIAR)	Construction and decommissioning	Contractor or Developer
6.2	Protected species – surveys, Species Protection Plans and licencing requirements	Pre-construction and pre-decommissioning surveys for protected mammal species (including otter, badger, pine marten, red squirrel and wildcat) will be undertaken no more than 6 months before the commencement of activities.	Pre-construction and pre-decommissioning	Contractor or Developer

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		Updated ecological information obtained from the pre-construction protected species' surveys will be used to inform and guide the implementation of Species Protection Plans (SPPs) or species-specific mitigation plans, identification of any licencing requirements and appropriate mitigation (including micro-siting) if required. SPPs will be designed to provide the contractor and ECoW with approved methodologies and mitigation measures for carrying out certain activities and will be agreed in consultation with SNH. (Section 6.11.6 to 6.11.8 of the EIAR)		
6.3	Presence of water voles – surveying and Species Protection Plan	A water vole SPP will be prepared for the proposed development in accordance with *Dean et al.* (2016) and SNH (2018d) guidance, with an appropriate licence obtained from SNH where required. The SPP will be finalised in consultation with SNH following a pre-construction water vole survey undertaken in accordance with current guidance. (Section 6.11.11 to 6.11.13 of the EIAR)	Construction and decommissioning	Contractor or Developer
6.4	Presence of reptiles – Species Protection Plan	Common lizard and potentially adder are the only reptile species likely to be found during construction works associated with the proposed development, with only incidental observation of common lizard recorded during baseline surveys. A SPP will be prepared for reptiles prior to the commencement of construction activities. The SPP will detail measures to be implemented during construction activities to protect reptiles (and amphibians	Construction and decommissioning	Contractor or Developer

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		encountered) from harm during the construction of the scheme. The SPP will be agreed in consultation with SNH and detail emergency procedures to be implemented by site workers in the event reptiles are encountered during works. (Section 6.11.15 to 6.11.17 of the EIAR)		
6.5	Construction Environmental Management Plan	A Construction Environmental Management Plan will be prepared, and will include: • Good practice construction measures. • Pollution prevention controls and monitoring information. • Habitat Specific Protection Plans (HSPPs) for wet dwarf shrub heath and blanket bog. (Section 6.9.5 and 6.9.6 of the EIAR)	Construction	Contractor or Developer
6.6	Habitat Management Plan	A Habitat management Plan will be prepared, based on the Outline HMP provided as Appendix 6.6. This will include measures which will: • Promote improved structural diversity of wet heath and blanket bog; • Manage fish cover; • Manage bank side vegetation; • Encourage piparian planting to enhance terrestrial biodiversity, with woodland and edge habitat suitable for species including black grouse; • Control predators (mink). (See Appendix 6.6)	Operation	Developer

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
6.7	Watercourse crossing design	Watercourse crossings will be designed and built to withstand 1:200 year flood events. Main watercourse crossings will be bottomless arched culverts. Post-construction checks for water vole will also be undertaken. (Section 6.9.9, 6.9.10 and 6.9.12 of the EIAR)	Construction and decommissioning	Developer or Contractor
6.8	Fish monitoring	14.1.1 A monitoring plan will also be established and incorporated into the CEMP in consultation and agreement with SEPA and the Cromarty Firth Fisheries Trust to characterise baseline conditions prior to construction works commencing and to continue throughout the construction phase to confirm that the mitigation measures with respect to water quality and maintenance of potential fish passages are performing. The monitoring plan would also include details of response and remediation measures in the event mitigation measures are found not to be performing. (Section 6.9.14 and 6.9.15 of the EIAR)	Pre-construction, construction and operation.	Developer
07 Ornithology				
7.1	Legislative compliance	Site clearance activities, where commenced during the core breeding bird season (1st March to 31st August inclusive), will therefore be subject to a pre-clearance survey by a competent ornithologist to identify any active wild bird nests. Should any active nests be found, works will only proceed under the advice of the	Pre-Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		appointed ornithologist. Work exclusion buffers around identified nest sites would be implemented where necessary in accordance with best available species guidance applicable at the time and/or as agreed in consultation with SNH. (Section 7.11.4 of the EIAR)		
7.2	Potential for disturbance to lekking black grouse	No construction works within 750 m of identified “main lek sites” will be undertaken prior to 9am in the months of April and May. (Section 7.11.5 of the EIAR)	Construction	Contractor
08 Hydrology				
8.1	Establishment of drainage infrastructure	All long-term and temporary drainage infrastructure will be established on a running-basis ahead of excavation works. This includes temporary bunding and cut-off drains around turbine bases, hardstanding areas and borrow pits. (Section 8.6.106 of the EIAR)	Construction	Developer and Contractor
8.2	Design of ‘hard’ infrastructure to encourage drainage	All installed ‘hard’ infrastructure, including hardstanding areas and borrow pit excavations, will be designed and constructed with a slight gradient to encourage drainage into a filter drain or settlement pond, to allow infiltration into vegetated areas and as shallow through-flow into soils where appropriate (Section 8.6.107 of the EIAR)	Construction	Developer (design) and Contractor (construction)
8.3	Depth and length of trackside drainage	Trackside drainage will be no longer or deeper than necessary to provide the required track drainage. (Section 8.6.108 of the EIAR)	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
8.4	Installation of cross-drains under tracks	Cross-drains under tracks will be installed at an appropriate frequency to mimic natural drainage patterns and to minimise concentration of flows. (Section 8.6.109 of the EIAR)	Construction	Contractor
8.5	Licences for watercourse crossings and construction site works	All required licences for watercourse crossings and construction site works will be in place prior to works on site beginning. (Section 8.6.111 of the EIAR)	Pre-construction	Developer or Contractor
8.6	Sediment control protection	• Silt fencing or appropriate alternative sediment control protection will be installed on the downhill side of excavations to prevent inadvertent discharge of silty water into or towards any site watercourse. • All engineering works adjacent to watercourses, including access tracks and watercourse crossing structures, will have appropriate sediment control measures established prior to any groundworks. • Vegetation will be retained along watercourse banks to act as additional protection to the watercourses. (Section 8.6.112 to 8.6.114 of the EIAR)	Construction	Contractor
8.7	Water control measures for areas of large excavation (borrow pit sites, turbine base excavations, hardstanding areas)	Temporary water control measures will be implemented as necessary adjacent to areas of larger excavation. These will include borrow pit sites and may also include turbine base excavations and hardstanding areas. These measures will take the form of temporary settlement ponds, filter drains or proprietary treatment measures such as Silt Busters.	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		Detail will be provided within the Pollution Prevention Plan(s) required for the Construction Site Licence and suitability will be determined following appropriate on-site soil tests. (Section 8.6.115 of the EIAR)		
8.8	Weather effects on earthmoving	All earthmoving activity will be restricted during periods of wet weather, particularly for work occurring within 20 m of a watercourse or within areas of peat deeper than 1.5 m, to minimise mobilisation of sediment in heavy rainfall. (Section 8.6.116 of the EIAR)	Construction	Contractor
8.9	Water collecting within excavations	Any water collecting within excavations will be pumped out prior to further work within the excavation. The water is likely to require treatment to remove suspended solids prior to discharge to ground. (Section 8.6.117 of the EIAR)	Construction	Contractor
8.10	Re-establishment of vegetation on stripped ground	• Vegetation cover will be re-established as quickly as possible on all areas of stripped ground, once activity involving these areas is complete. This will include track verges, screening bunds, cut slopes and much of the site during decommissioning and restoration works. Where possible this will be achieved using excavated peat acrotelm. • Additional measures including hydroseeding and/or use of a biodegradable geotextile will be considered if insufficient peat turf is available and for areas of particular sensitivity that require immediate protection.	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		(Section 8.6.118 of the EIAR)		
8.11	Oil and fuel – delivery, storage, handling, disposal and management	• Oil and fuel storage and handling on site will be undertaken in compliance with SEPA's *Guidance on Pollution Prevention 2 – Above ground oil storage tanks* and with the *Water Environment (Oil Storage) (Scotland) Regulations 2006*. • Risk assessments will be undertaken and all Hazardous Substances and Non-Hazardous Pollutants that will be used and/or stored on site will be identified. Hazardous substances likely to be on site include oils, fuels, hydraulic fluids and anti-freeze. No non-hazardous pollutants have been identified as likely to be used on site. Herbicides will not be used. • All deliveries of oils and fuels will be supervised. All storage tanks will be located within impermeable, bunded containers where the bund is sufficient to contain 110% of the tank's capacity. For areas containing more than one tank, the bund will be sufficient to contain 110% of the largest tank's capacity or 25% of the total capacity, whichever is the greater. • Any valve, filter, sight gauge, vent pipe or other ancillary equipment will be located within the containment area.	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		• Waste oil will not be stored on site but will be removed to dedicated storage or disposal facilities. • Management procedures and physical measures will be put in place to deal with spillages, such as spill kits and booms. • Maintenance procedures and checks will ensure the minimisation of leakage of fuels or oils from plant. (Section 8.6.119 to 8.6.126 of the EIAR)		
8.12	Vehicle maintenance, refuelling and servicing	Refuelling and servicing will be undertaken in a designated area or location with adequate precautions in place, such as a dedicated impermeable surface with lipped edges to contain any contaminants. Where vehicle maintenance is necessary in the field, owing to breakdown, additional precautions will be taken to contain contaminants, such as spill trays or absorbent mattresses. (Section 8.6.127 and 8.6.128 of the EIAR)	Construction	Contractor
8.13	Concrete batching location and associated protections	If required, concrete batching will take place in one designated location within the site construction compound. This location will be at least 250 m from the nearest watercourse. Protective bunding will be installed around the batching area to ensure that contaminated runoff is contained. Dedicated drainage will be installed to ensure that water from the batching area can be suitably treated to reduce alkalinity and suspended sediment load prior to discharge, or	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		removed from site by tanker for treatment and disposal offsite. (Section 8.6.130 of the EIAR)		
8.14	Emptying the site welfare facility holding tank	Site welfare facilities will include a suitably sized holding tank, which will be emptied by tanker and removed from site on an appropriate timescale for disposal at a suitably licensed facility. (Section 8.6.131 of the EIAR)	Construction	Contractor
8.15	Ensuring staff are aware of Site Spillage and Emergency Procedures	The Site Spillage and Emergency Procedures will be prominently displayed at the site and staff will be trained in their application. The Procedures document will incorporate guidance from the relevant SEPA Guidance Notes.	Construction and decommissioning	Contractor
8.16	Spillage or discharge that has the potential to be harmful or pollute the water environment.	In the event of any spillage or discharge that has the potential to be harmful to or to pollute the water environment, all necessary measures will be taken to remedy the situation. These measures will include: • Identifying and stopping the source of the spillage; • Containing the spillage to prevent it spreading or entering watercourses by means of suitable material and equipment; • Absorbent materials, including materials capable of absorbing oils, will be available on site to mop up spillages. These will be in the form of oil booms and pads and, for smaller spillages, quantities of proprietary absorbent materials. Sand bags will also be readily	Construction and decommissioning	Developer and/or Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		available for use to prevent spread of spillages and create dams if appropriate. • Where an oil/fuel spillage may have soaked into the ground, the contaminated ground will be excavated and removed from site by a licensed waste carrier to a suitable landfill facility. • The emergency contact telephone number of a specialist oil pollution control company will be displayed on site; and • Sub-contractors will be made aware of the guidelines for handling of oils and fuels and of the spillage procedures at the site. SEPA will be informed of any discharge or spillage that may be harmful or polluting to the water environment. Written details of the incident will be forwarded to SEPA no later than 14 days after the incident. (Section 8.6.133 and 8.6.134 of the EIAR)		
8.17	Works within the Allt Giubhais Beag catchment (turbine 1 and ancillary infrastructure)	• No excavation works will begin until cut-off drains and sediment protection (silt fencing and/or pegged straw bales, as appropriate) have been installed between the turbine base and hardstanding area and the direct flow paths towards the Allt Giubhais Beag. These will require sign-off by the Environmental Clerk of Works prior to ground works beginning. • Visual monitoring of the watercourse at its closest point downstream of the ground works and at the intake location will be undertaken on a twice-daily basis whilst works are ongoing at	Construction and decommissioning	Developer and/or Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		Turbine 1. Any signs of siltation of suspended sediment in the water will be recorded and reported to the Environmental Clerk of Works for appropriate follow-up. • In-situ water quality monitoring will be undertaken as required, determined by the Environmental Clerk of Works. • No maintenance of refuelling activities will take place within the watercourse catchment. • Sediment protection measures will remain in place, with regular checks to ensure their continued effective operation, until all ground works are completed at Turbine 1 and vegetation has re-established on exposed soil areas. • Should any concerns be raised, work at Turbine 1 will be suspended until further investigation can be undertaken to identify the cause of the concerns and their validity. Works will not restart until the investigation has demonstrated that it was a false alarm or until additional protection measures are installed to prevent a recurrence, to the Environmental Clerk of Works' satisfaction. (Section 8.6.135 of the EIAR)		
8.18	Maintenance and monitoring of drainage infrastructure, tracks and hardstanding	Long-term drainage infrastructure will have a monitoring and maintenance programme established, to include regular visual inspection of drainage infrastructure to check for blockages, debris or damage that may impede flow. Remediation will be undertaken	Construction	Developer and/or Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
	areas, and bridge structures	immediately. Routine maintenance will be scheduled where possible for dry weather. Tracks and hardstanding areas will be monitored on a regular basis, particularly following periods of heavy or prolonged rainfall or after snow clearance. Any sections of track or hardstanding showing signs of excessive wear will be repaired as necessary with suitable rock from the borrow pit or external sources. All bridge structures will have appropriate splash control measures as part of their design, to prevent silty water splashing into the watercourse from vehicle movements. The splash controls will be monitored regularly to ensure they remain effective and have not become damaged in any way. (Section 8.6.136 to 8.6.138 of the EIAR)		
09 Geology, Hydrogeology and Peat				
9.1	Suitability of rock for track and hardstanding construction	Rock testing would be undertaken on appropriate samples from the two borrow pit areas to determine its suitability for unbound track and hardstanding construction. This would include testing to determine likely degradation patterns during the lifespan of the development. Should the tests identify problems with parts of the rock within the borrow pit footprints, care would be taken to ensure that unsuitable material is not used for construction but would be retained for use in borrow pit restoration. (Section 9.7.5 of the EIAR)	Pre-construction	Developer

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
9.2	Presence of groundwater in borrow pit areas; discharge licencing	Groundwater monitoring boreholes would be established within the two borrow pit areas prior to any construction work beginning, to a depth at least 1 m below the deepest expected excavation. Groundwater level monitoring would be undertaken to determine whether groundwater is present within the borrow pit areas and, if it is, at what level the seasonally highest groundwater table stands. Any groundwater within the borrow pit area would be managed in line with best practice, with discharge via a settlement pond to allow any entrained sediment to be removed prior to discharge. Any required discharge licence would be obtained prior to excavation commencing. (Section 9.7.6 of the EIAR)	Pre-construction and construction	Developer and/or Contractor
9.3	Rainfall recharge into bedrock around Turbine 1	Shallow filter drains would be installed around Turbine 1 to facilitate rainfall recharge into the bedrock at this location, to minimise changes caused by introduction of hard engineering in the area. (Section 9.7.7 of EIAR)	Construction	Contractor
9.4	In-trench groundwater flow (cable trenches)	Cable trenches would be laid in disturbed trackside material. In areas where cable routes cross up or down steep slopes, clay bunds or alternative impermeable barrier would be placed for every 0.5 m change in elevation along the length of the trench to minimise in-trench groundwater flow. (Section 9.7.8 of the EIAR)	Construction	Contractor
9.5	Unused or unsuitable aggregate material uses	Any unused or remaining unsuitable aggregate material, plus any spare rock material arising from hardstanding or track reinstatement, may be used to reinstate the borrow pits to a suitable profile, and	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		capped with soil or turf to promote re-establishment of natural vegetation cover. (Section 9.7.9 of the EIAR)		
9.6	Subsurface electrical cables	Any subsurface electrical cables would be left *in situ*. (Section 9.7.10 of the EIAR)	Decommissioning	Contractor
9.7	Drainage where track sections cross wetland or bog areas	Where track sections cross wetland or bog areas, cross-drainage will be provided within the track construction to ensure continuity of flow. This may take the form of a drainage layer within the track, suitably closely-spaced drainage pipes, or both as appropriate. These will be determined on a case-by-case basis to suit each individual area. (Section 9.7.11 of the EIAR).	Construction	Contractor
9.8	Works adjacent to wetland areas	All works through and adjacent to wetland areas will be supervised by the Environmental Clerk of Works with particular respect to works near identified GWDTE. (Section 9.7.12 of the EIAR).	Construction	Contractor or Developer
9.9	General site specific mitigation – track drainage and micrositing requirements	Site-specific mitigation, including track drainage segregation to avoid 'flushing' from excavation works, and micrositing to avoid specific higher sensitivity areas, will be identified and established where appropriate. (Section 9.7.13 of the EIAR)	Construction	Contractor
9.10	Vehicle movement in unapproved areas	All traffic routes would be clearly demarcated and vehicles would not be permitted access outwith these areas. (Section 9.7.14 of the EIAR)	Construction	Contractor
9.11	Traffic flow and movement during decommissioning	Traffic routes would follow established access tracks. Decommissioning would be phased such that more distant infrastructure is removed first, in order to avoid	Decommissioning	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		vehicle movement across unaffected ground. (Section 9.7.15 of the EIAR)		
9.12	Ground compaction prior to site reinstatement	Site areas under former infrastructure (hardstandings, access tracks and borrow pit floors) would be ripped or routed to remove effects of ground compaction prior to reinstatement. (Section 9.7.16 of the EIAR)	Decommissioning	Contractor
9.13	Vehicle movement on unstripped ground	Only tracked or low ground pressure vehicles would be permitted access to unstripped ground. (Section 9.7.17 of the EIAR)	Construction and decommissioning	Contractor and Developer
9.14	Soil stripping, separation and containment	Soil stripping would be undertaken with care and would be restricted to as small a working area as practicable. Topsoil would be removed and laid in a storage bund, up to 2 m in height, on unstripped ground adjacent to the working area. It would be attempted to retain the turf layer vegetation-side-up where possible, although ground conditions may make this challenging. Subsoils and superficial geological deposits would be removed subsequently and laid in storage bunds, also up to 2 m in height, clearly separated from the topsoil bund. Care would be taken to maintain separate bunds for separate soil types in order to preserve the soil quality. (Section 9.7.18 of the EIAR)	Construction	Contractor
9.15	Movement of peat	For work within areas of peat, acrotelmic peat (the uppermost 0.5 m) would be removed as for the topsoil. It would be attempted to retain the acrotelm vegetation-side-up where possible, although ground conditions may make this challenging. The underlying catotelmic peat would be stored bunds up to 1 m in height. Catotelmic peat is sensitive to handling, and loses its	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		internal structure easily, so would be transported as short a distance as possible to its storage location. Excavation of catotelmic peat has been limited by careful infrastructure design. (Section 9.7.19 of the EIAR)		
9.16	Soil and peat storage bunds	All soil and peat storage bunds would be left with rough, unsmoothed surfaces to minimise soil loss from rainfall erosion. Bunds on sloping ground would have sediment control measures installed near the base, on the downslope side, to collect and retain any sediment mobilised by rainfall. (Section 9.7.20 of the EIAR)	Construction	Contractor
9.17	Site restoration and rehabilitation using excavated soil and peat	Excavated soil and peat would be used in site restoration and rehabilitation at the end of the construction period, in order to promote fast re-establishment of vegetation cover on worked areas and areas of bare soil or peat that are not required for the operational phase of the development. Soils and peat would be stored for as short a time as practicable, in order to minimise degradation through erosion and desiccation. (Section 9.7.21 of the EIAR)	End of the construction phase	Contractor
9.18	Dry weather affecting peat and soil bunds	Should prolonged periods of dry weather occur, a damping spray would be employed to maintain surface moisture on the soil and peat bunds. This would help to maintain vegetation growth in the turfs and to retain the soil structure. (Section 9.7.22 of the EIAR)	Construction	Contractor
9.19	Risk arising from developing on peatland areas	Construction work would make use of current best practice guidance relating to developments in peatland areas. A risk management system, such as a geotechnical risk register, would be compiled and	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		maintained at all stages of the project and developed as part of the post-consent detailed design works, and would be updated as new information becomes available. (Section 9.7.23 of the EIAR)		
9.20	Peat landslide	Members of project staff would undertake advance inspections and carry out regular monitoring for signs of peat landslide indicators. A geotechnical specialist would be on call to provide advice if required by project area conditions. (Section 9.7.24 of the EIAR).	Construction and decommissioning	Contractor or Developer
9.21	Construction on and near problem areas	Micrositing would be used to avoid possible problem areas where practicable. This would be assisted by additional verification of peat depths, to full depth, in any highlighted areas where construction work is required. Track drainage would be installed in accordance with published good practice documentation and would be minimised in terms of length and depth in order to minimise concentration of flows. (Section 9.7.25 of the EIAR)	Construction	Contractor and/or Developer
9.22	Weather and construction near watercourses and areas of deep peat	Construction activities would be restricted during periods of wet weather, particularly for any work occurring within 20 m of a watercourse or within areas of identified deeper peat. Careful track design would ensure that the volume and storage timescale for excavated materials would be minimised as far as practicable during construction works. (Section 9.7.26 of the EIAR)	Construction	Contractor and/or Developer
9.23	Re-establishment of vegetation	Vegetation cover would be re-established as quickly as possible on track and infrastructure verges and cut slopes, by re-laying of excavated peat acrotelm, to	Construction and decommissioning	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		improve slope stability and provide erosion protection. Additional methods, including hydroseeding and/or use of a biodegradable geotextile, would be considered if necessary in specific areas. (Section 9.7.27 of the EIAR)		
9.24	Peat slide indicators and emergency procedures	Construction staff would be made aware of peat slide indicators and emergency procedures. Emergency procedures would include measures to be taken in the event that an incipient peat slide is detected.	Construction, operation and decommissioning	Contractor
10 Noise and Vibration				
10.1	Turbine noise	The selection of the turbine to be installed should be in line with ETSU-R-97 limits. (Section 10.7.2 of the EIAR)	Pre-construction	Developer
10.2	Construction noise – onsite	• Those activities that may give rise to audible noise at the surrounding properties and heavy goods vehicle deliveries to the site would be limited to the hours 07:00 to 19:00 Monday to Friday and 08:00 to 17:00 on Saturdays and Sundays unless otherwise approved in advance by THC (except in case of an emergency). Those activities that are unlikely to give rise to noise audible at the project area boundary, or light vehicle traffic accessing the project area such as that involved with staff mobilisation, may continue outside of the stated hours; • Construction activities shall adhere to good practice as set out in BS 5228; • All equipment maintained and in good order;	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		• Where flexibility exists, activities undertaken away from residential properties, set back by the maximum possible distances; • Construction plant capable of generating high noise and vibration levels would be operated in a manner to restrict the duration of the higher magnitude levels. (Section 10.7.3 of the EIAR)		
10.3	Construction noise – traffic	A Traffic Management Plan (TMP) will be developed and secured through planning condition to control the movement of vehicles to and from the Development site. The TMP will include measures to reduce daily construction traffic volumes if a high percentage of stone import to site is required, through traffic management and programme design, including potentially extending the construction period (Section 10.7.3 of the EIAR)	Pre-construction	Contractor and/or Developer
11 Traffic and Transport				
11.1	Traffic impacts	Implementation of the Traffic Management Plan (TMP), identifying how traffic will be managed throughout the duration of the construction period. The TMP will define and secure the prescribed routes for HGV access. The TMP would also include measures adopted by the Contractor, such as signage, wheel washing facilities and any temporary access arrangements. (Section 11.7.1 and 11.7.2 of EIAR)	Pre-construction and construction	Contractor
12 Aviation, Radar and Telecommunications				

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
	Pre-construction notifications to CAA/DIO	Prior to commencement of construction, notification will be given to DIO and CAA of: • The date construction starts and ends; • The maximum height of construction equipment; and • The latitude and longitude of every turbine. (Section 12.7.2 of the EIA)	Pre-construction	Developer
12.1	Application of aviation lighting on turbines	The applcation of an Aviation Lighting Scheme, to be agreed by planning condition with all relevant aviation stakeholders including the CAA, DIO and Highland Council, is understood considered likely to remove all concerns. (Section 12.7.1 of the EIAR)	Construction	Developer
12.2	Re-routing telecommunications	Agreement has been reached with the two relevant fixed-link operators to mitigate via re-routing. Re-routing to be completed before the proposed development becomes operational. (Section 12.8.1 of the EIAR)	Pre-construction and construction	Developer
13 Climate Change				
13.1	Peat handling and management	Any excavated peat would be carefully handled and treated in order to minimise drying and the loss of carbon to the atmosphere. Peat handling would comply with SEPA's Regulatory Position Statement for Developments on Peat (2010), as well as current good practice prepared by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection	Construction	Contractor

Ref	Issue	Description of mitigation measure (reference within text)	Timing	Responsible Party
		Agency, Forestry Commission Scotland and Historic Environment Scotland (2015). (Section 13.7.2 of the EIAR)		