M74 West Renewable Energy Park

Environmental Impact Assessment Report

Volume 2: Main Report

September 2024

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Glossary of Terms and Abbreviations

Glossary of Terms

Term	Definition
Abnormal Indivisible Load	Loads / vehicles which exceed the maximum vehicle weight, axle weight or dimensions which are set out in the Road Vehicles (Construction and Use) Regulations 1986 as amended.
Aeronautical radio navigation aids	Ground-based radio beacons that are used to assist aircraft to navigate.
Applicant	M74 West Limited.
Assessment	Process by which information about effects of a proposed plan, project or intervention is collected, assessed and used to inform decision making.
Automatic Traffic Counter	Equipment which is laid across a road and measures traffic characteristics such as the number of vehicles passing over it, speed and classification.
Average Daily Traffic	The average traffic flow over the course of a day which passes a particular location on the road network each day.
Balance of Plant	Infrastructural components of a windfarm, except the turbine and its elements.
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.
Brash	Cut off tree branches and tree tops.
Bird Disturbance Management Plan	Document produced prior to construction commencing (during the discharge of considtions) to ensure the safeguarding of wild birds.
British Horse Society	British equine charity.
Collision Risk Analysis Area	500m buffer used to create the analysis area for collision modelling.
Construction Phase	Period during which the building or assembling of a proposed development and its infrastructure is undertaken.
Construction Traffic Management Plan	Document which outlines traffic management measures to mitigate adverse impacts associated with construction related traffic.
Consultation	Process by which those organisations or individuals with an interest in the area associated with the proposed scheme 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 Airspace	A category of airspace in which all aircraft must obtain clearance from a controller prior to entry and must obey air traffic control instructions when inside the airspace.
Coupe	An area of woodland that has been or is planned for felling.
Cultivation “mounding”	Creating improved planting positions by creating earth mounds.
Cumulative Impact/Effect	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.
Cumulative Visual Effects	Effects that can be caused by combined visibility, which occurs where the observer is able to see two or more developments from one viewpoint and/or sequential effects which occur when the observer has to move to another viewpoint to see different developments.

Term	Definition
Decommissioning	Period during which a development and its associated infrastructure are removed from active operation.
Department for Transport	Department for Transport.
Design Manual for Roads and Bridges	Design Manual for Roads and Bridges.
Developable Area	Areas on which the development of site infrastructure is proposed.
Direct Effects	Effects directly attributable to the Proposed 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 Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) regulations 2017. Collective term for the various statutory instruments through which the directives on environmental assessment have been implemented in the UK.
Electronic Service Delivery for Abnormal Loads	Outlines who needs to be notified about a proposed abnormal load delivery route.
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
Environmental Impact Assessment Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations).
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.
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 (cSAC or pSAC), and Ramsar sites.
Forest Residue	Non marketable woody matter, small tree tops, branches and tree stumps.
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.
Harvesting	Timber felling extraction and haulage.
Heavy Goods Vehicle	All goods vehicles > 3.5 tonnes gross maximum weight.
Impact	Change that is caused by an action; for example, land clearing (action) during construction that results in habitat loss (impact).
Indirect Effects	Effects resulting indirectly from the Proposed Development as a consequence of the direct effects. Indirect effects often occur away from the site, or as a result of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects.
Instrument Flight Procedures	A series of written and graphical instructions to pilots to enable them to depart from and arrive at airports safely when flying in cloud or poor visibility.

Term	Definition
Key Characteristics	Those combinations of elements which are particularly important to the current character of the landscape and help to give an area its particularly distinctive sense of place.
King George V Docks	Located in Glasgow, KGV is the port from which the AIL components will be delivered.
Landscape Character	The distinct and recognisable pattern of elements that occur consistently in a particular type of landscape that makes one landscape different from another, rather than better or worse.
Landscape Receptors	Aspects of the landscape resource that have the potential to be affected by the Proposed Development.
Landscape Value	The relative value or importance attached to different landscapes by society. A landscape may be valued by different stakeholders for a variety of reasons (often as a basis for designation or recognition), because of its quality, special features (including perceptual aspects such as scenic beauty), tranquillity or wildness, cultural associations, or other conservation issues.
Light Goods Vehicles	All commercial vehicles < 3.5 tonnes gross maximum weight.
Magnitude (of change)	The combination of judgements about the size and scale of the predicted effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short or long term in duration.
Miles per Hour	Measurement unit of speed on British roads.
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.
Motorway	Motorway.
National Cycle Route	Designated National Cycle Routes within the UK.
National Road Traffic Forecast	Factors used to apply future year growth to traffic flows.
Natural Heritage Zone	Defined regional areas used for bird species populations in Scotland.
Non-statutory Consultee	Organisations and bodies that should be consulted on relevant planning applications.
Nutrient Enrichment (eutrophication)	Excess richness of nutrients in water or soils which results in adverse effects on the diversity of the biological system, the quality of the water, and the uses to which the water may be put.
Operation	Functioning of a development on completion of construction.
Ordnance Survey	Great Britain’s national mapping agency.
Photomontage	A visualisation which superimposes an image of a proposed development upon a photograph or series of photographs.
Planning Advice Note	Scottish Government’s planning guidance documents.
Pollution	Any increase of matter or energy to a level that is harmful to living organisms of their environment (when it becomes a pollutant).
Primary Surveillance Radar	A device which transmits pulses of radio energy into the air and records reflections of those pulses from objects in the sky such as aircraft.
Proposed Development	The M74 Renewable Energy Park: The project that the applicant or promoter seeks to implement.
Receptor	Defined individual environmental feature usually associated with population, fauna and flora with the potential to be affected by a project.
Residential Visual Amenity Threshold	Where visual effects would result in serious harm to living conditions or residential amenity.

Term	Definition
Residual Effects	Effects attributable to the Proposed Development following assessment of any proposed design mitigation/ enhancements.
Roosting Site (bats)	Place where bats rest or sleep.
Roosting Site (birds)	Place where birds rest or sleep.
Route Survey Report	Report assessing the suitability of a route to transport abnormal loads.
Sensitivity	The specific receptors' vulnerability to change. Sensitivity is assessed by combining judgements of the susceptibility of the receptor to the specific type of change or development proposed and the value related to that receptor.
Scenarios	Combinations of wind farm developments at different stages in the planning system, used in the cumulative assessment.
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.
Secondary Surveillance Radar	A form of radar that sends out a query signal which is received by equipment in aircraft, which then respond with a coded reply that identifies that particular aircraft to the radar operator.
SG	LDP2 'Wind Energy Development: Development Management Considerations' Supplementary Guidance (Feb 2020).
Shadow Flicker	A phenomenon caused by the moving shadow of the turbine rotor being cast over a narrow opening, such as a window or open door.
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.
Sites of Special Scientific Interest	Main national conservation site protection measure in Britain designated under the wildlife and countryside act 1981.
South Lanarkshire Council	South Lanarkshire Council.
Special Area of Conservation	Sites designated under EU Directive (82/43/ECC) for the conservation of natural habitats and wild fauna and flora.
Special Protection Area	Sites designated under EU Directive (79/409/EEC) for the conservation of wild birds.
Scottish Planning Policy	Scottish Planning Policy (2014) – Scottish Government policy on how nationally important land use planning matters should be addressed.
Standard Instrument Departure	A type of IFP for aircraft departing from an airport.
Standard Terminal Arrival Route	A type of IFP for aircraft arriving at an airport.
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.
The 2009 Act	The Climate Change (Scotland) Act 2009.
The 2019 Act	The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019.
The Electricity Act	Electricity Act 1989.
The Institute of Environmental Management and Assessment	The Institute of Environmental Management and Assessment.

Term	Definition
The Planning Act	Town and Country Planning Act (Scotland) 1997 as amended by The Planning etc. (Scotland) Act 2006 The provisions of the Planning (Scotland) Act 2019 are also starting to come into force.
The Site	The full application boundary.
Transport Scotland	Transport Scotland.
Trunk Road	Trunk Road.
Uncontrolled Airspace	A category of airspace in which any aircraft can fly without clearance from or contact with any air traffic control agency.
Vantage Point	Defined location used for targeted flight activity surveys.
Visual amenity	The overall pleasantness of views enjoyed by people of their surroundings or to the visual setting or backdrop to the activities they enjoy whilst: living; working; recreating; visiting or travelling through an area.
Visual receptors	Individuals and/ or groups of people who have the potential to be affected by the Proposed Development.
Wireline	A 2D visualisation which lays a grid over the 3D terrain model to illustrate landform.
Yield Class	An index of productivity of even aged stands of trees.
Zone of Theoretical Visibility (ZTV)	A map, usually digitally produced, showing areas of land within which a development is theoretically visible.

Abbreviation of Terms

Abbreviation	Expanded Term
A&DS	Architecture & Design Scotland
ACIfA	Associate of Chartered Institute for Archaeologists
ACoW	Archaeological Clerk of Works
ACP	Airspace Change Proposal
ADT	Average Daily Traffic
AECS	Agri-Environment Climate Scheme
AIL	Abnormal Invisible Loads
AIL	Abnormal Indivisible Load
AOD	Above Ordnance Survey
AP	Annual Probability
APDO	Approved Procedure Design Organisation
asl	above sea level
ATC	Automatic Traffic Counter
ATCSMAC	Air Traffic Control Surveillance Minimum Altitude Chart
AWI	Ancient Woodland Inventory
BDMP	Bird Disturbance Management Plan
BEMP	Biodiversity and Environmental Management Plan
BESS	Battery Energy Storage System
BGS	British Geological Survey
BHS	British Horse Society
BNAL	Battery/ Solar Noise Assessment Location
BoCC	Birds of Conservation Concern
BoP	Balance of Plant
BP	Borrow Pit
BS	British Standard
BTO	British Trust for Ornithology
CA	Conservation Area
CAA	Civil Aviation Authority
CAR	Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended)
cd	Candela

Abbreviation	Expanded Term
CEMP	Construction (or Contract) Environmental Management Plan
CIEEM	Charted Institute of Ecology and Environmental
CIfA	Chartered Institute for Archaeologists
CLVIA	Cumulative Landscape and Visual Impact Assessment
cm	Centimetre(s)
CMLI	Chartered Member of the Landscape Institute
CNAL	Construction Noise Assessment Location
CO2	Carbon Dioxide
CRAA	Collision Risk Analysis Area
CRM	Collision Risk Model
CTMP	Construction Traffic Management Plan
CVWI	Clyde Valley Breeding Wader Initiative
CZTV	Cumulative Zone of Theoretical Visibility
dB	Decibels
DfT	Department for Transport
DGC	Dumfries and Galloway Council
DME	Distance Measuring Equipment
DMRB	Design Manual for Roads and Bridges
DTM	Digital Terrain Model
DWPA	Drinking Water Protection Areas
EAC	East Ayrshire Council
ECoW	Ecological Clerk of Works
ECU	Energy Consents Unit
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EnvCoW	Environmental Clerk of Works
ESDAL	Electronic Service Delivery for Abnormal Loads
ESK	Esdalemuir Seismic Array
EU	European Union
FLI	Fellow of the Landscape Institute
FML	Fixed Minimum Limit

Abbreviation	Expanded Term
ft	Feet
GBR	General Binding Rule
GDL	Inventory Garden and Designed Landscape
GIS	Geographical Information System
GLVIA3	Guidelines for Landscape and Visual Impact Assessment, Third Edition
GPG	Good Practice Guide
GPP	Guidance for Pollution Prevention
GW	Gigawatt
GWDTE	Groundwater Dependent Terrestrial Ecosystem
ha	Hectare(s)
HER	Historic Environment Record
HES	Historic Environment Scotland
HGV	Heavy Goods Vehicle
HMP	Habitat Management Plan
HRA	Habitats Regulation Appraisal
ICAO	International Civil Aviation Organisation
IEF	Important Ecological Feature
IEMA	The Institution of Environmental Management and Assessment
IFPs	Instrument flight procedures
IOA	Institute of Acoustics
IOF	Important Ornithological Feature(s)
KGV	King George V Docks
km	Kilometre(s)
kV	Kilovolt
LB	Listed Building
LCT	Landscape Character Types
LDP2	South Lanarkshire Local Development Plan 2 2020
LGV / Lights	Light goods vehicles
LI	Landscape Institute
LLSC	Lanarkshire & Lothians Soaring Club
LOD	Limit of Deviation
LVIA	Landscape and Visual Assessment

Abbreviation	Expanded Term
m	Metre(s)
M	Motorway
mAOD	Metres Above Ordnance Datum
Mph	Miles per Hour
MRT	Multi Radar Tracker
MSA	Minimum Sector Altitude
NAL	Noise Assessment Location
NATS	(formerly) National Air Traffic Services
NBN	National Biodiversity Network
NCI	Nature Conservation Interest
NCR	National Cycle Route
NHZ	Natural Heritage Zone
nm	nautical mile
NML	Noise Monitoring Location
NPF4	National Planning Framework 4
NRHE	National Record of the Historic Environment
NSA	National Scenic Area
NRTF	National Road Traffic Forecast
NVC	National Vegetation Classification
OBEMP	Outline Biodiversity and Environmental Management Plan
OCEMP	Outline Construction Environmental Management Plan
OHL	Overhead Line
OS	Ordnance Survey
PAN	Planning Advice Note
PLHRA	Peat Landslide Hazard and Risk Assessment
PMP	Peat Management Plan
PPP	Pollution Prevention Plan
PSR	Primary surveillance radar
PV	Photovoltaic
PWS	Private Water Supply
RAF	Royal Air Force
RBMP	River Basin Management Plan

Abbreviation	Expanded Term
RD	Rotor Diameters
RSA	Regional Scenic Area
RSPB	Royal Society for the Protection of Birds
RSR	Route Survey Report
RVAA	Residential and Visual Amenity Assessment
SAC	Special Area of Conservation
SBC	Scottish Borders Council
SBL	Scottish Biodiversity List
SEPA	Scottish Environmental Protection Agency
SHT	Scottish Hill Tracks
SID	Standard Instrument Departure
SIL	Seismic Impact Limit
SLA	Special Landscape Area
SLC	South Lanarkshire Council
SLR	Single-lens Reflec
SM	Scheduled Monument
SNH	Scottish Natural Heritage (now NatureScot)
SPEN	Scottish Power Energy Networks
SPP	Species Protection Plan
SSR	Secondary surveillance radar
SSRSG	South Strathclyde Raptor Study Group
SSSI	Site of special Scientific Interest
STAR	Standard Terminal Arrival Routes
SuDS	Sustainable Drainage Systems
T (Traffic and Transport)	Trunk Road
T	Turbine
TA	Technical Appendix
TMA	Terminal Control Area
TMZ	Transponder Mandatory Zone
TS	Transport Scotland
TSO	Transmission System Operator

Abbreviation	**Expanded Term**
UK	United Kingdom
UKCP18	UK Climate Projections 2018
VFR	Visual Flight Rules
VP (Ornithology)	Vantage Points
VP (LVIA)	Viewpoint
WFD	Water Framework Directive
WHO	Word Health Organisation
WLA	Wild Land Area
WoSAS	West of Scotland Archaeology Service
WSI	Written Scheme of Investigation
ZTV	Zone of Theoretical Visibility

1 Introduction

1.1 Introduction

1.1.1 This Environmental Impact Assessment Report (EIAR) has been prepared by Ramboll UK Limited (Ramboll) on behalf of M74 West Limited ('the Applicant') in relation to an application for consent[1] to construct and operate an electricity generating station with a generation capacity of greater than 50 MW ('the Application').

1.1.2 The Proposed Development will include up to 22 wind turbines with maximum blade tip height of 200 m above ground level (agl). It is expected that each wind turbine would have a rated capacity of around 6.1-7.5 MW per turbine giving a total generating capacity for the wind energy element of the Proposed Development in a range between 134.2 MW and 165 MW . In addition, the Site will accommodate solar power generators, approximately 80 MWac capacity, and a battery energy storage system (BESS) approximately 50 MW capacity. The project is to be referred to as M74 West Renewable Energy Park ('the Proposed Development'). The Proposed Development will be located on a 1,275 hectare (ha) site located approximately 1.1 km northwest of Abington and approximately 4.5 km southeast of Douglas, in South Lanarkshire. The site location is shown in Figure 1.1.

1.1.3 The EIAR comprises four volumes:

- Volume 1: Non-Technical Summary (NTS);
- Volume 2: Main Report;
- Volume 3a: Figures;
- Volume 3b: Visualisations;
- Volume 4: Technical Appendices.

1.2 Purpose and Scope of the EIAR

1.2.1 The EIAR has been prepared to accompany an application to Scottish Ministers under Section 36 of the Electricity Act 1989[2]. The EIAR has been prepared in accordance with *The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended)* (herein referred to as the 'EIA Regulations'). The EIAR has been prepared to meet the requirements of Schedule 4 of the EIA Regulations and the Institute of Environmental Management and Assessment (IEMA) Quality Mark Criteria.

1.2.2 The Proposed Development for which the applicant is seeking consent is as follows:

"The erection and 40-year operation of a Renewable Energy Park comprising up to 22 wind turbines, each with a maximum overall height to vertical blade tip of 200 m, an approximately 80 MWac solar photovoltaic (PV) array, approximately 50 MW battery energy storage system (BESS) together with ancillary development including internal transformers and related switchgear at each turbine; associated turbine foundations and hardstanding areas; a network of new and upgraded access tracks with associated water crossings, passing places and turning heads; borrow pits; substation compound; temporary site construction compounds;

[1] An application for consent for the Proposed Development will be made to the Scottish Ministers under section 36 of the Electricity Act 1989, along with a request for a direction that planning permission be deemed to be granted under section 57(2) of the Town and Country Planning (Scotland) Act 1997 as amended

[2] Electricity generation projects 50MW and below are authorised under the Town and Country Planning (Scotland) Act 1997. Those over 50MW are authorised under Section 36 of the Electricity Act, 1989.

network of electrical cables; concrete batching plant and new/improved vehicular access from the M74 and from the B7078, which both interect the Site."

1.2.3 The Proposed Development has a secured transmission grid connection connecting to the proposed Redshaw substation in October 2028. It is understood that the connection would be made via an underground cable. The Transmission System Operator (TSO), Scottish Power Energy Networks (SPEN), will provide the grid connection, including gaining the necessary consents. The exact route of the connection and the detailed technological solution have not yet been determined. As such, the grid connection is not included within the scope of this EIAR.

1.3 Other Planning Documents

1.3.1 The Application is accompanied by the following documents that do not form part of the EIAR:

- Planning Statement;
- Design and Access Statement;
- Pre-Application Consultation Report;
- Economic and Community Impact Report; and
- Community Benefit Statement

1.4 Site History

1.4.1 The Site covers an area of approximately 1,275 ha and currently comprises open moorland, improved and semi-improved grassland, an area of forestry and is intersected by the M74 motorway and B7078 local road. The Site has been subject to extensive sand and gravel quarrying, with quarrying activity currently being concluded at Thirstone Quarry, located to the north of the B7078 and M74 in the central and northern parts of the Site, and previous quarrying activity identified by Ordnance Survey mapping in the northern and western parts of the Site. In addition, there are a number of utility and telelcommunications links that cross the Site, including two high pressure gas pipelines, Scottish Water pipelines and fixed telecommunications links operated by Vodafone Ltd.

1.4.2 The wider landscape features numerous existing wind farms within 15-20 km, including large developments such as Clyde and its extension to the east, and Andershaw and Middlemuir occupying the western part of the moorland area where the area of the Site identified for positioning wind turbines is located.

1.4.3 There are two residential properties located within the Site boundary and further residential settlements located within 10 km of the red line boundary, concentrated particularly within the villages of Abington, Crawfordjohn, Roberton and Douglas.

1.5 The Applicant

1.5.1 M74 West Ltd is a wholly owned subsidiary of Renewco Power Ltd. Renewco Power is a specialist renewable energy developer focused on onshore wind, solar PV, battery storage and green hydrogen projects. The Glasgow based company is actively developing over 4 GW of renewable projects in 4 markets: the UK, Spain, Italy and the US and employs over 40 people. The company's objective is that the development of these renewable energy projects in a responsible manner will accelerate the deployment of clean energy assets and enable countries to de-carbonise their power systems, while helping local communities to thrive. The company was formed by a highly experienced team of entrepreneurs and renewable sector specialists with significant development, technical, project structuring, construction, and financing expertise across all renewable technologies.For further information about Renewco Power visit: https://www.renewcopower.com/.

1.6 EIA Process

1.6.1 EIA is a process that includes the identification, description and assessesment of the potential significant environmental effects (both positive and negative) of a proposed development and proposes mitigation to avoid, reduce and offset any adverse environmental effects.

1.6.2 The Proposed Development is of a type listed in Schedule 2 of the EIA Regulations (item (1) "a generating station"). On the basis that "*the development is likely to have significant effects on the environment by virtue of factors such as its nature, size or location*", an Environmental Impact Assessment (EIA) is required. In this case, the Applicant has volunteered to undertake an EIA rather than request a formal screening opinion.

1.6.3 The key stages in the EIA process adopted for the Proposed Development to date are summarised below.

Scoping and Consultation

1.6.4 The Applicant submitted a request for a Scoping Opinion to Scottish Ministers in January 2024. This request was accompanied by a Scoping Report, prepared by the Applicant, which set out a summary of the proposals; identified the likely significant environmental effects, and summarised the proposed scope of the EIA.

1.6.5 A Scoping Opinion was received from ECU on 15th April 2024. The contents of this and other consultation responses received are summarised in **Technical Appendix 1.1: Consultation Register (EIAR Volume 4)**, along with a list of all bodies consulted during the scoping exercise.

1.6.6 In addition to seeking a Scoping Opinion, the Applicant conducted two public exhibitions to seek the views of the local community. Exhibitions were held as follows:

- 8th February 2024, Abington; and
- 12th June 2024, Crawfordjohn.

1.6.7 A summary of the representations received during the public exhibitions is provided in the Pre-Application Consultation Report submitted with the consent application.

1.6.8 Further detail on the key issues identified through the scoping and consultation process are described in Chapter 3: Design Evolution and Alternatives.

1.6.9 Following scoping and baseline characterisation the EIAR provides an impact assessment chapter for each of the following topics:

- landscape and visual amenity;
- cultural heritage;
- ecology;
- ornithology;
- hydrology, hydrogeology and geology;
- traffic and transport;
- noise;
- aviation; and
- shadow flicker.

Topics Scoped Out of the EIAR

1.6.10 During the scoping process, there were a number of areas where it was identifiedthat the Proposed Development would not give rise to significant effects on the environment. These areas are described below.

AIR QUALITY

1.6.11 The Proposed Development is not considered likely to give rise to significant effects on air quality. There is potential for it to give rise to some localised and temporary construction-related air quality effects associated with dust (e.g. from foundation construction and the passage of vehicles along access tracks) and construction plant and traffic exhaust emissions. However, the nature of the construction activities is that they will be relatively short term, intermittent and controllable through the application of good construction practice, and also at sufficient distance from sensitive receptors to be considered low/negligible impact.

1.6.12 The potential for nuisance effects on residential or recreational amenity will be limited and will be strictly controlled in accordance with a detailed Construction Environmental Management Plan (CEMP). An Outline CEMP is included in EIAR: Volume 4: Technical Appendix 2.1. On this basis, there is no potential for significant construction or operational air quality effect and no Air Quality assessment has been undertaken as part of the EIAR.

CLIMATE CHANGE

1.6.13 The Proposed Development itself will contribute to climate change mitigation through the production of renewable energy and a corresponding reduction in carbon emissions from other more carbon intensive generation sources.

1.6.14 However, it is acknowledged that the Proposed Development will still give rise to carbon emissions associated with its construction. Accordingly, a Carbon Balance assessment has been prepared and submitted as a Technical Appendix to the EIAR (**Technical Appendix 2.4, EIAR Volume 4**). The report includes a calculation of the expected carbon savings over the lifetime of the Proposed Development and is presented using the latest version of the Scottish Government's Carbon Calculator Tool[3]. This remains the suitable standardised tool for use in relation to net carbon saving calculations for wind farm developments across the UK.

1.6.15 The assessment has been undertaken in accordance with the Scottish Government's recommended methodology[4] and presents the carbon emissions associated with ground conditions, access preparations, foundation excavations, materials used on-site, the transportation of materials and components to Site, and any other carbon loss (e.g. through the degradation of peat / peaty soils).

1.6.16 The vulnerability of the Proposed Development to climate change has been considered as part of the detailed design process, which considered the potential consequences of climate change (e.g. increased flood risk potential and more extreme weather conditions). Embedded mitigation includes but is not limited to Sustainable Drainage System (SuDS), ultrasonic anemometers and remote operational control system (controller and SCADA systems) which is linked to an ice detection application and fire detection and warning systems. Therefore, no further assessment of the vulnerability of the Proposed Development to climate change, climate change resilience has been undertaken.

[3] Available at http://informatics.sepa.org.uk/CarbonCalculator/ [Accessed July 2020]

[4] Nayak et. al., (2010) Scottish 'Calculating Carbon Savings from Wind Farms on Scottish Peatlands – A New Approach'. Available at: https://www.gov.scot/publications/calculating-carbon-savings-wind-farms-scottish-peat-lands-new-approach/ [accessed July 2023]

Population and Human Health

1.6.17 The EIAR will consider human health in terms of amenity through the assessment of potential likely significant effects associated with water supplies, noise, traffic, visual amenity and shadow flicker. No other sources or pathways for effects on human health have been identified.

1.6.18 The potential for likely significant effects on "population" will be considered through the socio-economics, recreation and tourism assessment.

1.6.19 As such a separate human health impact assessment chapter will therefore not be presented in the EIAR.

1.6.20 Appropriate control measures to ensure potential effects on air and water quality are managed appropriately in the construction phase are addressed through an outline CEMP included in **Technical Appendix 2.1, EIAR Volume 4**.

Risk of Major Accidents and / or Disasters

1.6.21 The EIA Regulations require the consideration of the potential risks to human health, cultural heritage or the environment associated with the vulnerability of the Proposed Development to major accidents and disasters. This requirement is interpreted as requiring the consideration of high consequence events (even if of low likelihood) which would result in serious harm or damage to environmental receptors.

1.6.22 Given the nature of the Proposed Development, the potential for effects related to vulnerability to risks of to accidents and disasters is likely to be limited to those effects associated with extreme weather, mechanical failure or structural damage. Relevant types of major accident/ disaster, given the predominantly rural context of the Proposed Development, include:

- severe weather events, including high winds, high rainfall leading to flooding, or extreme cold leading to heavy snow and ice loading;
- fire;
- traffic related accidents; and
- mass movement associated with ground instability.

1.6.23 Severe weather resilience will be a core component of the wind farm design, and, includes consideration of flooding resilience and the ability to manage the site remotely in the event that it is inaccessible due to hazardous weather conditions. The wind farm design will include consideration of designing out health and safety risks associated with construction and operation (including accidents and disasters associated with fire and traffic movements) in accordance with the duties under The Construction (Design and Management) Regulations 2015.

1.6.24 Potential risks and hazard associated with mass movement (peat instability) have been assessed and presented in **Technical Appendix 8.3: Peat Landslide Hazard and Risk Assessment (EIAR Volume 4)**.

1.6.25 No other potential significant effects on human health, cultural heritage or the environment associated with the vulnerability of the Proposed Development to major accidents and disasters have been identified and therefore no specific Major Accidents and Disasters assessment has been included in the EIAR.

ICE THROW

1.6.26 Standard mitigation for the risk of ice throw comprises off-site monitoring to enable the deactivation of turbines on sensing ice accumulation, as well as physical and visual warnings for both site personnel and third parties. In line with current guidance , a permanent warning sign at the site's entrances is proposed to alert the public to the possibility of ice throw under certain weather conditions. Considering the above, no potential significant impacts as a result of ice throw from the Proposed Development are anticipated and no ice throw assessment is provided within this EIAR.

ESKDALEMUIR SEISMIC ARRAY

1.6.27 The Site lies within the 50 km MoD Safeguarding zone for the Eskdalemuir Seismic Array. The detection capabilities of the Eskdalemuir Seismic Array are protected from seismic noise generated by wind turbines using a cumulative 0.336 nm noise budget for all turbines built within 50 km of the array. As the Site is approximately 43 km from the array, it is an extremely efficient use of any available vibration budget.

1.6.28 The Applicant contracted subject matter experts Xi Engineering Consultants to determine the impact of the Proposed Develpment on the Eskdalemuir Seismic array. **Technical Appendix 1.5 (EIAR Volume 4)** calculates the required Seismic Vibration budget for the Proposed Development and compares this to the available budget based on most up to date science. It is expected that the Proposed Development will be capable of accommodation within the revised noise budget and safeguarding policy that are under consideration by the Scottish Government and the MoD.

1.6.29 The proposed government policy to maximise deployment within the safeguarding zone is to enforce a Seismic Impact Limit (SIL). The analysis shows that the preferred Government and Industry SIL levels of 2-2.5 GW would provide sufficient budget for the Site to be built out within the cumulative seismic budget and therefore not compromise the safeguarding of the array.

TELECOMMUNICATIONS

1.6.30 Three fixed telecommunications links, operated by Vodafone cross the Proposed Development Site:

- Vodaphone Link 1 (I.D: 0496701/1 /) runs between transmitters at Craghead Hill (292260E 623760N) to Lesmahagow, South Lanarkshire (284070E 640870N).
- Vodafone Link 2 (I.D: 1332702/1 /) runs between transmitters at Craighead Hill (292276E 623789N) to Douglas, South Lanarkshire (286947E 629964N).
- Vodafone Link 3 (I.D: 1334216/1 /) runs between transmitters north of Crawfordjohn, South Lanarkshire (289181E 626910N) to Whitelaw Brae, South Lanarkshire (300392E 625963N).

1.6.31 A Telecommunications Assessment has been undertaken to identify potential infringements of the links by turbines and is presented in **Technical Appendix 1.6 (EIAR Volume 4)**. The assessment identified that Turbine 5 and Turbine 14 would be within the Fresnal Zone of one telecommunications link. However, a technical mitigation solution would be agreed between the Applicant and the service operator following consent of the Proposed Development, if granted. The technical mitigation solutions which would be considered include:

- Micrositing of turbines;
- Re-networking of the link via existing telecommunications sites; and
- Use of a leased line.

1.6.32 Considering the above, no significant effects are anticipated on telecommuncations as a result of the Proposed Development.

Baseline Characterisation

1.6.33 Baseline characterisation is the process by which the environmental conditions now and in the future assuming no development on the site are established. The process has included a combination of desk research, site survey and empirical study and projection.

1.6.34 The environmental baseline adopted for the purposes of the EIA is stated in each of the technical assessment chapters provided in the EIAR. The baseline is normally taken as the current character and condition of the site and surrounds, and the likely significant environmental effects of the development are then assessed in the context of the current conditions. However, potential future baseline scenarios, particularly with regard to the ongoing quarrying operations and quarry restoration work immediately adjacent to the Site are included within the assessments, where applicable.

Mitigation by Design and Consideration of Alternatives

1.6.35 Following the baseline characterisation, the information collected on environmental constraints was used to inform the consideration of design alternatives. An iterative process was followed, whereby the Applicant considered a range of turbine layout, height and access proposals, as well as different extents of solar array area. The aim of the design element of the EIA process was to develop an optimal solution which seeks to maximise potential renewable energy generation, within technical and environmental constraints. The main aim has been to avoid likely significant environmental effects through the design. Further details on the design process adopted for the Proposed Development are set out within Chapter 3: Design Evolution and Alternatives.

Impact Assessment

1.6.36 The next stage in the EIA process was to complete an impact assessment to address the likely significant effects remaining following the implementation of mitigation by design. An assessment chapter has been provided for each issue where it is considered that there are likely significant effects associated with the construction, operation, decommissioning or restoration phases of the Proposed Development. Each assessment chapter considers primary, secondary, direct, indirect and cumulative effects and defines the assessment methodology used and the criteria by which a significant effect is defined.

Additional Mitigation

1.6.37 The impact assessment is used to identify where additional mitigation is required to address likely significant effects, where it has not been possible to avoid the effect through design of the turbine or infrastructure layout. Mitigation has been considered following a hierarchy of first seeking to avoid effects, followed by seeking a reduction in effects to level not considered significant, and finally where necessary and possible, offsetting or compensatory measures are considered. **Chapter 13: Schedule of Mitigation (EIAR Volume 2)** provides a summary of the mitigation measures provided in each of the technical chapters to avoid, reduce or offset impacts which could give rise to significant residual effects. In addition, some good practice environmental management measures and commitments have been proposed to further reduce environmental effects, which are not considered to give rise to likely significant effects with or without mitigation.

Statement of Competence

1.6.38 In accordance with regulation 5(5) of the EIA Regulations, by appointing Ramboll UK Limited (Ramboll) the Applicant has ensured that the EIAR has been prepared by 'competent experts'. The EIAR has been compiled and approved by professional EIAR practitioners at Ramboll, holding relevant undergraduate and post-graduate degrees, membership of the Institute of Environmental Management and Assessment (IEMA) and Chartered Environmentalist status with the Society for the Environment. The EIAR meets the requirements of the IEMA EIA Quality Mark Scheme. This is a voluntary scheme operated by IEMA that allows organisations to make a commitment to excellence in EIA and to have this commitment independently reviewed on an annual basis.

1.6.39 The project team comprises the companies presented in Table 1.1 below. Professional qualifications for the lead author of technical reports is included in **Technical Appendix 1.2 (EIAR: Volume 4)** and each of the impact assessment chapters provides details of the relevant professional memberships of the author, code or practice followed and assessment methodology used.

Table 1.1: Project Team

Discipline Organisation	Discipline Organisation
Lead EIA Consultant	Ramboll
Planning and Policy	David Bell Planning
Landscape and Visual Amenity	MVGLA Ltd
Cultural Heritage	CFA Archaeology
Ecology and Ornithology	MacArthur Green
Hydrology, Hydrogeology and Geology	Ramboll
Traffic and Transport	Pell Frischmann
Noise	TNEI
Aviation	Aviatica
Socio-Economics	BIGGAR Economics
Telecommunications	Pager Power
Shadow Flicker	Ramboll

1.7 Copies of the EIAR

1.7.1 Paper copies of the **Non-Technical Summary (EIAR Volume 1)** and **Visualisations (EIA Volume 3b)** along with USB sticks containing the full EIAR will be made available to view at the following publicly accessible locations:

- Crawfordjohn Village Hall, Crawfordjohn; and
- The Old Schoolhouse, Abington

1.7.2 This EIAR, including all figures, technical appendices and accompanying documents are available to view and download on the project website (https://www.renewcopower.com/portfolio/united-kingdom/uk-projects/m74-west-renewable-energy-park/) free of charge.

1.7.3 The application documents will be available via the Scottish Government Energy Consents Unit portal (https://www.energyconsents.scot/Default.aspx) and South Lanarkshire planning portal.

1.7.4 The Applicant will work closely with the ECU to ensure all statutory consultees receive a physical copy of this EIAR upon request.

1.7.5 In the interests of sustainability, reference to the paperless (project website/ECU/ SLC planning portal) version is strongly recommended. For anyone who has difficulty accessing the documentation online, a CD or USB copy will be made available free of charge. Hardcopies of the Non-Technical Summary can also be made available free of charge by contacting m74west@renewcopower.com.

1.8 Commenting on the Application

1.8.1 When the application for the Proposed Development is lodged with Scottish Government the applicant will advertise the application in accordance with legislation as follows:

- A local newspaper for two successive weeks (Carluke & Lanark Gazette and Carluke & Lanark Advertiser);
- a *national newspaper* for one week (The Herald);
- the *Edinburgh Gazette* for one week; and
- on the Developers' application website at: https://www.renewcopower.com/portfolio/united-kingdom/uk-projects/m74-west-renewable-energy-park/

1.8.2 The advertisement will provide details of the date by which representations should be made. The Scottish Government will invite formal representations on the Proposed Development, which will be taken into account before any decision is reached on the application.

1.8.3 Any representations in relation to the application should be made to the Energy Consents Unit mail box, at representations@gov.scot, via the Energy Consents website at www.energyconsents.scot or by post to The Scottish Government, Energy Consents Unit, 4th Floor, 5 Atlantic Quay, 150 Broomielaw, Glasgow, G2 8LU, identifying the Proposed Development and specifying the grounds for representation. Written or emailed representations should be dated, clearly stating the name (in block capitals), full return email and postal address of those making representations.

2 Development Description

2.1 Introduction

2.1.1 This chapter provides a description of the Proposed Development for the purposes of identifying and assessing likely significant effects. Information is provided on:

- the location of the Proposed Development;
- the physical characteristics of the development, including, the land-use requirements during the construction and operational phases;
- the main characteristics of the construction and operational phase of the development having regard to the type and quantity of expected residues and emissions; and
- typical activities associated with the decommissioning of the Proposed Development.

2.1.2 This chapter is supported by the following technical appendices which are presented in Volume 4: Technical Appendices of the EIAR:

- Technical Appendix 2.1: Outline Construction Environmental Management Plan (OCEMP);
- Technical Appendix 2.2: Borrow Pit Assessment;
- Technical Appendix 2.3: Forestry Impact Assessment; Technical Appendix 2.4: Carbon Balance Assessment; and
- Technical Appendix 2.5: Glint and Glare Assessment. Figures 2.1-2.12 are presented in Volume 3a: Figures of the EIAR and are referred to in the text as appropriate. The figures are as follows:
  - Figure 2.1: Site Layout;
  - Figure 2.2: Typical Wind Turbine Elevations;
  - Figure 2.3: Typical Turbine Foundations and Crane Hardstanding;
  - Figure 2.4: Typical Access Track Detail ;
  - Figure 2.5: Typical Substation and Compound Layout;
  - Figure 2.6: Typical Cable Trench Section;
  - Figure 2.7: Typical Temporary Construction Compound Layout;
  - Figure 2.8: Battery Storage Layout;
  - Figure 2.9: Typical Battery Detail;
  - Figure 2.10: Typical PCS Elevations;
  - Figure 2.11: Typical CCTV and Fencing Layout; and
  - Figure 2.12: Typical Solar PV Equipment and Materials Detail.

2.2 Site Location

2.2.1 The 'Site' (defined by the red line boundary on **Figure 1.1: Site Location (EIAR Volume 3a)**) covers an area of approximately 1,275 hectares (ha) and is located approximately 1.1 km northwest of Abington and approximately 4.5 km southeast of Douglas, in South Lanarkshire (approximate OS Grid Reference for Site centre: NS 989983 26013).

2.2.2 There are two residential properties within the red line boundary; Thirstone Cottage and the Strand. These properties are financially involved in the Proposed Development and it is intended that both properties will be used as part of the Proposed Development and will not continue in residential use. In addition, there are a number of residential properties in close proximity to the Site, including Blackburn Farm, Netherton Farm, Crawfordjohn Mill Farm, Craighead Farm and Duneaton House, as well as residential settlements at further distance concentrated particularly within the villages of Abington, Crawfordjohn, Roberton and Douglas.

2.2.3 The Site predominantly comprises open moorland, improved and semi-improved grassland, an area of forestry, and is intersected by the M74 motorway and B7078 and B740 local roads. The landscape is typical of the wider location, with the Site positioned in the northern portion of the Southern Upland Hills, with Tinto Hill located approximately 8 km to the north. The Duneaton Water, a tributary of the River Clyde, passes through the eastern part of the Site and forms part of the northern and southern boundary. The A702 forms the eastern boundary. There are numerous existing wind farms within 15-20 km, including large developments such as Clyde and its extension to the east, and Andershaw and Middlemuir occupying the western part of the wider moorland area which includes some of the proposed turbine array. A number of relevant developments are proposed in the immediate vicinity, including the Redshaw 400 kV substation[1] and Bodinglee Wind Farm[2] on land immediately adjacent to the northwest of the Site, north of the B7078 and M74 respectively.

2.2.4 There are two statutory sites designated for nature conservation within 5 km of the Site: Red Moss Special Area of Conservation (SAC) and Red Moss Site of Special Scientific Interest (SSSI), both designated for raised bog. The Site boundary slightly overlaps with the Red Moss SAC and SSSI (as shown in **Figure 6.1 (EIAR Volume 3a)**; no development would be undertaken within this part of the Site, however, habitat management for waders is proposed in this area as part of the Outline Biodiversity Enhancement Management Plan (**Technical Appendix 6.6, EIAR Volume 4**).

2.2.5 There are five designated heritage assets (all of which are scheduled monuments) within the Site boundary, as well as two sites recorded in the Historic Environment Record (HER) classed as being of potential national importance. Ten listed buildings have been identified as being within 5 km of the Site: eight of Category B and two of Category C.

2.2.6 A number of watercourses run through the Site. Mill Burn is present along the northeastern boundary of the Site and Black Burn is present at the southern boundary. The Duneaton Water forms the south-most part of the site boundary. The eastern part of the Site where the solar array is proposed, drains in a generally easterly direction towards the Duneaton Water and the River Clyde. Duneaton Water forms the northern boundary of the solar array area to the north of Abington Services.

2.2.7 A single area of ancient woodland, Dod Wood, is located adjacent to the Site boundary, immediately north of the B7078. In addition, a further area of ancient woodland, Whitrae Wood, is located approximately 100 m south of the Site boundary, on the north-eastern slopes of Craighead Hill. Areas of ancient woodland within 5 km of the Site are numerous, with most of these concentrated to the south and northwest.

2.3 Project Description

2.3.1 The Proposed Development would comprise up to 22 turbines, solar power generators and battery energy storage system (BESS) along with associated infrastructure, arranged as illustrated on **Figure 2.1: Site Layout (EIAR Volume 3a**).

[1] Further information on the proposed Redshaw substation can be found here: https://www.spenergynetworks.co.uk/pages/redshaw_400kv_substation.aspx [accessed 13/06/2024]

[2] Further information on the proposed Bodinglee Wind Farm can be found here: https://www.onpathenergy.com/bodinglee/ [accessed 13/06/2024]

2.3.2 The Proposed Development would include the following key components:

- Up to 22 wind turbines with a maximum tip height of 200 m;
- permanent foundations supporting each wind turbine, and associated permanent and temporary crane hardstanding at each wind turbine base;
- a main site entrance for use during construction and operation, at the current entrance to Thirstone Quarry;
- two site entrances to the south of the B7078 and one site entrance off of the B740 directly south of the B7078, which will be designed to accommodate abnormal indivisible loads (AIL) required for turbine component delivery;
- a further site entrance from the M74 motorway to the northern part of the site only, to allow delivery of AIL required for turbine component delivery. Empty loads will return to the road network via the existing underpass and the B7078, rejoining the M74 at Junction 13;
- five further site entrances to the solar array area, four from the B7078 (two to the north and two to the south) and one from the A702 immediately north of Abington Services;
- a series of new on-site access tracks with associated watercourse crossings and turning heads;
- underground cable arrays within the Site connecting the turbines and solar panels to the on-site substation;
- substation compound and control building;
- repurposing of the house at Thirstone Cottage as a site office;
- repurposing of the property at The Strand as a strategic spares store;
- solar power generators, of approximately 80 MWac generating capacity;
- a battery energy storage system (BESS) with approximately 50 MW capacity and 200 MWh of storage; and
- four temporary construction compounds and laydown areas, the main one located adjacent to the substation and BESS sites and three satellite areas: one located in the northern area of the turbine array and the other two located in the solar array area, one adjacent to the B7078 and other adjacent to the A702 road.

2.3.3 In addition, the following ancillary works would be necessary:

- habitat management plan areas, including plantation forestry felling and replacement planting;
- extraction of rock from borrow pits; five borrow pit search areas have been located within the turbine area, a sixth borrow pit search area is proposed within the solar area;
- temporary on-site concrete batching plant may be required. This would be located within the temporary compound areas and/or borrow pit search area; and
- works on land outside the main development area and immediately adjacent to the M74 to allow the delivery of abnormal loads to the northern area of the site (e.g. construction of over-run areas, temporary modifications to street furniture).

2.3.4 The locations of the proposed turbines and other infrastructure would be subject to 'micrositing'. This process allows for minor changes in turbine or infrastructure locations to respond to possible variations in ground conditions across the site, which would only be confirmed following detailed site investigation work carried out immediately prior to construction. This process also provides scope for further mitigation of localised potential environmental effects through avoidance of sensitive features. It is anticipated that a micrositing distance of 100 m would form a condition accompanying any consent. Any repositioning would not encroach into environmentally constrained areas and would be carried out under the supervision of an ecological clerk of works and an appropriately experienced and qualified engineer. The proposed locations for all infrastructure including wind turbines, solar generators, BESS, tracks, construction compounds, the substation and borrow pits, are shown on **Figure 2.1: Site Layout (EIAR Volume 3a)**.

Wind Turbines and Turbine Layout

2.3.5 The turbine coordinates of the proposed turbines are set out in Table 2.1: Turbine Locations.

Table 2.1: Turbine Locations

Turbine Number	Easting	Northing
1	289226	628279
2	289653	628010
3	289983	627700
4	288602	627840
5	289004	627578
6	289398	627296
7	289907	627124
8	290496	626904
9	291024	626883
10	287981	627375
11	288776	626791
12	289303	626583
13	289747	626380
14	290183	626235
15	290787	626292
16	291256	626117
17	287557	626728
18	287965	626424
19	288535	626071
20	289421	625632
21	290002	625678
22	290089	625121

2.3.6 These locations would be subject to micrositing during the construction phase. The Construction Environmental Management Plan (CEMP) would include detailed guidance on the application of the micrositing tolerance which would be set by the consent condition. An OCEMP is included in **Technical Appendix 2.1: OCEMP (EIAR Volume 4)**.

2.3.7 The exact model of wind turbine to be installed at the Proposed Development would be selected through a competitive procurement process. In each assessment in the EIA, a worst-case scenario of the turbine dimensions/characteristics relevant to that topic has been used. An indicative turbine for the Proposed Development is shown on **Figure 2.2 Typical Wind Turbine Elevations (EIAR Volume 3a)**.

2.3.8 Wind turbines are available in a variety of colours, the most common being off white or light grey. The finish is normally semi-matt. The colour of the turbines would be agreed in consultation with South Lanarkshire Council (SLC).

2.3.9 Based on current (2024) wind turbine generator technology the typical generation capacity for a turbine of the size and design proposed would be between 6.1-7.5 MW.

Permanent Land Take (Operational Phase)

2.3.10 The site area is approximately 1,275 ha (**EIAR Volume 3a: Figure 2.1: Site Layout**). Within this area the permanent land take would be limited to the wind turbine hardstanding area, BESS hardstanding area, access tracks (all areas of the Proposed Development), permanent crane hardstandings and substation hardstanding area, which account collectively for about 1.40% of the total area within the Site.

2.3.11 The turbine foundation (**EIAR Volume 3a: Figure 2.3: Typical Turbine Foundations and Crane Hardstanding Dimensions**) is made up of a central excavation of approximately 27 m diameter and an approximate depth of 3-5 m subject to prevailing ground conditions. Sloping batters would increase the excavated area to approximately 35 m diameter at ground level.

2.3.12 Each turbine requires a crane hardstanding to facilitate construction and maintenance. At each turbine there would be a 0.191 ha permanent crane hardstanding (**EIAR Volume 3a: Figure 2.3: Typical Turbine Foundations and Crane Hardstanding Dimensions**).

2.3.13 A 2 m wide maintenance hardstanding would be created around the base of each turbine. The foundation excavation would be backfilled and covered with soil, leaving only the concrete plinth exposed at ground level to which the steel tower would be attached.

2.3.14 The Proposed Development would result in the construction of approximately 21.1 km of new track. The required running width of the track would be typically a minimum of 5 m on straight sections, with 0.5 m wide shoulders on each side. Tracks would be wider on bends. Typical access track details are presented on **Figure 2.4: Typical Access Track Detail (EIAR Volume 3a)**. The total permanent land take area for the new tracks would be approximately 10.55 ha, which includes the hardstanding area for turning heads.

2.3.15 The Proposed Development would also include the upgrade of approximately 1.17 km of existing track. The total permanent land take area for the upgraded tracks would be approximately 0.58 ha.

2.3.16 The substation compound would take up an area of approximately 0.96 ha (**EIAR Volume 3a: Figure 2.5: Typical Substation and Control Building Layout**). The substation compound would comprise a substation, and control room building (if required), including basic welfare facilities (e.g. a toilet and parking area), and potentially some external electrical equipment. The building would accommodate all the equipment necessary for automatic remote control and monitoring of the Proposed Development in addition to the electrical switchgear, fault protection and metering equipment required to connect the Proposed Development to the electricity network. Depending on the nature of the connection, there may be external electrical infrastructure adjacent to the control building.

2.3.17 The battery storage compound would take up an area of approximately 2.0 ha (EIAR Volume 3a: Figure 2.8: Battery Storage Layout).

Temporary Land Take (Construction Phase)

2.3.18 A temporary area of excavation around each turbine would be identified during detailed design once an accurate cut and fill profile has been identified.

2.3.19 In addition to the permanent hardstanding, an additional 6,265 m^2 of temporary hardstanding for blade finger and secondary crane pads during the construction phase would be required at each turbine location.

2.3.20 There are four proposed temporary construction compound locations. The main construction compound within the turbine array area, located adjacent to the proposed substation and BESS areas, would require a hardstanding area of approximately 10,000 m^2. The temporary satellite construction compound in the turbine array area would require a hardstanding area of approximately 5,000 m^2, which allows area for staff parking, welfare and plant and material storage. Two temporary construction compound areas have also been identified within the solar array area, sized at 18,750 m^2 and 11,460 m^2.

2.3.21 The temporary concrete batching plant would be located either within the footprint of one of the temporary construction compounds described above or within a borrow pit search area.

2.3.22 Six potential borrow pit locations have been identified; these are rectangular in shape with approximate parameters provided in paragraph 2.3.47 below. The total area of each potential borrow pit location is given in Table 2.2 below; however, the total area of each borrow pit required would be determined at a later stage once the exact quantity of material required is known and further site investigations have been undertaken.

2.3.23 Ancillary excavation works and material storage around other parts of the Site, such as those for cable trenching, would have a negligible impact on environmental receptors due to the very minor scale of the excavation or duration of the works and are not considered further in this EIAR.

2.3.24 The area of temporary and permanent land take associated with the Proposed Development is presented in Table 2.2: Summary of Temporary and Permanent Land Take.

Table 2.2: Summary of Temporary and Permanent Land Take

Energy Project Element		**Temporary (m^2)**	**Permanent (m^2)**
Turbines, Crane Pads and Laydown Areas		108,372	42,108
On-site Access Tracks (New)		0	105,500
Substation Compound		0	9,600
BESS Compound		0	20,000
Temporary Construction Compounds	A	10,000	0
	B	5,000	0
	C	18,750	0
	D	11,460	0
Borrow Pits	1	11,000	0
	2	7,000	0
	3	4,200	0
	4	6,600	0
	5	3,300	0
	6	11,000	0
Total Land Take		**196,682**	**177,208**

Turbine Foundations and Hardstanding

2.3.25 Turbines are typically fixed to steel reinforced concrete foundations, approximately 27 m in diameter. The foundations would be formed in excavations approximately 3-5 m deep, depending upon ground conditions (**EIAR Volume 3a: Figure 2.3: Typical Turbine Foundations and Crane Hardstanding Dimensions**).

2.3.26 Concrete for site construction, including turbine foundations, would likely be batched on-site.

2.3.27 During the erection of the turbines, crane hardstanding areas would be required adjacent to each turbine base. Typically, these consist of a main crane hardstanding area adjacent to the turbine position where the main turbine erection crane would be located, plus additional areas of land temporarily required during the assembly of the main crane jib and assembly of the rotor. Figure 2.3 provides an illustration of a typical crane hardstanding arrangement (dimensions may vary). The hardstanding provides a stone platform with a total permanent area estimated at approximately 1,914 m^2 per turbine for the crane pads.

2.3.28 There would be a need to use cranes from time to time during the operational phase of the proposed development; therefore, the main crane hardstanding would be left uncovered to ease maintenance activities.

Turbine Lighting

2.3.29 The Proposed Development would require visible aviation lighting under the current Civil Aviation Authority (CAA) policy statement[3]. In order to mitigate the night time visual impact of the Proposed Development on non-aviation receptors a reduced lighting scheme has been designed and will be submitted to the CAA for approval. The reduced lighting scheme proposes 2000 candela steady red lights on eight of the 22 turbines (T1, T3, T4, T9, T16, T17, T19 and T22), but no mid-tower lighting. Further detail is provided in **Chapter 11: Aviation (EIAR Volume 2)**.

2.3.30 In addition to lighting on the turbines themselves, low-level security lighting at the substation, battery energy storage system (BESS) and solar array would also be required.

Electrical Cabling

2.3.31 Electrical connections from the wind turbines and solar panels to the onsite electrical substation and control building will be made via underground cables. All power and cabling on site will be laid in trenches approximately 1.25-2 m wide (depending on the number of circuits in each trench) and approximately 1 m deep, located adjacent to the access tracks, in the verge or close to the track which will allow for easy access to lay the cable. Some cable trenches will also be required along the B7078 and A702 public roads. Typical cable trench detail is illustrated in **Figure 2.6: Typical Cable Trench (EIAR Volume 3a)**.

On-Site Substation Compound

2.3.32 The substation compound would measure approximately 9,600 m^2 and would include a substation and control building, two 33/132 kV transformers, an auxiliary transformer and other associated substation equipment, including a building operated by the transmission licence holder (Scottish Power Energy Networks).

2.3.33 The electrical cables would terminate at the substation, which will include control building of approximately 360 m^2 in size containing switchgear, control equipment and basic welfare

[3] CAA Policy and Guidelines on Wind Turbines, CAP 764 (Draft June 2020)

facilities including a toilet. The substation compound would also include a parking area (**EIAR Volume 3a: Figure 2.5: Typical Substation and Control Layout**).

Battery Energy Storage

2.3.34 A BESS area, measuring approximately 124 m x 160 m, is proposed adjacent to the substation and would contain battery containers, switchgear container, power conversion systems and security fencing (**EIAR Volume 3a: Figure 2.8: Battery Storage Layout**). The BESS area would have two separate access points consisting of crushed stone hardstanding. The crushed stone hardstanding would be located around the BESS infrastructure to allow for access and maintenance to all parts of the BESS area during operations.

Solar Array

2.3.35 The solar PV array would consist of approximately 3,065 solar panels laid out in approximately 37 m long rows, known as strings, with a spacing of approximately 9 m between each row. Each string of panels would be mounted on a rack comprising metal poles anchored to the ground via concrete footings or shallow piles. The approximate area that would be covered by the solar array would be 160 ha, within which the panels footings would be very small in extent, with grazing and vegetation management allowed to continue around them. Given the small extent of the footings these have not been included in the calculation of permanent land take in Table 2.2.

2.3.36 The panels would be mounted at approximately 0.8 m from the ground rising to 2.86 m and be tilted approximately 25 degrees from horizontal in a south facing direction **(EIAR Volume 3a: Figure 2.11 Typical Solar PV Equipment and Materials Detail).**

Temporary Construction Compounds

2.3.37 Four temporary construction compounds would be required to enable construction of the Proposed Development. The compounds would be located as shown on **Figure 2.1: Site Layout (EIAR Volume 3a)**. Each compound area would include:

- access tracks and internal circulation routes for vehicles and pedestrians;
- lighting for security and safety during hours of darkness;
- surface water management measures;
- temporary office accommodation and welfare buildings (toilets, kitchen/canteen, drying rooms);
- equipment storage;
- a receiving area for incoming vehicles;
- maintenance and refuelling facilities;
- waste, recycling and materials management facilities;
- general laydown areas; and
- parking

2.3.38 Four temporary construction compounds are proposed and the approximate areas would be as follows:

- Compound A: 10,000 m^2.
- Compound B: 5,000 m^2;
- Compound C: 18,750 m^2; and
- Compound D: 11,460 m^2.

2.3.39 An indicative layout of a typical temporary construction compound is shown in **Figure 2.8: Typical Temporary Construction Compound Layout (EIAR Volume 3a)**.

Access and Site Tracks

2.3.40 Access to Site would be taken from the following roads:

- Access to the northern section of the turbine area would be take directly from the M74, with unloaded vehicles leaving the Site via the underpass and the B7078 road;
- Access to the middle and southern sections of the turbine area would be taken from the B7078 and the B740; and
- Access to the solar array area would be taken from the B7078 road and the A702.

2.3.41 For more information on the delivery route to the site see **Chapter 9: Transport, Traffic and Access (EIAR Volume 2).**

2.3.42 Approximately 21.1 km of new onsite access tracks and approximately 1.17 km of upgraded track would be required to provide access to the wind turbines, substation compound, solar array, borrow pit search areas and construction compounds (Figure 2.1: Site Layout). Typical access track designs are shown in **Figure 2.4: Typical Access Track Detail (EIAR Volume 3a)**. This figure shows the use of typical cut and fill access tracks.

2.3.43 Tracks would have a typical 5 m running width with appropriate widening on bends, at junctions and passing places.

2.3.44 In all areas, the peat and topsoil have been confirmed as being less than 1 m deep. As such, the vegetation and soil would typically be stripped to a suitable subsoil layer and the track (approximately 300 mm – 500 mm thick) would be constructed on the subsoil. The upper topsoil layer, together with turf, would be stored temporarily for use in landscaping and revegetating the track shoulders and track side drainage or other reinstatement works across the Site.

2.3.45 Once the soil has been removed, as described above, to a suitable founding layer, the road and running surface would be constructed by tipping and compacting aggregate of the required shape and thickness. Cross-sections of the final road shape following reinstatement of the roadside slopes by replacing the layers of excavated material in the correct order are presented in **Figure 2.4: Typical Access Track Detail (EIAR Volume 3a)**.

2.3.46 The on-site track layout has been designed to minimise environmental disturbance and land take by avoiding areas of deeper peat and steep slopes in excess of 12 degrees as well as, wherever possible, avoiding or minimising impact on areas of identified environmental constraints.

2.3.47 The track layout has been carefully designed to minimise the number of watercourse crossings where possible, which are discussed in section 2.4 below.

Borrow Pits

2.3.48 Indicative borrow pit locations have been identified covering a total area of approximately 43,100 m^2 to supply material to construct the Proposed Development. The use of all of these borrow pits would provide a greater volume of rock than would be needed for the construction of the Proposed Development and the approximate dimensions identified allow for the current uncertainty on the quality of the rock at these locations. A micrositing allowance of up to 100 m (as per paragraph 2.3.3) has been placed around these locations, as shown on **Figure 2.1: Site Layout (EIAR Volume 3a)**. Detailed design of the borrow pits would be undertaken post-consent and it is likely that only some of the borrow pits would be required, and smaller areas than indicated actually excavated; however, for the purposes of the assessment the full extent of all six borrow pits has been assessed (**EIAR Volume 4: Technical Appendix 2.2: Borrow Pit Assessment**).

Table 2.3: Borrow Pit Areas				
Borrow Pit No.	**NGR Reference (Centre)**		**Approximate Excavation Dimensions (m)**	**Area of Land Impacted (m^2)**
1	288858	628024	110 x 100	11,000
2	289103	627716	100 x 70	7,000
3	288515	627872	70 x 60	4,200
4	289122	626805	110 x 60	6,600
5	290377	624913	110 x 30	3,300
6	292252	625101	110 x 100	11,000

2.3.49 Stone would be required for various purposes, primarily track and hardstanding construction. If the stone on site is found to be suitable then a proportion of this could be won from foundation excavation and the remainder will be sourced from on-site borrow pits or from off-site quarries.

Connection to Electricity Grid

2.3.50 The Proposed Development would connect to the proposed Redshaw Substation, which is to be located on a site approximately 2 km northwest of the on-site substation. The grid connection would be the responsibility of the transmission licence holder (Scottish Power Energy Networks); however, it is understood that the connection would be made via underground cable. This would be subject to a separate permitting process; as such the details of the grid connection route are unknown at this stage.

2.4 Construction Activities

Construction Programme

2.4.1 The estimated construction period of the Proposed Development is approximately 18 months. This period is indicative only and may be subject to variation as a result of factors which include, but are not limited to, weather restrictions, ground conditions encountered through detailed investigation, turbine component and material delivery, timing of grid connection works and public highway constraints. However, this is considered to represent a realistic case for the purposes of assessment.

2.4.2 Construction by the appointed main contractor will begin following agreement of the detailed design and approval of any pre-commencement conditions with the appropriate consenting authority. Key construction activities will involve:

- construction of the temporary construction compounds and laydown areas;
- public road improvement and junction creation;
- construction of main site access track;
- construction of all access tracks having established all required borrow pits;
- design and construction of temporary and permanent drainage measures;
- installation of concrete batching plant;

- construction of turbine foundations, crane hardstandings and laydown areas;
- construction of the solar array;
- excavation of cable trenches;
- laying of electricity and communications cables in trenches;
- construction of substation and control building;
- construction of BESS;
- delivery, installation, testing and commissioning of wind turbines and ancillary equipment;
- installation of external turbine transformers and switchgear in enclosed kiosks;
- site reinstatement and restoration in accordance with peat management plan; and
- implementation of Habitat Management Plan (HMP) measures.

2.4.3 The works are likely to follow the order as detailed above, however many activities will be undertaken concurrently to minimise the overall construction programme. Site restoration will be undertaken as soon as possible in affected areas to minimise disruption to land use. Where appropriate measures to be delivered as part of the HMP will be implemented at the earliest practicable opportunity to maximise and expedite the potential for beneficial effects.

2.4.4 Further ground investigation surveys will be undertaken prior to the main construction works beginning onsite to determine the specific quality of rock and the rock head depth underlying the locations for site infrastructure. Initial site investigations have informed the design of the layout of the Proposed Development (i.e. Phase 1 and Phase 2 Peat probing) including positioning and anticipated construction characteristics of site access roads. The full site investigation works required to inform detailed civil engineering design would take place six months to one year before the main construction period commences.

2.4.5 The appointed contractor will develop the details of the site design and construction methods in compliance with the Applicant’s contract requirements and the EIAR.

2.4.6 The access tracks will be left in place following construction to provide permanent access for maintenance, repairs and eventual decommissioning of the Proposed Development. The construction works will be undertaken by a competent and experienced contractor in accordance with the project consent and any associated conditions and also in accordance with good industry practice. Prior to commencing construction, a more detailed construction and reinstatement programme will be submitted to the consenting authority.

2.4.7 Traffic movements associated with the construction of the Proposed Development including required Heavy Goods Vehicles (HGV) and heavy/abnormal load movements are described in **Chapter 9: Traffic and Transport (EIAR Volume 2).**

2.4.9 An indicative construction programme for the Proposed Development is illustrated in Table 2.4 below.

Table 2.4: Indicative 18-Month Construction Programme

	Month																	
Task *	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										■	■	■	■					
8												■	■	■	■	■	■	
9													■	■	■	■	■	■
10																■	■	■
11	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

*Task:

1. Forestry felling
2. Site establishment / plant deliveries
3. Borrow pit working, access track construction and hardstanding areas
4. Foundations
5 Substation construction
6. BESS Installation and civils works
7. Cabling
8. Erection and commissioning of turbines / Solar PV installation
9. Site reinstatement & restoration
10. Testing and commissioning
11. HMP implementation works

Hours of Work

2.4.10 The normal working hours will be as follows:

- Monday to Friday 0700-1900;
- Saturday 0700-1300; and
- no working on Sundays or public holidays without prior written approval from SLC.

2.4.11 No works, with the exception of turbine delivery, the completion of turbine erection and commissioning or emergency work, will take place outside these hours, and any such out-of-hours works will be subject to prior agreement with SLC. The requirement for out-of-hours work could arise, for example, from delivery and unloading of abnormal loads or health and safety requirements, orto ensure optimal use is made of fair weather windows for the erection of turbine blades and the erection and dismantling of cranes.

Construction Traffic and Plant

2.4.12 Vehicle movements associated with construction works would include:

- Cars and minibuses for transporting construction personnel to the site;
- Heavy goods vehicles (HGVs) for pre-construction delivery of site offices, construction equipment and materials;
- HGV abnormal load vehicles for delivery of the turbine components and base rings; and
- Mobile road going cranes, used for the erection of the turbines; and
- Standard HGVs for transporting electric cable, solar panels, BESS containers, steel reinforcement for foundations, construction plant fuel and other items and equipment.

2.4.13 A Traffic Management Plan would be agreed in consultation with SLC and Transport Scotland. This would address the scheduling, routing and overall management of abnormal loads movements along with the programming and management of all other HGV movements (**EIAR Volume 4: Technical Appendix 9.1: Traffic Assessment**).

Watercourse Crossing Schedule

2.4.14 As noted above, the number of watercourse crossings has been minimised through site design. Nevertheless, there is a requirement for nine crossings of watercourses as identified on 1:25k mapping.

Standard Mitigation and Working Methods during Construction

Construction Environmental Management Plan (CEMP)

2.4.15 The assessment in this EIAR has been carried out on the basis that standard mitigation measures would be implemented during the construction work, including compliance with both project wide and site-specific environmental management procedures, which would be included in the Construction Environmental Management Plan (CEMP). An OCEMP is provided in **Technical Appendix 2.1 (EIAR Volume 4)**. A detailed CEMP would be submitted to SLC for approval in consultation with relevant statutory consultees prior to construction commencing. The CEMP would, as a minimum, include details of:

- construction methodologies;
- pollution prevention measures;
- public liaison provision;
- peat slide, erosion and compaction management;
- control of contamination/pollution prevention;
- drainage management and SuDS;
- water quality monitoring;
- management of construction traffic;
- control of noise and vibration; and
- control of dust and other emissions to air.

2.4.16 **Technical Appendix 2.1: OCEMP (EIAR Volume 4)** provides a list of generic mitigation measures that would be included in the CEMP and implemented during the construction and decommissioning of the Proposed Development. It would be a contractual requirement that the appointed contractor complies with the CEMP.

Watercourse Crossings

2.4.17 **Technical Appendix 8.4: Watercourse Crossings Assessment (EIAR Volume 4)** contains details of the watercourse crossings required as part of the Proposed Development and the proposed crossing type together with the relevant requirements in relation to *The Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended.*

2.4.18 The final crossing type would be identified as part of the detailed design of the Proposed Development prior to construction and in line with current best practice guidance.

Private Water Supplies

2.4.19 A review of Private Water Supplies (PWS) has been undertaken for the Site and a 5 km buffer around the site boundary **(EIAR Volume 4: Technical Appendix 8.6)**. The assessment identified two PWS abstraction sources recorded within 5 km of the Site.

2.4.20 Mitigation to prevent pollution impacts on any downstream PWS would be set out in a Water Management Plan which would form part of the CEMP, to ensure that the Proposed Development would not lead to significant impact to water abstraction and other hydrological receptors. SEPA would be consulted on the contents of the CEMP and the Water Management Plan prior to commencement of works as part of the discharge of relevant conditions attached to any consent.

2.4.21 The CEMP is presented in **Technical Appendix 2.1: OCEMP (EIAR Volume 4)** and the private water supply assessment is presented in **Technical Appendix 8.6 (EIAR Volume 4)**.

Peat Management

2.4.22 **Technical Appendix 8.2: Outline Peat Management Plan (EIAR Volume 4)** outlines the proposed working methods where the excavation of peat would be required and provides further details on potential volumes of peat excavated and the likely requirements for reinstatement. This provides details of the predicted volumes of peat that would be excavated for the Proposed Development, the characteristics of the peat that would be excavated, and how the excavated peat would be reused and managed. This document would be updated during the detailed design stage and consulted on with SEPA prior to construction and would be included in the final version of the CEMP.

2.4.23 The detailed peat surveys across the site have identified that approximately 54,370 m^3 of peat would be excavated as part of the construction activities associated with the Proposed Development. The Outline PMP outlines how that peat would be recovered, managed and reused within the site.

Peat Slide Risk

2.4.24 **Technical Appendix 8.3: Peat Landslide Hazard and Risk Assessment (PLHRA)** provides further technical information on the likely risk and hazards associated with peat instability, and the proposed standard mitigation and working methods that would be implemented during construction to seek to avoid adverse effects associated with peat instability.

Site Reinstatement and Restoration

2.4.25 Following commissioning of the Proposed Development, the construction site will be reinstated. Reinstatement will form part of the contractual obligations for the Principal

Contractor and will include all temporary works, such as crane pads, borrow pits, temporary compounds and laydown areas.

2.4.26 Following removal of the temporary works, best practise techniques will be used to ensure soils are replaced in the order they were removed with original vegetation reinstated around the permanent hardstanding areas where possible. Where required, reseeding of the temporary works areas will also be undertaken with an appropriate seed mix.

2.5 Operation Management and Maintenance

Life of the Project

2.5.1 The expected operational Proposed Development is 40 years from the date of commissioning. Solar PV is designed to operate largely unattended however maintenance may be required on a six-monthly basis. Maintenance will consist of cleaning of the solar modules and inverters, maintenance of landscaping and electrical maintenance. Wind turbines and wind energy projects are also designed to operate largely unattended. Each turbine at the Proposed Development would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut the turbine down should the need arise. Sometimes the turbines would re-start automatically (if the shut-down had been for high winds, or if the grid voltage had fluctuated out of range), but other shut-downs (e.g. generator over temperature) would require investigation and manual restart.

Operational Residues and Emissions

2.5.2 The EIA Regulations require that the EIAR provides an estimate, by type and quantity, of expected residues and emissions (such as water, air and soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types of waste produced) resulting from the construction and operation of the Proposed Development.

2.5.3 Table 2.5: Residues and Emissions provides a summary of the anticipated residues and emissions.

Table 2.5: Residues and Emissions

Topic	Potential Residue/Emission
Water	Construction: Occasional and low quantity discharges could arise from pumping, or over-pumping in order to dewater foundation excavations and borrow pits. Pollution sources could arise as a result of soil erosion or from oil/ fuel or chemical storage and use. All discharges would be managed in accordance with the Water Environment (Controlled Activities) (Scotland) Regulations 2011. The proposals for water the control and management of water quality and quantity from the Proposed Development are presented in **Technical Appendix 2.1: OCEMP (EIAR Volume 4)**. Further detail on the surface water management proposed during construction is provided in **Chapter 8: Hydrology, Hydrogeology and Geology (EIAR Volume 2)**. Operation: No water emissions or pollution sources have been identified for the operational phase.

Table 2.5: Residues and Emissions	
Topic	**Potential Residue/Emission**
Air	Construction: The construction phase would require the transport of people and materials by road, with associated emissions to the atmosphere. There are no air quality management areas within the vicinity of the Site. Overall the quantity of air emissions is expected to be low relative to the general background air emissions from road traffic. No significant air emissions are anticipated. Operation: Due to the nature of the Proposed Development no significant point source or diffuse air emissions would be produced during its operation. The Proposed Development would contribute to providing renewable electricity, in turn displacing emissions associated with fossil fuel-based electricity generation elsewhere. The construction of the proposed infrastructure, and subsequent operation and decommissioning of the Proposed Development would include activities that either directly or indirectly result in CO_2 emissions. **Technical Appendix 2.4: Carbon Balance Assessment (EIAR Volume 4)** calculates the greenhouse gas emissions and carbon payback times for wind farm developments in Scottish peatlands and concludes that the Proposed Development would 'pay back' the carbon emissions associated with its construction, operation and decommissioning in a 0.6-2.8 year period, with an expected value of 1.5 years.
Soil and Subsoil	Construction: Soil and subsoil excavation, handling and storage would be required during construction. All soil and subsoil would be stored temporarily for use in reinstatement, such that there would be no residue (surplus) remaining following the construction work. Further details on peat management are provided in **Technical Appendix 8.2: Outline Peat Management Plan (EIAR Volume 4)**. Operation: No requirement for soil or subsoil excavation or handling during the operation phase has been identified. No pollution sources have been identified for the operational phase.
Noise and Vibration	Construction: Noise sources during the construction phase would include increased traffic flows and noise from construction plant. Further details are provided in **Chapter 9: Noise (EIAR voilume 2)**. Operation: The wind turbines would generate noise during operation, and the noise levels would vary according to the wind speed. The solar panels and BESS would also generate noise during operation. The location of residential receptors in relation to the Proposed Development was a consideration in the design development process and the predicted noise levels are within acceptable limits. Full details of the noise impact assessment are present in **Chapter 9: Noise (EIAR Volume 2)**.
Light	Construction: **Technical Appendix 2.1: OCEMP (EIAR Volume 4)** notes that temporary lighting would be required at the temporary construction compounds for security purposes and to ensure that a safe working environment is provided to construction staff. In addition, temporary lighting could be required to ensure safe working conditions at infrastructure locations during construction.

Table 2.5: Residues and Emissions	
Topic	**Potential Residue/Emission**
	All temporary lighting installations would be downward facing and all lights would be switched off during daylight hours and out with working hours. Operation: It is proposed to install infrared lighting on the turbines in a pattern that would be acceptable to the Ministry of Defence (MoD) for aviation visibility purposes. The lighting proposed would not be visible to the naked eye. The substation buildings are likely to be equipped with passive infra-red controlled security lighting. These would illuminate the substation compound area when activated. Any effect would be temporary and not expected to be significant during normal operation of the Proposed Development.
Heat and Radiation	No significant sources of heat and radiation have been identified during either the construction or operation phase of the Proposed Development.
Waste	Construction: **Technical Appendix 2.1: OCEMP (EIAR Volume 4)** provides details on pollution prevention control and site waste management that would be implemented during construction. A Site Waste Management Plan would be designed to follow the principles of: Avoidance; Minimisation; Separable; Recyclable. Operation: The power generation aspect of the Proposed Development would not produce any waste emissions or pollutants. The general operation and maintenance of the Proposed Development has the potential to produce a small amount of waste. This is likely to be restricted to waste associated with the control building from employees and visiting contractors and the storage of oils and lubricants.

2.6 Decommissioning

2.6.1 At the end of the project's operational life, a decision would be made as to whether to refurbish, remove, or replace the turbines, solar PV, and BESS. If refurbishment or replacement were to be chosen, relevant consent applications would be made. If a decision were to be taken to decommission the Proposed Development, this would entail the removal of all the turbine components, solar PV, transformers, the substation, the BESS and associated buildings. Underground cables and access tracks would be left in place and foundations removed to a depth of 0.5 m below ground level to avoid environmental effects from removal. A Decommissioning Plan would set out environmental protection measures and restoration principles which would be implemented. This plan would be submitted to SLC for approval and implemented thereafter.

2.6.2 An assessment of the decommissioning of the Proposed Development has not been undertaken as part of the EIA as: i) the future baseline conditions (environmental and other developments) cannot be predicted accurately at this stage, and ii) the proposals for refurbishment / decommissioning are not known at this stage. However, an outline decommissioning strategy is included in the CEMP (EIAR Volume 4: Technical Appendix 2.1: OCEMP).

3 Design Evolution and Alternatives

3.1 Introduction

3.1.1 This chapter provides a description of the reasonable alternatives studied by the Applicant, which are relevant to the Proposed Development and its specific characteristics, in accordance with regulation 5(2)(d) and schedule 4 (paragraph 2) of the EIA Regulations. The chapter provides a description of the main reasons for selecting the chosen option for the Proposed Development, taking into account the effects of the Proposed Development on the environment.

3.1.2 This chapter is supported by Figures 3.1-3.3, which are presented in EIAR Volume 3a: Figures and are referred to in the text as appropriate. The figures are as follows:

- Figure 3.1: Turbine Design Iteration;
- Figure 3.2: Solar Design Iteration; and
- Figure 3.3: Environmental Constraints.

3.1.3 This chapter is structured to provide the following:

- A review of the Site selection considerations, including a review of the planning history of the Site, Site context, policy relevant to the Site selection and the Site feasibility assessment;
- An overview of the design objectives for this Site;
- A description of the reasonable alternatives studied (noting that this is limited to those which are considered relevant to the Proposed Development); and
- A description of the main reasons for selecting the final Proposed Development.

3.2 Site Selection Considerations

3.2.1 This section provides a description of the factors that led to the selection of the Site as a suitable location for wind farm development.

Current Land Use and Site Context

3.2.2 The 'Site', as defined by the red line boundary on Figure 1.1 (EIAR Volume 3a), is located immediately northwest of Abington and approximately 4.5 km southeast of Douglas, in South Lanarkshire, Scotland. The Site occupies an area of approximately 1,275 hectares (ha) and currently comprises open moorland, improved and semi-improved grassland, an area of forestry and is intersected by the M74 motorway and B7078 and B740 local roads. The Site has been subject to extensive sand and gravel quarrying, with quarrying activity currently being concluded at Thirstone Quarry, located to the north of the B7078 and M74 in the central and northern parts of the Site, and previous quarrying activity identified by Ordnance Survey mapping in the northern and western parts of the Site. In addition, there are a number of utility and telelcommunications links that cross the Site, including two high pressure gas pipelines, Scottish Water pipelines and fixed telecommunications links.

3.2.3 The landscape is typical of the wider location, with the Site positioned in the northern portion of the Southern Upland Hills, with Tinto Hill located approximately 8 km to the north. There are numerous existing wind farms within 15-20 km, including large developments such as Clyde and its extension to the east, and Andershaw and Middlemuir occupying the western part of the moorland area where some of the proposed turbine array is located. A number of relevant developments are proposed in the immediate vicinity, including the Redshaw 400 kV substation and Bodinglee wind farm on land immediately adjacent to the Site, north of the B7078 and M74 respectively.

3.2.4 There are two statutory sites designated for nature conservation within 5 km of the Site: Red Moss Special Area of Conservation (SAC) and Red Moss Site of Special Scientific Interest (SSSI), both designated for raised bog and occupying largely the same area. The Site boundary slightly overlaps with the Red Moss SAC and SSSI (as shown in **Figure 6.1 (EIAR Volume 3a)**; no development would be undertaken within this part of the Site however wader management is proposed in this area as part of the Outline Habitat Management Plan.

3.2.5 There are five designated heritage assets (all of which are scheduled monuments) within the Site boundary, as well as two sites recorded in the Historic Environment Record (HER) classed as being of potential national importance. Ten listed buildings have been identified within 5 km of the Site: eight of Category B and two of Category C.

3.2.6 A number of watercourses run through the Site. Mill Burn is present along the northern boundary of the Site and Black Burn is present at the southern boundary. Wildshaw Burn, a tributary of the Duneaton Water, drains the western part of the Site. The eastern part of the Site drains in a generally northeasterly direction towards the Duneaton Water and the River Clyde. Duneaton Water forms the northern boundary of the solar array area.

3.2.7 An area of ancient woodland, Dod Wood, is located adjacent to the Site boundary, immediately north of the B7078. In addition, a further area of ancient woodland, Whitrae Wood, is located approximately 100 m south of the Site boundary, on the north-eastern slopes of Craighead Hill. Further areas of ancient woodland within 5 km of the Site are numerous, with most of these concentrated to the south and northwest.

Relevant Planning Policy

3.2.8 NPF4 has introduced centralised development management policies which are to be applied Scotland wide, and also continues the approach set out in NPF3 of identifying national developments. Proposed National Development 3 (ND3), entitled 'Strategic Renewable Electricity Generation and Transmission Infrastructure', includes renewable energy developments of over 50 MW in installed capacity; therefore, the Proposed Development has national development status. The Proposed Development will make a contribution to the attainment of renewable energy and electricity targets and emissions reduction at both the Scottish and UK levels.

3.2.9 This EIAR does not make any judgements regarding the 'acceptability' of the Proposed Development. A separate Planning Statement is provided which presents an appraisal of the Proposed Development with reference to the energy and planning policy framework and other relevant material planning considerations.

Site Selection and Feasibility

3.2.10 In 2022, the Applicant undertook a number of site search studies followed by early evaluation of feasibility, based primarily on landscape and visual amenity. These studies served to identify potential sites that might be available and which, based on a high-level evaluation of landscape and visual considerations, would have potential for wind energy development.

3.2.11 The Site was identified as having potential for the generation of large amounts of additional renewable energy, from wind in particular, for a number of reasons:

- The Site is situated on the northern edge of the Southern Uplands amidst a cluster of operational and proposed wind farm developments, including the operational Middle Muir wind farm to the west and Clyde wind farm to the southeast. The consented Priestgill wind farm is also located between the northern part of Clyde and the Site, and the proposed Bodinglee wind farm lies immediately to the northwest of the Site. As such there is similar development already in the area.
- The Site has good anticipated wind resource.
- The Site has suitable space, topography, and gradient to accomodate solar PV panels.
- Parts of the Site have been used extensively in the past for rock and sand and gravel quarrying and these areas are considered unlikely to contain significant depth of peat.
- The Site has good proximity to the national road network, with suitable access options for both construction traffic and abnormal indivisible loads (AIL).
- The Site has good access to the electricity transmission network, being crossed by an existing 400 kV overhead transmission line (OHL) and located in close proximity to a proposed transmission substation.

3.2.12 The Site has potential to accommodate a renewable energy project that would make a significant contribution to meeting national energy policy and climate emergency policy related goals of achieving net-zero emissions by 2045.

3.3 Design Process

3.3.1 The Applicant appointed a team of specialist consultants to work alongside M74 West Ltd in designing and developing the energy park proposal. Consistent with renewable energy policy, the key overall objective is to maximise the energy generation potential of the Site, whilst having regard to the protection of sensitive environmental receptors. A design process was agreed with the team that included the parameters set out in the following paragraphs.

3.3.2 The approach to design was informed by and responded to:

- Good practice and windfarm design guidance such as SNH (2017) Siting and Design of Wind Farms in the Landscape (Version 3a);
- Planning policy documents (e.g. NPF4, South Lanarkshire Local Development Plan); and
- Consultation responses received through pre-application consultation, EIA scoping and the Gatecheck process.

3.3.3 A design brief was agreed with the Applicant setting out key parameters for the Proposed Development. The brief included:

- a preliminary landscape-led turbine layout provided by the Applicant, which had been designed to create a legible composition in views from the surrounding area and when travelling through the Site;
- details of land available (illustrated by the application Site boundary);
- indication of the section of the Site technically suitable for locating the solar array; and
- requirements for Site construction compounds, borrow pits, substation, BESS, laydown areas, access track geometry and crane hardstanding geometry.

3.3.4 The design brief subsequently set the scope for constraint mapping with the Applicant being responsible for defining technical requirements such as turbine spacing to avoid turbulence, maximum gradient of potential turbine locations, and associated track infrastructure.

3.3.5 Design guidance from the Applicant confirmed the following requirements for Site infrastructure:

- turbines should be located at a distance of at least tip height + 10% (i.e. 220 m distance) from the M74 motorway and from the existing 400 kV OHL;
- turbines should be located at a distance of hub height + 50% (i.e. 183.75 m distance) from the underground gas pipeline which crosses the Site;
- turbines should be contained within the Site boundary by a distance equivalent to turbine tip height (i.e. 200 m distance) where practicable;
- all watercourses should have a 50 m exclusion area placed around them, in order to ensure protection of water quality, in line with SEPA requirements;
- access tracks should minimise the need for watercourse crossings;
- access track running width to be between 4.5 m and 7 m depending on gradient and bends;
- access tracks should be straight for 20 m before and after a bridge, culvert or hardstanding area;
- turning areas to be provided sized to allow turning of loaded or unloaded blade transporters (as required); and
- where possible, borrow pit search areas should be sited in locations that can be reached via existing tracks, in order to avoid the need to construct extensive sections of track to reach them and obtain materials.

3.3.6 Following agreement of the design brief, the team was instructed to undertake all necessary desktop studies and field work to identify key environmental receptors and constraints (including cumulative constraints) of relevance to the design and assessment of the Proposed Development.

3.3.7 Further analysis was completed to categorise constraints as either 'hard constraints' or 'soft constraints'. Hard constraints were defined as those features with formal protection as defined in legislation or adopted planning/ industry guidance, whereas soft constraints were characterised as having potential to constrain the development but, subject to careful design consideration and/ or mitigation measures, the Proposed Development could be accommodated.

3.3.8 The Proposed Development turbine layouts considered throughout the design evolution process are further explained in Section 3.5 and are presented in **Figure 3.1: Turbine Design Iteration (EIAR Volume 3a)**. A summary of the constraints analysis is illustrated in **Figure 3.3: Environmental Constraints (EIAR Volume 3a)**.

3.4 Environmental Issues and Design Constraints

3.4.1 Following a baseline characterisation of the Site, the key environmental issues for consideration in the design process were identified. Recommendations for how environmental constraints should be addressed in the design process were then made in relation to each technical topic. A summary of the key design considerations and recommendations is provided in Table 3.1.

3.4.2 Issues were considered through design with the aim of 'designing out' significant effects. Where it is not possible to mitigate by design, the issues have been considered further as part of the EIA.

Table 3.1: Preliminary Site and Design Guidance for M74 West Renewable Energy Park		
Topic	**Analysis**	**Design Recommendations**
Landscape and Visual: Landscape Fabric	The M74 corridor in the vicinity of the Site covers a very large area broadly from high ground to the east of Douglas to the lower ground near Moffat, the core area of which is where the M74 dissects or cuts through the Southern Uplands. As is typical throughout this narrow valley, substantial new additional or upgraded infrastructure has been established over time. Either side of the motorway the high ground of the Southern Uplands dominates the landscape character. Numerous landscape studies have identified that the landscape character type of the Southern Uplands can accommodate wind energy development. This is based on the large-scale character of the landscape.	On the basis of the large scale of the landscape and the topographic character of the area, the landscape design of the Proposed Development should relate to the large topographic features or to the large-scale infrastructure. This could mean for example that the turbines are placed on either side of the M74 at regular distances from each other, or as is the case at Clyde, the turbines create random groups on plateaus but when the ridges are narrow the layout follows the centre of the ridge. The Site is relatively flat and located at the northern foothills of the Southern Uplands within the Plateau Moorlands LCT, which is of large scale. The landscape has a simple visual pattern without any predominant visual features. The ground-based features that reinforce the northwest to southeast linear character of the landscape through the valleys that accommodate the Site are the motorway, the railway line, overhead transmission lines and fences. In addition, the River Clyde and its tributaries form a strong landscape feature in the eastern part of the Site. It was therefore considered that the turbine layout should be designed so as to create an immediately legible composition. Land ownership boundaries, in combination with a gentle curving M74, the alignment of the overhead transmission line and the old alignment of the A74 (now the B7078) lent themselves to being reinforced by a strong geometric layout. The geometry of the turbines in a grid like pattern creates a visual interaction between the M74 and the turbines. It introduces logic to the scheme and makes it visually legible.
Landscape and Visual: Landscape Character and Designations	From the production of initial Zone of Theoretical Visibility (ZTV), the following designations/ landscape classifications would be assessed within the LVIA: • Special Landscape Areas, South Lanarkshire: – Leadhills and Lowther Hills SLA (partly within the Site boundary); – Upper Clyde Valley and Tinto SLA (adjacent, to the east of the Site); – Douglas Valley SLA (3 km to the northwest); – Middle Clyde Valley SLA (11 km to the north); • Landscape Character Types within the Site:	The land use will be changing from predominantly agricultural to include energy generation and this will also have visual effects. When considering cumulative effects, the Proposed Development fills a 'gap' between Middlemuir and Andershaw wind farms to the southwest, Bodinglee (in planning) to the west and Grayside (in planning), Priestgill (consented) and Clyde to the east. The implications of an increasing geographic area with wind turbines as its defining characteristic will be considered in detail as part of the cumulative assessment.

Table 3.1: Preliminary Site and Design Guidance for M74 West Renewable Energy Park		
Topic	**Analysis**	**Design Recommendations**
	– Plateau Moorlands – Glasgow & Clyde Valley (LCT 213); – Upland River Valley – Glasgow & Clyde Valley (LCT 207); – Broad Valley Upland (LCT 208); – Upland Glen – Glasgow & Clyde Valley (LCT 209); – Southern Uplands – Glasgow & Clyde Valley (LCT 217); • Other nearby LCTs with more than limited theoretical visibility: – Rounded landmark Hills LCT 218); and – Plateau Farmlands – Glasgow & Clyde Valley (LCT 201).	
Landscape and Visual: Visual Amenity	The LVIA would consider the visual impacts on settlements. Significant impacts to visual amenity are unlikely to occur beyond 15 km, therefore settlement beyond this has been scoped out. The ZTV indicated theoretical visibility at a number of settlements surrounding the Site, including Abington, Roberton and Crawfordjohn within approximately 5 km. There are several key transport routes within the study area that would be subject to potential views of the Proposed Development including the M74, the A702, A73, B7078, B740, B797 and the A70 and a small number of local roads in the vicinity of the Site. In addition to roads, the rail links within the study area would also be considered. The Southern Upland Way (SUW) long distance path, closest to the Site at approximately 11 km to the south, would be included within the LVIA, as well as National Cycle Route 74 (NCN74) which passes though the Site along the B7078. NCN74 also forms part of the proposed Clydesdale Way long distance route, which aims to create a long distance walking/cycling route through Clydesdale by reinficing and closing gaps between existing routes.,	Key issues in respect of landscape effects and effects on views and visual amenity, including 'residential' visual amenity are likely to include: • effects on the character of the landscape and how this will be perceived by people; • effects on the amenity of recreational routes, including the SUW and NCN74; as well as on views from key summits used by hill walkers, such as Tinto Hill; • effects on sequential views as obtained from transport corridors including the M74, the West Coast main railway and from local roads the B7078 and the A720, • effects on views from and visual amenity of settlements; and • potential effects on visual amenity from residential properties.

Table 3.1: Preliminary Site and Design Guidance for M74 West Renewable Energy Park		
Topic	**Analysis**	**Design Recommendations**
Cultural Heritage and Archaeology: Designated heritage assets (and non-designated heritage assets of national importance) on-site	There are five scheduled monuments (designated assets of national heritage value and high sensitivity) and two non-designated heritage assets of national importance within the site boundary. Of these, the assets most likely to experience a significant effect as a result of the Proposed Development would be: : • Thirstone, stone circle 1300m NNW of (SM 5094) • Black Hill, fort 650m NW of Craighead (SM 2606) • Netherton, cairn 800m SW of (SM4513) • Knock Leaven cairn (WoSASPIN 10454) Designated and non-designated assets are protected by NPF 4, Historic Environment Policy for Scotland (HEPS) and the Local Development Plan. Due to the national importance of these assets, no groundbreaking works should take place within these areas, thus limiting the potential for direct impacts. The proximity of turbines to these assets should be carefully considered due to the potential for significant effects on their settings.	Where possible, turbines, solar arrays and infrastructure should be sited to minimise impacts on the settings of the scheduled monuments and non-designated heritage assets of national importance within the site boundary. Stand-off buffers have been suggested to minimise, as far as possible, the potential for significant impacts on setting. However, as these assets lie within the area of the Proposed Development there will remain the potential for significant impacts on their settings. Buffers have been placed around the Scheduled Monument polygon data (downloaded from HES's data portal). There is no guidance as to what should, or may, constitute a hard constraint buffer and those allocated are based on professional judgement of what may be appropriate as an initial basis to seek to reduce potential for adverse effects.
Cultural Heritage and Archaeology: Non-designated heritage assets on-site (regional or local importance)	There are 50 known heritage assets within the site boundary. These include non-designated assets (of regional or local importance) recorded in the South Lanarkshire's Historic Environment Record (HER), the National Record of the Historic Environment (NHRE) or identified through examination of historic maps or/and lidar imagery. Under NPF 4, non-designated heritage assets, places and their setting should be preserved in situ wherever feasible. Non-designated assets have the potential to be subject to direct physical impacts from the Proposed Development. Impacts would relate to the removal (partial or whole) of these heritage assets through groundbreaking works and construction activities on Site. Where reasonably practicable, direct impacts on non-designated assets should be avoided.	Where possible, turbines, solar arrays and site infrastructure should be sited to avoid impacts upon known remains. Where infrastructure will be located in close proximity to known assets, but will not directly impact upon them, mitigation measures such as the temporary fencing-off, or marking-off, assets to prevent inadvertent damage by plant movement during the construction phase may be required. Where assets cannot be avoided, potential direct impacts are likely to require mitigation through preservation by record undertaken through archaeological watching brief(s) or excavation. Shapefiles are provided for non-designated asset polygon data derived from the SLC HER, NHRE, and those identified through examination of historic maps or/and lidar imagery.
Cultural Heritage and Archaeology:	There are a number of designated heritage assets and non-designated assets of schedulable quality within 10km of the	There is no guidance as to what should, or may, constitute an appropriate stand-off distance for the development types proposed sufficient to

Table 3.1: Preliminary Site and Design Guidance for M74 West Renewable Energy Park

Topic	Analysis	Design Recommendations
Designated heritage assets and non-designated heritage assets of national importance beyond the Site boundary	Proposed Development which could also be subject to impacts on their settings: • 55 Scheduled Monuments. • 80 non-designated assets of schedulable quality. • 99 Listed Buildings. • Two Conservation Areas. There are no Inventory Gardens and Designed Landscapes and no Historic Battlefields or World Heritage Sites within 10 km of the site boundary. These assets are protected by NPF 4, HEPS and the LDP.	preserve the integrity of the settings of these assets. Each must be considered on its own merits.
Ecology	Key considerations at the Site include: • The Red Moss SAC and SSSI - afforded protection in legislation under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and the Nature Conservation (Scotland) Act 2004. • Ancient semi-natural woodland or Plantations on ancient woodland sites – afforded protection under Scottish Government's policy on control of woodland removal (NPF4 Policy 6b). • Bats – A European protected species – are afforded protection in legislation under Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). A number of Moderate Potential Roost Features and High Potential Roost Features were recorded on the Site, mostly trees as well as some buildings. • Other constraints from protected species include badger setts and an otter couch which were recorded on site. • Trout were recorded in low numbers in some of the watercourses on site. The Site is not accessible to migratory salmonids. Localised areas of priority habitats present (specified in UK Biodiversity Action Plan, Annex I of the Habitats Directive, or the	A 75 m buffer between infrastructure and the Red Moss SAC/SSSI should be incorporated into the design to avoid impacts on the SAC/SSSI. Crossings over watercourses that are hydrologically linked to the SAC / SSSI should be minimised. Avoid direct impact / land-take of ancient woodland. A 65m buffer (based on the candidate turbine) from blade tip to habitat feature, e.g. woodland edges should be incorporated into the design to avoid impacts on bats. Initially a very precautionary 275.5 m buffer was applied to the identified bat roost features (i.e. 200 m + rotor radius, as per guidance) in the absence of further surveys. However, this large buffer would only apply for maternity roosts/significant hibernation and/or swarming sites. Further surveys were undertaken in respect of two such features, to determine the likelihood of a bat roost being present. The further survey confirmed that the constraint buffer could be removed and only the 50 m to blade tip buffer need apply. A 30 m buffer from active badger setts/holes (100 m buffer if blasting/piling) should be incorporated to avoid impacts on badger. A 30 m buffer from recorded Otter couch should be implemented (for turbines, solar array and infrastructure) to avoid impacts on Otter. Watercourse crossings should be minimised and a 50 m buffer around watercourses for all infrastructure should be maintained except where a minimum number of crossings are essential.

Table 3.1: Preliminary Site and Design Guidance for M74 West Renewable Energy Park		
Topic	**Analysis**	**Design Recommendations**
	Scottish Biodiversity List, including blanket bog E1.6.1 and wet heath E1.7)	Infrastructure, turbines, solar arrays, and works should avoid Annex 1 habitats and potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs) (where possible) in order to minimise impacts.
Ornithology	Baseline surveys for the Proposed Development were undertaken between September 2022 and September 2023. A second summer of bird surveys has been undertaken in 2024 to provide confirmatory information. Surveys recorded the following target species: curlew, golden plover, goshawk, greylag goose, herring gull, lapwing, merlin, osprey, peregrine falcon, pink-footed goose, red kite, ringed plover, short-eared owl and woodcock. Breeding waders: curlew, lapwing and ringed plover were identified to be breeding within the 500m survey area. Breeding Schedule 1/Annex 1 species: red kite, peregrine falcon and short-eared owl were identified to be breeding within the 2km survey area beyond the Site boudnary. Black grouse: no black grouse leks were recorded and no evidence of black grouse was recorded across the baseline survey period.	No design constraints for breeding curlew, lapwing, ringed plover or short-eared owl recommended/required. Constraint buffers for the breeding red kite and peregrine falcon (500 m buffer from known nest locations) were provided, as a hard constraint for any proposed turbine locations but as a moderate constraint for the solar PV areas. This is due to their locations being outwith the Site boundary and the topography between the nest locations and the site boundary.
Hydrology and Hydrogeology	In respect of hydrology and hydrogeology, the following was identified on-site: • The potential for two high Groundwater Dependent Terrestrial Ecosystems (GWDTE) areas within the northern and central part of the Site, to the north of Knock Leaven hill; and • The potential for three moderate GWDTE areas within the southern part of the Site, on the lower slopes of Black Hill. There are two private water supplies (PWS) within 1 km of the Site; however, both are located on the opposite bank of the Duneaton Water to the Site and there would be no potential for interaction with the Proposed Development.	SEPA guidance is that 250 m/ 100 m buffers are needed for high and moderate GWDTEs respectively. Potential high GWDTEs should be considered; however where the habitats are clearly linked to either rainfed systems or surface watercourses/ features, they should not be treated as a design constraint. The design should avoid placing turbines, and infrastructure within 50 m of natural watercourses in order to protect water quality. For the solar array, the design should ensure a suitable buffer from land drains on the east of Black Hill and Craighead Hill. For the solar areas proposed on the east slopes of Black Hill and Craighead Hill, panels should ideally contour with the slopes so runoff is conveyed over the shortest possible distance before falling to ground. The design should aim to minimise the number of direct interactions with the water environment by designing out watercourse crossings where possible and minimising interactions with the SAC/SSSI in particular. Tracks should be perpendicular to watercourses at crossing points. Impermeable surface for infrastructure / battery storage etc would require detailed drainage design to manage surface water runoff.

Table 3.1: Preliminary Site and Design Guidance for M74 West Renewable Energy Park		
Topic	**Analysis**	**Design Recommendations**
		Planting below the solar arrays should ensure greenfield conditions are maintained and that rates of infiltration and runoff do not increase. Planting should also ensure soil integrity is maintained such that soil erosion does not occur below the lower edge of panels.
Peat	A review of the SNH Carbon Rich Soil, Deep Peat and Peatlands Habitat Map (2016) and peat probing confirms that areas of peat and organic material are present across the Site. The Stage 1 peat probing survey confirmed that peat >0.5 m depth is present across 9.0% of the Site; and no peat (0 – 0.5 m depth) is present across 91.0% of the Site. Peat >1.0m depth is present at 4.7% of the Site.	The design should avoid siting turbines and infrastructure in areas of peat, particularly deep peat (>1 m depth).
Traffic and Transport	The main transport impacts would be associated with the movement of general HGV (and LGV) traffic travelling to and from the Site during the construction phase of the Proposed Development. Each turbine is likely to require between 11 and 13 abnormal loads to deliver the components to Site. The components would be delivered on extendable trailers which would then be retracted to the size of a standard HGV for the return journey.	HVGs taking access to the northern part of the Site will access this area from the M74 motorway. Southern parts of the site will be accessed from the B7078 road.
Noise	IOA GPG guidance state 'If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary'. Due to the proximity of neighbouring schemes, an initial cumulative noise review was undertaken. The initial cumulative noise review identified the following key noise sensitive receptors: • Greenfield; • Over Balgray; and • Red Moss Hotel. It should be noted that the Red Moss Hotel will no longer considered a residential receptor, on the basis that it is permanently closed. In addition, the Applicant is aware of the submitted request for EIA screening at Red Moss Hotel for Battery Storage, covering the entire Red Moss Hotel (Application ref. ECU00005043)	The key design criteria for the Site should ensure that the 'Total ETSU-R-97 Noise Limits' are not exceeded by the cumulative operation of all turbines in the area. To enable wind farm noise for individual developments to be controlled 'Site Specific Noise Limits' must be set which take account of the proportion of the Total ETSU-R-97 Noise Limit which has been given to, or could realistically be used by other schemes.

Table 3.1: Preliminary Site and Design Guidance for M74 West Renewable Energy Park		
Topic	**Analysis**	**Design Recommendations**
Aviation	Impacts on the Lowther Hill radar are certain since turbines of any height within the Site would be within line of sight of this radar. Certain areas of the Site are outwith line of sight of the Cumbernauld primary surveillance radar. Layout design and/or turbine height reduction may reduce/eliminate visibility from the Cumbernauld radar. The Site is within Low Flying Area 20(T) – a Tactical Training Area (TTA) where Operational Low Flying down to 100ft agl is permitted. Lanarkshire and Lothians Soaring Club operates paragliders regularly from a number of sites on and around Tinto Hill.	NATS En Route will require the developer to enter into a radar mitigation services contract. This is likely to focus on using the inherent technical capacity of the Lowther Hill radar but may also require in-fill using another NATS radar that does not have line of sight to the turbines. Regarding the Low Flying Area the EIAR will explore the potential for a reduced lighting scheme for submission to the Civil Aviation Authority (CAA) for approval. Radar-activated lighting systems would also be evaluated. The Site is located in the outer parts of the 10 km radius zone around Tinto Hill and does not include any significant ridges that might be used for soaring.
Telecommunications	The Ofcom Spectrum Information Portal identified two fixed telecommunications links within 2 km of the Site, both Vodafone microwave links starting from Craighead Hill (immediately south of the Site). However, further investigation identified three fixed telecommunications links, operated by Vodafone, that cross the Site. Details below: • Vodaphone Link 1 (I.D: 0496701/1 /) runs between transmitters at Craghead Hill (292260E 623760N) to Lesmahagow, South Lanarkshire (284070E 640870N). • Vodafone Link 2 (I.D: 1332702/1 /) runs between transmitters at Craighead Hill (292276E 623789N) to Douglas, South Lanarkshire (286947E 629964N). • Vodafone Link 3 (I.D: 1334216/1 /) runs between transmitters north of Crawfordjohn, South Lanarkshire (289181E 626910N) to Whitelaw Brae, South Lanarkshire (300392E 625963N). The JRC has confirmed that there are no energy industry scanning telemetry links in the vicinity of the Site.	Detailed calculations have been completed to identify potential infringements of the links by turbines and confirm that Turbines 5 and 14 would be within the Fresnal Zone of one telecommunications link and are contained in **Technical Appendix 1.6 (EIAR Volume 4)**. The Applicant will undertake further micrositing at the detailed design stage to achieve greater distance, where possible, or will seek to agree a technical solution with the service operator There are no scanning telemetry systems in the vicinity with the potential to be affected.

3.5 Design Evolution and Alternative Layouts

3.5.1 Figures 3.1 and 3.2 summarise the Proposed Development design evolution from initial landscape design to the design freeze layout. During the design evolution process three design iterations and revisions were produced. The following paragraphs explain the changes made through the three main design iterations.

Turbine Layout

Turbine Numbering

3.5.2 Throughout the design evolution process, the removal/addition of turbines resulted in the need to re-number turbines. Turbines were renumbered as shown on Figure 3.1 (EIAR Volume 3a) in the Design Freeze Layout. A summary of turbine numbering is shown in Table 3.2.

Table 3.2: Summary of Turbine Numbering

Layout 1	Layout 2	Layout 3	Layout 4
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	Removed		
11	10	10	10
12	11	11	Removed
13	12	12	11
14	13	13	12
15	14	14	13
16	15	15	14
17	16	16	15
18	17	17	16
19	18	18	17
20	19	19	18
21	20	20	19
	21	21	20
	22	22	21
	23	Removed	
	24	23	22

Layout 1: Landscape Design Layout (21 turbines)

3.5.3 The Landscape Design Layout represented the original turbine layout proposed by the Applicant, based on consideration of landscape capacity only in conjunction with landownership constraints.

3.5.4 The Landscape Design Layout considered landscape design and wind yield constraints using available wind yield data at the time.

3.5.5 At this stage in the Site's design, it was considered that the Site could theoretically accommodate up to 21 turbines up to a 200 m maximum tip height. The Landscape Design Layout formed the basis for which initial environmental considerations would be reviewed against.

Layout 2: Scoping Layout (24 turbines)

3.5.6 The Scoping layout represented the layout that was developed based on an initial desk-based constraints review, taking account of the following:

- the findings of the ornithology surveys and initial ecology surveys;
- the results of the Stage 1 peat probing survey;
- constraints mapping of cultural heritage assets, watercourses and corresponding buffer distances and residential properties; and
- confirmation that one residential property (the Strand) would be purchased by the Applicant should the development proceed.

3.5.7 As a result of a review of the constraints listed above, the following turbine movements were made:

- Turbines 1, 2 and 3 were moved southeast, as a group, to provide greater separation from Wildshaw Hill cairn scheduled monument;
- Turbines 4, 5, 6 were moved as a group to maintain further distance to the buffer around a potential bat roost feature (a group of trees) to the west of Turbine 4;
- Turbine 10 was removed, in order to preserve the line of sight between Wildshaw Hill cairn and Auchensaugh Hill cairn scheduled monuments;
- Turbine 14 was moved north to avoid the buffer around a bat habitat at Thirstone cottage (outhouse);
- Turbine 18 was moved northeast to increase its distance from a fixed telecommunications link, while maintaining elevation;
- Turbines 14, 15, 16, 17 and 18 were reviewed again in terms of landscape composition and moved to ensure maintenance of a linear arc when travelling through the Site on the M74;
- Turbines 19, 20 and 21 were moved northwards, as a group, in order to avoid deep peat and to increase their distance from the Red Moss SAC/SSSI;
- Four new turbines were added to the west of Black Hill and in proximity to the Strand residential property. These additions were made based on further landscape analysis and the involvement of the Strand in the Proposed Development rendering it less sensitive to noise impacts.

3.5.8 Overall, one turbine was removed (Turbine 10) and four turbines (Turbines 21, 22, 23 and 24) were added, resulting in a 24-turbine Scoping Layout. Turbines were re-numbered for the EIA Scoping Report, as presented in Table 3.2.

Layout 3: Further Environmental Constraints Layout (23 turbines)

3.5.9 Following the Scoping stage, further environmental constraints information was gathered and led to the development of an amended layout, which was identified in response to the following:

- initial noise modelling based on a number of candidate turbines;
- community feedback following the initial public consultation period in February 2024;
- the results of the Stage 2 peat probing survey;
- confirmation of the preferred stand-off distance from the high-pressure gas pipeline crossing the Site; and
- additional ecological survey information.

3.5.10 As a result of a review of the constraints outlined above, the following turbine movements were made:

- Turbine 8 was moved south to the edge of the gas pipeline buffer to allow the track towards Turbine 9 to cross the gas pipeline at 90 degrees;
- Turbine 9 was moved southwest to maintain spacing with Turbine 8;
- Turbine 13 was moved northeast to take it out of the constraint area identified around a badger sett;
- Turbine 14 was moved north to ensure suitable track alignment to reach Turbine 15 whilst avoiding deep peat;
- Turbine 15 was moved west in response to the movement of Turbine 16 to the west;
- Turbine 16 was moved west to take it out of the gas pipeline buffer;
- Turbine 17 was moved west to maintain spacing with Turbine 16;
- Turbine 18 was moved northwest in order to take it out of an area of blanket bog and wet modified bog habitat;
- Turbine 19 was moved west to ensure greater distance from the unnamed watercourse to the east, as well as from an area of blanket bog habitat and deep peat;
- Turbine 21 was moved east of the unnamed watercourse, to allow access to be taken from the access point off the B7078 further southeast. It was also moved slightly further south to avoid oversailing the B7078 road;
- Turbine 22 was moved north to ensure a 100 m buffer between it and a potential bat roost feature (the Strand property);
- Turbine 23 was removed following analysis of initial noise modelling results. In particular, this was based on the identification of noise exceedances at Blackburn Farm, as well as to a lesser extent at other properties (Crawfordjohn Mill Farm, Greenfield and Over Balgray). It was also identified that removal of this turbine would reduce potential impacts on residential visual amenity at Crawfordjohn Mill Farm and nearby properties on Manse Road, and would reduce the potential for adverse impact on the settings of the scheduled monuments Netherton, cairn 800m SW of (SM4513) and Auchensaugh Hill, cairn (SM4234).

3.5.11 In addition, Turbines 2 and 3 were moved south to avoid oversailing the Site boundary to the north.

3.5.12 Overall, one turbine was removed (Turbine 23) resulting in a 23-turbine Further Environmental Constraints Layout. Turbines were re-numbered as presented in Table 3.2.

Layout 4: Design Freeze Layout (22 turbines)

3.5.13 The design freeze layout represents the final layout which was amended in response to the following:

- Further consideration of cultural heritage constraints following a consultation meeting with Historic Environment Scotland (HES) on 14th May 2024.

3.5.14 In response to the concerns of HES in relation to the potential for impact on heritage assets, the following design changes were made:

- Turbine 11 was removed following further analysis of its potential impact on the setting of the scheduled monument Thirstone, stone circle 1300m NNW of (SM 5094).

3.5.15 The removal of this turbine resulted in a 22-turbine Design Freeze Layout, and turbines were re-numbered as presented in Table 3.2.

Solar Layout

3.5.16 The layout of the proposed solar array was adapted in response to environmental and technical constraints as detailed below. Two iterations of the solar layout were produced (**Figure 3.2, EIAR Volume 3a**).

Scoping Layout

3.5.17 The scoping layout was presented as an indicative area. The first iteration of the solar design aimed to maximise the number of solar arrays within the search area and it was considered that that Site could accommodate solar PV generators in the areas shown on the Scoping Layout in **Figure 3.2 (EIAR Volume 3a)**.

Design Freeze Layout

3.5.18 Environmental constraints information was gathered and the following constraints led to the refinement of the indicative solar PV area:

- Cultural heritage constraints, in particular, non-designated heritage assets;
- Ecology constraints, including protected species signs;
- Landscape and visual considerations;
- Hydrology considerations; and
- Infrastructure constraints.

3.5.19 The solar layout was refined in response to these constraints as follows:

- A cultural heritage walkover survey was undertaken in November 2023, which identified a number of non-designated assets within the indicative solar area. The extent of the solar area was refined to ensure greater distance would be maintained from these heritage assets, particularly in the northeastern part of the solar array area, as advised by the heritage consultant;
- The ecology constraints identified included a potential bat roost feature and an otter couch. Suitable buffer distances to these features were suggested and these were incorporated into the design of the solar layout, including placement of panels, inverters, access and compounds;
- The landscape analysis identified the importance of placing solar panels selectively and avoiding the smaller unconstrained parcels of land within the solar search areas and more undulating parts of the Site. It was also recommended that parcels of land with steep slopes should be avoided in order to reduce overall visibility. In particular, it was

recommended that the sections closest to the roundabout on the B7078/M74 slip road should be excluded, as well as the section of the western solar area which lay to the north of the OHL.

- The hydrology analysis identified drains on the east of Black Hill and Craighead Hill that should be subject to a minimum 10 m buffer. The final layout avoids areas of drains on Craighead Hill and provides a 10 m buffer from the drain on Black Hill in line with the advice.
- Existing underground utilities, including Scottish Water pipelines, a gas transmission pipeline and an ethylene pipeline, were identified within the solar array area and the design was amended in order to ensure that no solar generators would be located directly over these connections.

3.5.20 Feedback on other technical disciplines, including noise and glint and glare, was also considered; however, such feedback did not require further changes beyond those described above.

3.6 Summary of Preferred Option

3.6.1 The preferred option taken forward for assessment is the Layout 4: Design Freeze Layout as presented in **Chapter 2: Development Description (EIAR Volume 2)** and shown in **Figure 2.1: Site Layout (EIAR Volume 3a)**.

3.6.2 By following the design guidance described in Table 3.1, the turbines were sited to reduce potential impacts to landscape, views and heritage features, the infrastructure footprint has been optimised to minimise overall track length and the number of watercourse crossings. Likely significant effects have been avoided or minimised as far as reasonably practicable through the design process.

4 Landscape and Visual Amenity

4.1 Executive Summary

4.1.1. The Landscape and Visual Impact Assessment (LVIA) considered potential effects that the Proposed Development would have on the landscape, views, and visual amenity of the local environment. A Zone of Theoretical Visibility (ZTV) map was used to identify receptors likely to be affected by views of the Proposed Development, including people at local settlements, on roads around the study area (focussed on approximately 25 km from the Site), and those on local paths. Visual effects were identified for a number of selected viewpoints representative of views seen by people in the surrounding area. The LVIA included existing wind farms in the baseline. Cumulative effects were considered using three potential future scenarios.

4.1.2. ZTV mapping and visualisations indicate that the turbines of the Proposed Development will be visible from the immediate vicinity of the Site, up to hills/ridges within approximately 5 km, and beyond that visibility would depend more on topography and woodland cover. Views from the northern half of the study area, across low-lying farmland and moorland would include the turbine array in the foreground of the Southern Uplands to the south. Views from the southern half of the study area would be considerably more limited by local topographic variations of the Southern Uplands.

4.1.3. Visibility of the solar PV arrays would be widespread within 1 km, and limited beyond to higher ground to the east and west of the M74 motorway, within the River Clyde valley to the east, and south west of Abington.

4.1.4. Thirstone Quarry would be restored as part of the Proposed Development in accordance with the consented quarry restoration plan. The substation and Battery Energy Storage System (BESS) would be located within the excavated area and the quarried sides would provide screening reducing visibility within the wider landscape. In addition, woodland and scrub would be planted around the substation and BESS as part of the Outline Biodiversity Enhancement Management Plan and provide some partial screening to those elements.

4.1.5. Effects on landscape character were considered using Landscape Character Types (LCTs) identified by NatureScot as units of landscape with consistency of character. The Proposed Development would be located within a transitional landscape covering the following LCTs:

- LCT 207: Upland River Valley -Glasgow & Clyde Valley;
- LCT 208: Broad Valley Upland;
- LCT 209: Upland Glen – Glasgow & Clyde Valley;
- LCT 213: Plateau Moorland – Glasgow & Clyde Valley; and
- LCT 217: Southern Uplands – Glasgow & Clyde Valley

4.1.6. The majority of the Proposed Development would be located within the Plateau Moorland – Glasgow and Clyde Valley LCT including 21 of the turbines. The other LCTs would include limited parts of the Proposed Development including permanent infrastructure, solar PV array modules, invertors, and temporary construction compounds.

4.1.7. The topography of the Southern Upland hills around the Site would influence visibility of the Proposed Development. Widespread theoretical visibility is predicted within 5 km, extending beyond onto plateau farmland either side of the M74 motorway to the north west, and summits and upper slopes of the Southern Uplands to the east, west and south, gradually reducing in geographical coverage as the distance increases.

4.1.8. It is noted that the surrounding landscape includes several notable operational wind farms including Clyde and extension to the south east, and Middle Muir and Andershaw to the west where the Proposed Development would occupy an area between the two wind farms, but would appear separate. Panoramic views which also include other wind energy developments that are further afield would be experienced from the M74 motorway corridor, the B7078 road, footpaths and nearby hill summits.

4.1.9. Significant effects are identified for landscape and visual receptors within approximately 15 km. Given the distribution of effects within that area, these are considered to be limited and localised for a development of this scale in this type of landscape.

4.1.10. Approximately 328 ha (1.7%) of the Site falls within the Leadhills and Lowther Hills Special Landscape Area (SLA), a local landscape designated by South Lanarkshire Council (SLC). The Proposed Development includes two turbines (20 and 22), two hardstanding's, 1.4 km of access track, approximately 463 solar panels, a borrow pit search area and two inverters are located within this 328 ha of the Leadhills and the Lowther Hills SLA designation.

4.1.11. The landscape description of the SLA places the area as part of the Lowther Hills range which in itself is part of the 'Southern Uplands LCT. Because of the introduction of extensive coniferous forestry and of wind farms, parts of the Southern Uplands LCT have been redefined as 'sub' types, for example Southern Uplands with Forestry. This refinement demonstrates the dynamic and evolving, or changing, nature of our landscapes.

4.1.12. Special qualities of this SLA include a lack of extensive forestry or wind farm development which engenders a sense of emptiness. This is not the case in equal measure across the designated area. Middle Muir, Andershaw and Clyde Wind Farms are located on the northeastern and northwestern periphery of the SLA and create the boundary to the designated area. This would be further reinforced by the introduction of the Proposed Development and would not erode the quality of the designation. . For this reason, a not significant effect was judged on the SLA. Three other SLAs were also predicted to receive theoretical visibility of the Proposed Development. Due to a combination of distance and screening by landform and woodland, effects on all three were judged to be not significant.

4.1.13. A Residential Visual Amenity Assessment (RVAA) was undertaken for properties within 2.5 km of the turbine array. A total of twenty-four residential receptors were identified within 2.5 km and fifteen were judged to have a significant effect. No properties/group were judged that the RVAA threshold would be reached due to a combination of factors including distance from the turbine array and screening from landform and woodland. Therefore, no significant effects on RVAA are identified.

4.2 Introduction

4.2.1. This chapter of the EIAR identifies and assesses the potential effects that the Proposed Development would have on the landscape, views and visual amenity of the local environment.

4.2.2. Landscape and visual assessments are separate, though related processes. Effects on the landscape as a resource may be caused by changes to the constituent elements of the landscape, its aesthetic or perceptual qualities and character. Visual effects as experienced by people may be caused by changes in the appearance of the landscape (views) resulting from the Proposed Development.

4.2.3. This chapter sets out the baseline for the LVIA, but assesses landscape and visual effects separately, followed by an assessment of cumulative effects. The reporting of assessments focuses on likely significant effects that may arise from the Proposed Development, and those that are informative to the decision maker.

4.2.4. This LVIA has been prepared by MVGLA, led by Marc van Grieken, a Fellow of the Landscape Institute (FLI), former member of the Board of Trustee, a Design Forum member for

Architecture & Design Scotland (A&DS). Marc was also previously Chairman of the Landscape Institutes Technical Committee responsible for technical guidance and chair of the Advisory Panel of the *Guidelines for Landscape and Visual Impact Assessment* (GLVIA3).

4.2.5. Marc was assisted by Graeme Glencorse, a Chartered Member of the Landscape Institute (CMLI) with 17 years' experience in LVIA, MVGLA's graphics team, specialists in LVIA figures and visualisations, and Tom Finnie Photography.

4.2.6. This chapter is supported by the following figures and technical appendices:

- Volume 3a: Figures;
  - Figure 4.1: LVIA Study Area;
  - Figure 4.2: Zone of Theoretical Visibility, Turbine Tips at 1:3000,000 scale;
  - Figure 4.3: Zone of Theoretical Visibility, Turbine Tips at 1:100,000 scale;
  - Figure 4.4: Zone of Theoretical Visibility, Turbine Hubs at 1:300,000 scale;
  - Figure 4.5 Zone of Theoretical Visibility with LCTs;
  - Figure 4.6: Zone of Theoretical Visibility and Proposed Viewpoints;
  - Figure 4.7: Zone Theoretical Visibility and Visual Receptors within 5 km;
  - Figure 4.8: Zone of Theoretical Visibility and Visual Receptors within 25 km;
  - Figure 4.9a: Cumulative within 25 km (as of 30/05/2024);
  - Figure 4.9b: Cumulative within 25 km List;
  - Figure 4.10: Zone of Theoretical Visibility with Operational and Under Construction Schemes;
  - Figure 4.11: Cumulative ZTV, Selected Consented Schemes and Proposed Developments: Priestgill;
  - Figure 4.12: Cumulative ZTV, Selected Application Schemes and Proposed Development: Boddinglee and Little Gala; and
  - Figure 4.13 Zone of Theoretical Visibility and Designated Landscapes.
- Volume 3b: Visualisations;
  - Figure 4.14 a-d: Viewpoint 1: Devonburn Road;
  - Figure 4.15 a-e: Viewpoint 2: B7078 Carlisle Road;
  - Figure 4.16 a-g: Viewpoint 3: M74 Southbound, B7078 near Parkhead;
  - Figure 4.17 a-k: Viewpoint 4: M74 within the Site;
  - Figure 4.18 a-r: Viewpoint 5: Abington Services;
  - Figure 4.19 a-e: Viewpoint 6: Castle Hill;
  - Figure 4.20 a-g: Viewpoint 7: Crawfordjohn;
  - Figure 4.21 a-c: Viewpoint 8: B740 Spango;
  - Figure 4.22 a-b: Viewpoint 9: A702 near Hartside;
  - Figure 4.23 a-e: Viewpoint 10: B7055 Greenhill;
  - Figure 4.24 a-e: Viewpoint 11: Tinto Hill
  - Figure 4.25 a-c: Viewpoint 12: Cairn Table;
  - Figure 4.26 a-d: Viewpoint 13: Lowther Hill;
  - Figure 4.27 a-c: Viewpoint 14: Culter Fell; and
  - Figure 4.28 a-c: Viewpoint 15: B7016 east of Biggar.
- Volume 4: Technical Appendices
  - Technical Appendix 4.1: Landscape and Visual Impact Assessment Methodology;
  - Technical Appendix 4.2: Landscape Character Assessment;
  - Technical Appendix 4.3: Visual Effects Assessment;
  - Technical Appendix 4.4: Cumulative Assessment;
  - Technical Appendix 4.5: Implications for Designated Landscapes;
  - Technical Appendix 4.6: Aviation Lighting Assessment; and

– Technical Appendix 4.7: Residential Visual Amenity Assessment.

4.2.7. Figures and technical appendices are referenced in the text where relevant.

4.3 Assessment Methodology

4.3.1. The LVIA methodology is detailed in **Technical Appendix 4.1 (EIAR Volume 4)** and follows the principles set out in the *Guidelines for Landscape and Visual Impact Assessment, Third Edition* (GLIVA3) (Landscape Institute and the Institute of Environmental Assessment, 2013)[1].

4.3.2. Mitigation of landscape and visual effects has been undertaken through design modifications and input to the design process. The design evolution is set out in **Chapter 3: Design Evolution and Alternatives (EIAR Volume 2)** and the Design Statement. As all mitigation is embedded within the final design for the Proposed Development, all effects identified are residual effects.

4.3.3. Effects considered to be significant for the purposes of the EIA Regulations are those classified as being 'Major' or 'Moderate'.

4.3.4. Using a precautionary approach, and although people may consider the appearance of wind farms to be positive for a variety of reasons, all likely landscape and visual effects are identified as adverse.

Scope of Assessment

4.3.5. This chapter considers potential effects during construction, operation, and decommissioning phases on landscape character and views including effects on views of aviation lighting; cumulative effects (additional and combined) with potential future wind farms, and the implications of these landscape and visual effects on designated landscapes. Effects associated with decommissioning are considered to be similar to construction, over a shorter duration.

4.3.6. The assessment considers potential effects across the wider study area, but that reporting is focussed on effects that are significant or pertinent to the meaningful discussion of landscape and visual effects of the Proposed Development.

4.3.7. The scope of the assessment has been informed by consultation responses detailed in **Technical Appendix 1.1: Consultation Register (EIAR Volume 4).**

4.4 Baseline Conditions

Current Baseline

The Site

4.4.1. The Site lies within a broad valley occupied by several infrastructure corridors (electricity transmission, transport, and utilities). The vicinity of these infrastructure corridors covers a very large area broadly from high ground to the east of Douglas to the lower ground near Moffat, the core area of which is where the M74 motorway dissects or cuts through the Southern Uplands. As is typical throughout this narrow valley, substantial new additional or upgraded infrastructure has been established over time. Either side of the M74 motorway the high ground of the Southern Uplands dominates the landscape character.

4.4.2. The Site covers an area of approximately 1,275 ha and is located northwest of Abington and approximately 1.3 km northeast of Crawfordjohn, in South Lanarkshire.

[1] Landscape Institute, Institute of Environmental Management and Assessment. (2013) *Guidelines for Landscape and Visual Impact Assessment, Third Edition*. (London: Routledge)

4.4.3. Occupying two distinct parcels connected by the B7078 road, the largest would include the turbine array and part of the solar PV array. This parcel is defined by a boundary fence line along the north adjacent to Mill Burn, before turning south towards the Knock of Leaven and eastwards along the B7078 road until reaching the Duneaton Water. To the south, the Site boundary follows the Black Burn, and is bounded in the west by a post and wire fence. Landcover is predominantly moorland and unimproved grazing but also includes Thirstone Sand and Gravel Quarry.

4.4.4. The second parcel is geographically smaller and is directly north and east of Abington Services on improved and semi-improved farmland, with the solar PV array located on either side of the M74 motorway and B7078 road. This area is bounded by the Duneaton Water to the north, the A702 road to the east, Craighead Hill to the south and a boundary fence to the west.

4.4.5. Landform within the Site is generally undulating rising to Outer Law (362 m Above Ordnance Datum (AOD)) in the north and Knock Leaven in the south (346 m AOD) of the turbine array. Landform within the solar PV array includes the steep-sided northern slopes of Craighead Hill in the south (approximately 370 m AOD within the Site), reducing northwards to approximately 230 m AOD.

The Surrounding Study Area

4.4.6. The initial study area of 45 km radius from the outermost turbines in all directions (see **Figure 4.1 (EIAR Volume 3a**) extends from Slamannan in the north, to Holywood in the south, and Innerleithen in the east to Tarbolton in the west. This extensive area was reduced following a review of the ZTV which established the limited potential for impacts based on the visibility predicted, to approximately 25 km from the Proposed Development covering plateau farmland in the north, plateau moorland in the central area, and the Southern Uplands in the south.

4.4.7. The location of the Site on upland moor towards the edge of the Southern Uplands gives rise to theoretical visibility of the Proposed Development both across the hills and out across the lowlands and M74 motorway corridor to the north. However, the lowlands to the north of the Site are characterised by frequent hedges, field boundary trees and woodland blocks and shelterbelts. As such, actual visibility would be considerably more limited as vegetation and frequent buildings close to the viewer would often screen distant views.

4.4.8. In other directions theoretical visibility is contained by the surrounding high ground to the east, west and south. Considering how topography affects the ZTV, it can be seen on **Figure 4.2 and 4.3 (EIAR Volume 3a)** that theoretical visibility of the Proposed Development would be widespread within 5 km, reducing slightly to facing slopes and summits within 10 km, and thereafter, the summits of hill tops in the Southern Uplands.

Existing Wind Farms

4.4.9. **Figures 4.9a-b (EIAR Volume 3a)** show that there are several operational and under construction wind farms within 25 km of the Proposed Development. This shows a large number of sites located within the plateau between the A71 road in the north, and the A70 road in the south, west of the M74 motorway. Further wind farms are located to the southeast and west of Abington. These wind farms, as existing features, are included in the baseline throughout the LVIA and form the baseline described as the 'Existing Scenario'.

Table 4.1: Existing Wind Farms			
Wind Farm	**Number of Turbines**	**Blade tip height (m)**	**Approximate distance (from nearest Proposed Development turbine) (km)**
2. Auchnotroch Farm	1	53.7	16.8
3. Auchren Farm	1	67	11.1
4. Auchrobert	12	132	16.8
5: Bankend Rig	11	76	22.5
6. Birkhill	1	99.5	9.3
7. Burnhouse	2	64	8.7
8. Cleughhead	1	79	14.7
9. Clyde	152	126.5	12.9
10. Clyde Extension	54	142	5.6
11. Cumberhead	12	180	13.2
12. Dalquahandy	10	131	10.3
13. Douglas West	13	149.9	7.4
14. Dungeval	13	100	20.6
15. Easterton Wind Cluster	1	67	10.3
16. Galawhistle	22	120	9.5
17. Garrelwood Farm	1	77	16.5
18. Glenkerrie	11	118	17.0
19. Glenmuckloch Energy Park	2	46.1	22.0
20. Hagshaw Hill Phase 2	20	80	8.0
21. High Waterhead Farm	1	67	16.5
22. JJs Farm	1	102	9.7
23. Kennoxhead Phase2	13	180	11.1
24. Kype Muir	26	132	19.0
25. Ladehead Farm	3	74	16.3
26. Lochhead Cluster	3	100	22.2
27. Lochhead Cluster Extension	2	100	20.9
28. Low Whiteside Farm	1	54	14.3
29. Lowerwaterhead Farm	1	67	15.6
30. Middle Muir	15	152	1.4
31. Nether Fauldhouse Farm	1	78	9.0
32. North Brckenridge	1	78	16.6
33. Nutberry	6	125	11.2
34. Sandy Knowe	24	125	23.3
35. Southfield Farm	1	67	18.4
36. Sunnyside Farm	2	62	18.0
37. Twenty Shilling Hill	9	125	23.6
38. Woodlands Farm T1	1	69	14.7

Table 4.1: Existing Wind Farms			
Wind Farm	**Number of Turbines**	**Blade tip height (m)**	**Approximate distance (from nearest Proposed Development turbine) (km)**
39. Woodlands Farm T2	1	69	14.9

Landscape Baseline

4.4.10. The landscape in the Study Area is diverse and dominated by the Southern Uplands, a range of hills that extends across the south of Scotland, occupying the central and southern parts of the Study Area. To the north, the study area is characterised by plateau farmland between Glasgow and the Southern Uplands. This creates a predominantly open and large-scale landscape punctuated by a series of interconnecting dales and valleys which are smaller in scale due to containment by landform and tree/forestry cover.

4.4.11. Landscape character is defined as a distinct, recognisable and consistent pattern of elements in the landscape that makes one tract of land different from another. LCTs refer to distinct tracts of land that are relatively homogenous in character, are generic in nature and can occur more than once in different parts of the country.

4.4.12. The NatureScot (2019)[2] landscape character database identifies distinct areas as LCTs at 1:50,000 scale, comprising combinations of landform, landcover and pattern, in geographical areas which convey a sense of place. This forms the most recent landscape character assessment covering the study area. NatureScot sets out the location and context, key characteristics, and landscape character description for each LCT. These LCTs form the basis of the assessment on landscape character and were verified during fieldwork.

4.4.13. A desk-based assessment identified a total of 57 LCTs within 45 km of the Site. These were reviewed in combination with Zone of Theoretical Visibility (ZTV) mapping and fieldwork. This review concluded that potential significant effects on landscape character would likely occur up to an area of 15 km from the Site. Therefore, a Study Area of 15 km was suggested in the Scoping Report (January 2024).

4.4.14. As the design of the Proposed Development has evolved, landscape character has continued to be reviewed. Annex 4.2.1 of **Technical Appendix 4.2 (EIAR Volume 4)** provides further justification for the scoping in or out of each LCT considered. This is based on analysis of their distance from the Proposed Development, extent of theoretical visibility predicted and verification during fieldwork.

4.4.15. A total of 7 LCTs have been taken forward for detailed assessment as follows:

- LCT 201: Plateau Farmland – Glasgow & Clyde Valley;
- LCT 207: Upland River Valley – Glasgow & Clyde Valley;
- LCT 208: Broad Valley Upland;
- LCT 209: Upland Glen – Glasgow & Clyde Valley;
- LCT 213: Plateau Moorlands – Glasgow & Clyde Valley;
- LCT 217: Southern Uplands – Glasgow & Clyde Valley; and
- LCT 218: Rounded Landmark Hills.

[2] NatureScot. (2019) *Scottish Landscape Character Types Map and Descriptions*. Available at: https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions [Accessed: 27th May 2024]

4.4.16. The key characteristics and baseline description of each LCT is detailed in **Technical Appendix 4.2 (EIAR Volume 4)** and their location within the study area shown on **Figure 4.5 (EIAR Volume 3a)**.

Visual Amenity

4.4.17. Visibility around the Study Area is reflective of the topography and woodland cover, with panoramic long-ranging views from hill tops to limited or framed views by adjacent slopes and woodland/forestry within dales and valleys, to extensive views across farmland. There are therefore divergent viewing experiences from different parts of the study area.

ROUTE RECEPTORS

4.4.18. The M74 motorway is the main route within the Study Area, orientated northwest to southeast, passing through the centre of the Site and would receive both close and distant views of the Proposed Development. Several other 'A', 'B' and minor roads are located within the Study Area broadly following valleys.

4.4.19. The West Coast Main Line railway also forms a major transportation route orientated in a generally north to south direction passing east of the Site.

4.4.20. Recreational routes include the NCR 74 between Glasgow and Gretna which follows the B7078 road passing through the Site, and SHT to the north, east and west of the Site.

4.4.21. A review of the ZTV followed by field work verification identified the following route receptors as potentially receiving significant effects to their views:

- M74 motorway – passes through the Site;
- A702 road Edinburgh to St John's Town of Dalry – passes the eastern boundary of the Site;
- B740 road between the B7078 road and Sanquhar – is within the western part of the Site;
- B7075 road between the A70 at Rigside and the A73 road – passes 5.9 km to the northeast of the Site;
- B7078 road straddling the former carriageways of the A74, parallel to the M74 motorway also includes the NCR 74 – passes through the Site;
- West Coast Main Line – approximately 440 m to the east of the Site;
- SHT 57: Roberton to Douglas – approximately 3.4 km to the east of the Site; and
- SHT 58: Douglas to Wanlockhead – approximately 700 m to the west of the Site.

4.4.22. A detailed assessment of the route receptors assessed is provided in **Technical Appendix 4.3 (EIAR Volume 4)**.

SETTLEMENT

4.4.23. In the study area, the landscape includes several large settlements that have extended southwards from Glasgow and along the M74 motorway. Thereafter, settlement tends to be situated within valleys next to major roads such as the A70, A71, A72 and A73 roads. These are connected by a series of 'B' and minor roads linking villages, hamlets and individual properties.

4.4.24. Analysis of ZTV mapping and verification in the field, identified the following settlements as potentially receiving a significant effect to views as a result of the Proposed Development:

- Crawfordjohn – 1.3 km to the west; and
- Roberton – 3.4 km to the north east.

RESIDENTIAL RECEPTORS

4.4.25. There are twenty-four groups or individual receptors within 2.5 km of the turbine array, as shown on **Technical Appendix 4.7, Figure TA4.7.1 (EIAR Volume 4)**, and are limited to the north due to the landscape being predominantly moorland. The majority of properties are located within the River Clyde valley to the east of the Site, around Abington and along the B7078 road to the south, and Crawfordjohn to the southwest.

4.4.26. Properties are assessed individually or, where a similar outlook occurs, considered as a group. Therefore, the RVAA detailed in **Technical Appendix 4.7 (EIAR Volume 4)**. Grouped properties have similarity of location, setting, outlook and screening.

4.4.27. Further detail regarding the existing views from particular locations are contained in **Technical Appendix 4.7 (EIAR Volume 4)** and **Figures TA4.7.2 - 4.7.25 (EIAR Volume 4**).

Designated Landscapes

4.4.28. Designated landscapes within 20 km are shown on **Figure 4.13 (EIAR Volume 3a)** and discussed in detail in **Technical Appendix 4.5 (EIAR Volume 4)**.

4.4.29. Part of the southern extent of the Site is located within the Leadhills and Lowther Hills SLA which has been included in the LVIA. The remaining part of the Site is not subject to any statutorily or nationally protected landscape-based designations. The eastern side is abutted by the Upper Clyde Valley and Tinto SLA.

4.4.30. Analysis of the ZTV identified a further two designated landscapes which have been taken forward for detailed assessment as follows:

- Middle Clyde Valley SLA; and
- Douglas Valley SLA.

Night-time

4.4.31. Sources of artificial lighting within the study area are associated with settlements such as Abington, Crawfordjohn, Douglas and Lamington which also create areas of skyglow. Other notable sources include vehicles travelling along the M74 motorway, and the network of connecting A, B and minor roads within valleys, and trains on the West Coast Railway Line. The surrounding landscape has restricted artificial lighting on account of the limited development within the Southern Uplands and moorland landscape although is influenced by nearby lighting reducing the quality of the dark sky experienced.

Future Baseline

4.4.32. The future baseline of the Site is expected to stay similar to as described previously in the landscape baseline with the exception being that Thirstone Quarry would be restored to the levels and use (rough grazing) specified in the restoration plan that form part of the planning consent for that development.

4.4.33. Within the surrounding area, the development of renewable energy would continue due to the high wind speeds and proximity to the grid. Presently, much of the land is grazed predominantly by sheep and low intensity cattle rearing, the continuation of this is dependent on the profitability of farming and is likely to continue alongside renewable energy developments. There is also pressure to plant trees for forestry, and carbon capture to address climate change although this would be dependent on suitable ground conditions.

4.4.34. Consented renewable energy schemes are also taken into account which are described as Scenario 2 schemes under the cumulative assessment and are included as part of the visualisations prepared for the Proposed Development and shown on **Figure 4.9a – b (EIAR**

Volume 3a). They are also included as part of the second scenario against which the Proposed Development is assessed in the main assessment, as there is a high degree of certainty that these schemes would be constructed in the coming years and would influence the landscape character of the study area.

Summary of Sensitive Receptors

Scoped Out Receptors

Scoped out of the LVIA, on the basis of initial fieldwork and ZTV coverage, are the following elements:

- Effects on landscape character beyond approximately 15 km;
- Effects on views from viewpoints beyond approximately 25 km, although there would be locations where the Proposed Development would be visible at greater distances;
- Effects on views from routes beyond approximately 25 km;
- Effects on views from local paths beyond approximately 5 km;
- Effects on views from settlements beyond approximately 10 km;
- Effects on designated landscapes beyond approximately 25 km;
- Cumulative effects with turbines of less than 50 m to blade tip; and
- Decommissioning effects, which are similar to, but in reverse of construction effects, reducing to nil on completion.

Scoped In Receptors

Table 4.2 lists the landscape and visual receptors that were scoped into the LVIA and provides details on their sensitivity.

Table 4.2: Summary of Landscape and Visual Receptor Sensitivity

Receptor	Sensitivity	Justification
Landscape Character Types		
Site	Medium	The majority of the Site is not covered by any national or local level landscape designation indicating a lower landscape value. The southern side of the Site south of the B7078 and east of the B740 roads covering approximately 329 ha is included in the Leadhills and Lowther Hills SLA. Susceptibility is considered to be medium due to the open nature of the landscape combined with other man-made features.
LCT 201: Plateau Farmland – Glasgow & Clyde Valley	Medium	Within 15 km from the Site, this LCT is partially covered by the Mid Clyde SLA which occupies the northern periphery of the LCT. A very small part of the south eastern periphery is also located within the Leadhills and Lowther Hills SLA. Elsewhere, no national or local level designations cover the LCT within 15 km of the Site, and landscape value is considered medium overall. This LCT retains a perception of being large in scale and open in nature, with no distinct skylines, and is heavily influenced through farming practices, modern development such as roads and houses, and includes areas of forestry, and several small to medium size wind turbines situated close to the M74 motorway. All these man-made features reduce landscape susceptibility to Low for wind and solar development.
LCT 207: Upland River Valley – Glasgow & Clyde Valley	High	The eastern half of the Duneaton Water unit (including the Site) is within the Leadhills and Lowther Hills SLA. Two thirds of the eastern side of the Douglas Water is designated as the Douglas Valley SLA, and a very limited part of the northern River Nethen unit is located within the Middle Clyde Valley SLA. No other national or local landscape designations cover the three units within 15 km of the

Table 4.2: Summary of Landscape and Visual Receptor Sensitivity		
Receptor	**Sensitivity**	**Justification**
		Site. Overall, landscape value is assessed considered as high. All three of the units identified within the 15 km study area are considered to have a high susceptibility to turbine development the Proposed Development due to forming a narrow valley between upland and plateau landscapes which are susceptible to large-scale developments.
LCT 208: Broad Valley Upland	High	The majority of this LCT is located within the Upper Clyde Valley LCT, the exception being a small area directly to the north of the Site, and the western side of the Douglas Water further to the north, overall, landscape value is considered. Landscape susceptibility is also considered to be high for this LCT due to its small-scale elements which make it unsuitable for the large-scale development of the turbine array.
LCT 209: Upland Glen – Glasgow & Clyde Valley	Medium (River Clyde unit) High (Culter Water unit)	The tributaries of the River Clyde unit covering the Glengonnar Water, Daer Water and Potrail Water are located within the Leadhills and Lowther Hills SLA, no other national or local landscape designation covers the River Clyde unit. The Culter Water unit of the LCT is located within the Upper Clyde and Tinto SLA. Landscape value is assessed as high for the upper parts of the River Clyde unit, and medium elsewhere, and high for the Culter Water unit. Landscape susceptibility for both units of the LCT is assessed as high for the turbine array due to the LCT forming a narrow valley that is susceptible to large-scale features.
LCT 213: Plateau Moorlands – Glasgow & Clyde Valley	Medium	The periphery of this LCT is designated at a local level in three separate locations and includes the Douglas Water to the north, Upper Clyde Valley and Tinto SLA to the north east, and the Leadhills and Lowther Hills SLA to the south. For the majority of the LCT, no national or local designations are identified, and landscape value is assessed as medium. This LCT is large in scale, open and includes a variety of man-made features including Middle M and Andershaw Wind Farms 1.4 km to the west of the Site, and Kennoxhead Phase 1 11.1 km to the west which lowers susceptibility to wind turbine development to low.
LCT 217: Southern Uplands – Glasgow & Clyde Valley	Low	This LCT is partially designated as the Upper Clyde and Tinto SLA in the northeast, and Leadhills and Lowther Hills SLA in the southwest. The remaining part of the LCT is not designated at a national or local landscape level. Landscape value is medium overall with parts of the periphery of the LCT displaying higher value. This LCT is large in scale, open and includes a variety of man-made features including Clyde Wind Farm, and been identified as being suitable for wind development which lowers landscape susceptibility to low.
LCT 218: Rounded Landmark Hills	High	The majority of this LCT is designated at a local level as the Upper Clyde Valley and Tinto SLA and landscape value is assessed as high. Landscape susceptibility is also judged to be high as the prominent rounded hills separated from the Southern Uplands are assessed as being unsuitable for sensitive to large-scale development as proposed.
Viewpoints		
VP1: Devonburn Road	Medium	This viewpoint is on a minor road close to dense and scattered settlement and is not within a national or local landscape designation and value is considered medium. Susceptibility of viewers is considered high as they include residents and people accessing local properties.
VP2: B7078 Carlisle Road	Medium	This viewpoint is located within the Douglas Valley SLA and on the NCNR 74, value is medium. Susceptibility of the viewers is also judged to be medium as users of the route are likely to have some appreciation of the view, in particular, cyclists.
VP3: M74 Southbound,	High	This viewpoint is not located within a national or local landscape designation but is recognised as the NCNR 74 and value is

Table 4.2: Summary of Landscape and Visual Receptor Sensitivity		
Receptor	**Sensitivity**	**Justification**
B7078 near Parkhead		considered as medium. Susceptibility of the viewers is also judged to be medium as users of the route are likely to have some appreciation the view, in particular, cyclists.
VP4: M74 within Site	Medium	This viewpoint is not located within any national or local landscape designation, value is considered medium. The M74 motorway is a relatively fast road comprising 3 lanes of traffic-oriented northwest to southeast through the Site and is a major transport route between Scotland and England. Passengers travelling in vehicles are likely to have some appreciation of views resulting in a medium susceptibility.
VP5: Abington Services	Medium.	This location is not located within any national or local landscape designations and is in the grounds of a motorway service station and value is judged to be medium. The picnic area has not been specifically sited to take advantage of the views and susceptibility is medium.
VP6: Castle Hill	High	This location is not located within any national or local landscape designation but is scenically attractive with elevated views of the River Clyde and value is considered high. The susceptibility of the viewers is also considered to be high as people accessing the summit are expected to appreciate the surrounding landscape.
VP7: Crawfordjohn	High	This location is situated on a minor road between the B7078 road and Sanquhar and is situated within the Leadhills and Lowther Hills SLA and value is considered high. The susceptibility of the viewers is high as they include residents, cyclists and vehicles crossing between South Lanarkshire and Dumfries and Galloway.
VP8: B740 Spango	High	This location is situated on a minor road between the B7078 road and Sanquhar, the northern half of this road where the viewpoint is located is within the Leadhills and Lowther Hills SLA, and value is considered high. The susceptibility of the viewers is high as they include residents, cyclists and vehicle users travelling between South Lanarkshire and Dumfries and Galloway.
VP9: A702 near Hartside	Medium	This viewpoint is located within the Upper Clyde Valley and Tinto SLA and value is judged as high. Susceptibility of viewers is judged as Medium, as road users are likely to appreciate the view of the surrounding landscape but is not considered to be higher as this is a relatively fast section of road with no lay-bys.
VP10: B7055 Greenhill	High	This viewpoint is located within the Upper Clyde Valley and Tinto Hills SLA and is a popular cycle route and value is considered high. The susceptibility of viewers are also considered to be high as users of the road are likely to appreciate the surrounding landscape.
VP11: Tinto Hill	High	This viewpoint is not within a national designation but is located within the Upper Clyde Valley and Tinto SLA and is a popular recreational route, and value is high. Susceptibility of viewers is also considered to be high as walkers' attention would be focussed on the views of the surrounding landscape.
VP12: Cairn Table	High	This viewpoint is within the East Ayrshire SLA and is a popular summit and circular walk and value is considered high. Susceptibility of viewers is also considered high as walkers would likely have an appreciation of the view across the landscape.
VP13: Lowther Hill	High	This viewpoint is located on the edge of the Leadhills & the Lowther Hills SLA and is a popular long-distance footpath (Southern Upland Way) resulting in a high landscape value. Susceptibility of viewers is also considered to be high as walkers' attention would-be focussed on the surrounding view.
VP14: Culter Fell	High	This viewpoint is located within the Upper Clyde Valley SLA and is a summit frequently visited by walkers, value is high. Susceptibility of viewers is also considered to be high as walkers' attention would be focussed on the surrounding view.

Table 4.2: Summary of Landscape and Visual Receptor Sensitivity		
Receptor	**Sensitivity**	**Justification**
VP15: B7016 east of Biggar	High	This viewpoint is located within the Upper Clyde Valley and Tinto SLA and is a popular road recreationally, value is considered high. Susceptibility of viewers is also considered high as road users would have an appreciation of the surrounding landscape.
Settlements		
Crawfordjohn	High	People at their home attach high value to their existing view and visual amenity and are more susceptible to being affected by changes.
Roberton	High	People at their home attach high value to their existing view and visual amenity and are more susceptible to being affected by changes.
Routes		
M74 Motorway	Low	This route passes through the Mid Clyde Valley and Douglas Valley SLAs to the north of the Proposed Development resulting in short sections of higher value, overall, the route is not covered by any national or local landscape designation and value is low. The M74 motorway is a relatively fast road comprising 3 lanes of traffic-oriented northwest to southeast through the Site and is a major transport route between Scotland and England. Passengers travelling in vehicles are likely to have some appreciation of views but would experience these at high-speed resulting in a low susceptibility.
A702 Road	Medium	Sections of this road pass through the Upper Clyde Valley and Tinto, Leadhills and Lowther Hills SLAs, and the Thornhill Uplands Regional Scenic Area (RSA) resulting in a higher value, overall, the route is not designated and value is judged as medium. Susceptibility of viewers is judged as medium, as road users are likely to have some appreciation of the view of the surrounding landscape.
B740 road	High	This road is situated on a minor road between the B7078 road and Sanquhar, the northern half of this road is within the Leadhills and Lowther Hills SLA, and value is considered high. The susceptibility of the viewers is high as they include local residents, cyclists and vehicle users travelling between South Lanarkshire and Dumfries and Galloway.
B7055 road	High	This road is located within the Upper Clyde Valley and Tinto Hills SLA and is a popular cycle route and value is considered high. The susceptibility viewers are also considered to be high as users of the road are likely to appreciate the surrounding landscape.
B7078 road / NCR 74	High	This road passes through the Douglas Valley SLA and designated as the NCNR 74, value is high. Susceptibility of the viewers is also judged to be high as users of the route are likely to appreciate the view, in particular, cyclists.
West Coast Main Line	Low	This route passes through the Upper Clyde Valley and Tinto SLA to the northeast of the Proposed Development resulting in short sections of higher value, overall, the route is not covered by any national or local landscape designation and value is low. The railway line is relatively fast and is a major transport route between Scotland and England. Passengers travelling are likely to have some appreciation of views resulting in a medium susceptibility.
SHT 57: Roberton to Douglas	High	This route is located partially within the Douglas Valley and Upper Clyde Valley and Tinto SLAs and is a popular footpath resulting in a high landscape value. Susceptibility of viewers is also considered to be high as walkers' attention would be focussed on the surrounding view.

Table 4.2: Summary of Landscape and Visual Receptor Sensitivity		
Receptor	**Sensitivity**	**Justification**
SHT 58: Douglas to Wanlockhead	High	This viewpoint is located partially within the Leadhills & the Lowther Hills SLA and is a popular footpath resulting in a high landscape value. Susceptibility of viewers is also considered to be high as walkers' attention would be focussed on the surrounding view.
Designated Landscapes		
Leadhills and Lowther Hills SLA	High	Local landscape designation.
Middle Clyde Valley SLA	High	Local landscape designation.
Upper Clyde Valley SLA	High	Local landscape designation.
Douglas Water SLA	High	Local landscape designation.

4.5 Assessment of Likely Effects

4.5.1. This section provides summary information on the assessment of potential effects of the Proposed Development, the detail of which is contained in the appendices to the chapter (**Technical Appendices 4.2-4.7, EIAR Volume 4**).

4.5.2. The LVIA includes existing wind farms as part of the baseline. This is later referred to as the Existing Scenario in the cumulative assessment, in which increasingly speculative cumulative scenarios (with consented, in-planning and scoping schemes) are considered separately.

The Proposed Development

4.5.3. The Proposed Development is described in full in **Chapter 2: Development Description (EIAR Volume 2)**.

4.5.4. The design evolution for the Proposed Development is set out in **Chapter 3 Design Evolution (EIAR Volume 2)**. This details the early evaluation of feasibility, based primarily on landscape and visual amenity.

4.5.5. The design of the Proposed Development relates to the expansive large-scale landscape within which the Site is located. The scale of this landscape is also indicated by large-scale infrastructure. There are no substantial features which interrupt or contain the scale of the landscape. Some land ownership boundaries may be indicated by boundary fences and variation in land use, but the main features of the M74 motorway and existing overhead line, the A702 and A71 roads, and West Coast Railway Line all reinforce the large-scale of the landscape. Die to the large-scale of the landscape, it is considered that the scale of the Proposed Development should match this by creating a strong 3-dimensional feature. Then the ultimate design layout was further influenced by

4.5.6. The design was influenced by a series of factors combining including:

- land ownership boundaries; and
- the alignment of the B7078 road.

4.5.7. When considering cumulative effects, the Proposed Development fills a 'gap' between Middle Muir and Andershaw wind farms to the southwest, Bodinglee (in planning) to the west and Grayside (in planning), Priestgill (consented) and Clyde to the south and east.

4.5.8.

Site

The Site covers an area of approximately 1,275 ha and is located northwest of Abington and approximately 1.5 km northeast of Crawfordjohn, in South Lanarkshire.

This Site is judged to have a sensitivity of **Medium**.

Potential Construction and Decommissioning Effects

4.5.9. During construction, vehicle movements and other activities associated with the construction of access tracks, compounds and substation, import of materials, turbine installation, solar array and reinstatement works at the end of the construction phase would have direct effects on the Site. In addition, during construction approximately 32.2 ha of Sitka spruce and mixed conifer forestry planted under the Forestry Grany Scheme would be felled to create a habitat management area set out in **Technical Appendix 6.6 (EIAR Volume 4)**.

4.5.10. The construction works would be of short-term duration and would be reversible in that construction activities would cease, and operational effects would take over. The extent of physical effects of the works within the Site would involve a relatively small geographical proportion of the Site as whole, the larger part of which would be physically unaffected by either construction works or operation. The scale of the components such as wind turbines, solar array would change the moorland characteristics of the Site. The magnitude of change is judged to be **High**.

4.5.11. As set out in Technical Appendix 4.2 (EIAR Volume 4), the effect of construction works on the Site, involving ground disturbances and activity is judged to be **significant (Major)** for the duration of the construction period.

4.5.12. Effects during decommissioning would be similar to those during the construction phase, but would reduce to not significant (negligible to none) upon completion of decommissioning phase.

Potential Operational Effects

4.5.13. During operation, activity on the Site related to the Proposed Development would be less than during the construction phase and associated to the operation and maintenance of the turbine and solar PV arrays, substation and BESS. The change from moorland and farmland to a renewable energy generating site with wind turbines, solar panels, BESS and supporting ground level infrastructure including substation facilities would be **High**, long-term and reversible. However, although the change from the Proposed Development would be greater, there would also be some positive changes to the landscape of the Site in relation to the Outline Biodiversity Enhancement Management Plan detailed in **Technical Appendix 6.6 (EIAR Volume 4)** and shown on **Figure 6.XX (EIAR Volume 4)**. This would include the following:

- Enhancement to approximately 143.10 ha of existing and degraded peatland habitat and creation of favourable conditions for the re-establishment of peatland vegetation;
- Retention of approximately 3.9 ha of native woodland and replanting of 24.09 ha of native broadleaf trees in the west of the Site where Sitka spruce and other conifer species were felled during construction;
- Creation of 10.44 ha of riparian woodland along the Duneaton Water and Black Burn;
- Creation of approximately 4.37 ha broadleaf woodland around the substation;
- Creation of approximately 3.57 ha of scrub planting and grassland to complement the broadleaf planting around the substation;

- Creation of approximately 108.96 ha of meadow grassland enhancement within the solar PV array area; and
- Creation of 865 m of species rich hedgerows adjacent to the A702 road.

4.5.14. Overall, the predicted effect on the Site is judged to be **significant (Major)** for the duration of the operational and maintenance phases.

Landscape Assessment

4.5.15. The landscape assessment for the Existing Scenario (which includes existing wind farms) is set out in **Technical Appendix 4.2 (EIAR Volume 4)** and considers the changes to the character of the surrounding area that are predicted to result from the Proposed Development during the operational phase.

LCT 201: Plateau Farmland – Glasgow & Clyde Valley

4.5.16. This LCT is situated between plateau moorland and settled valleys south of Glasgow and occupies two extensive areas in the northern half of the 45 km study area, one of which also is located within 15 km extending between Lesmahagow and Happendon, approximately 7 km to the northwest of the Site.

4.5.17. This LCT is judged to have a **Medium** sensitivity.

4.5.18. The turbine array ZTV illustrates potential for widespread theoretical visibility for areas of the LCT within 15 km of the Site. This would occur on Broken Cross Muir, farmland surrounding the settlement of Coalburn, and higher ground to the east and west of Lesmahagow. There would be no visibility of the solar array or ground level elements from within this LCT.

4.5.19. The Proposed Development would extend wind farm development southwards, partially infilling a gap between Middle Muir Wind Farm and the more distant Clyde Wind Farm and seen within the context of nearby Douglas West and Hagshaw Hill Wind Farms to the southwest of this LCT.

4.5.20. The size and scale of the change would be small because of distance and intervening screening by landform and vegetation which would also reduce the large geographical area predicted to receive theoretical visibility of the Proposed Development. The addition of the Proposed Development would not alter the key characteristics identified by NatureScot.

4.5.21. Changes to character would be associated with visibility of the Proposed Development in a neighbouring LCT and would be long-term and reversible following decommissioning. Magnitude of change would be **Low** during construction activities and the operation and maintenance phase resulting in a **not significant (Minor)** effect.

LCT 207: Upland River Valley – Glasgow & Clyde Valley

4.5.22. Of the four units of this LCT located within the 45 km study area, three would be within 15 km of the Site. The nearest, the Duneaton Water unit, lies partially within the Site and forms a broadly curved valley west of Crawfordjohn near to the Southern Uplands.

4.5.23. This LCT is judged to have a **High** sensitivity.

4.5.24. The turbine array ZTV indicates theoretical visibility would be limited to the upper north facing slopes above the Douglas Water. Extending from Happendon in the east, to Debog in the west. Much of this area is forested reducing the area of actual visibility of the Proposed Development although it is recognised that during the lifespan of the Proposed Development this forestry is likely to be felled.

4.5.25. Theoretical visibility is predicted to be reduced to the south facing slopes of the Douglas Water unit, reducing further in the Nethan Water unit because of intervening landform and vegetation. The size and scale of the change would be low affecting the upper parts of the valley rather than the valley floor, covering a small geographical area and it is not considered that the introduction of the Proposed Development to the landscape would alter the character of both units. Changes occurring would be short-term during construction, long-term during operation and reversible following decommissioning. Magnitude of change for both the Douglas Water and Nethen Water units is considered **Low**.

4.5.26. Within the Duneaton Water unit of the LCT, theoretical visibility is predicted to be widespread to approximately 13 km, thereafter, becoming more sporadic as intervening screening reduces the visual envelope. Potential effects would be indirect and associated with views of the turbine array with some limited theoretical visibility of the solar PV array near the Site.

4.5.27. The size and scale of the change to the character of the Duneaton Water would be high, covering much of the eastern side and north facing valley sides. These changes would be short-term during construction, long-term during operation and reversible following decommissioning. Magnitude of change for the Duneaton Water unit is therefore considered **High**.

4.5.28. The effect on character for the Duneaton Water unit of the LCT is **significant (Major)** due to the unit's proximity to the Proposed Development largely as a result of views of the turbine array. The other two units covering the Douglas Water and Nethan Water are considered to receive a **not significant (Minor)** effect on account of the limited geographical area affected which would occur mainly on the upper valley sides where wind turbines are a common feature. The addition of the Proposed Development is not considered to significantly alter the character of the Clyde valley.

LCT 208: Broad Valley Upland

4.5.29. This LCT covers the Clyde Valley between Douglas, Biggar and Abington and partially covers the Site to the north of Abington.

4.5.30. Overall, landscape sensitivity is considered **High**.

4.5.31. The turbine array ZTV shows widespread theoretical visibility to approximately 6 km; thereafter, views would be funnelled along the eastern side of the valley, and on the western side of the Douglas Water within 15 km. Actual visibility would be reduced by woodland and individual trees within the LCT.

4.5.32. The size and scale of the change would be large within 6 km from the Site and would be associated with the turbine array rather than the solar array which is predicted to have a smaller visual envelope within the LCT. Beyond 6 km, theoretical visibility is predicted to reduce both in the geographical area affected and number of turbines visible. Changes to character would be short-term during the construction phase, long-term during operation, and reversible following decommissioning. Magnitude of change would be **Medium** within 6 km of the Proposed Development, thereafter, reducing with distance to **Low** levels.

4.5.33. Overall, the effect on the character of the landscape is judged as **significant (Major)** within 6 km during both construction and operational phases because of visibility of the turbine array within a valley landscape. Thereafter, reducing to **not significant (Minor)** levels because of screening by landform, vegetation and distance for the majority of the LCT.

LCT 209: Upland Glen – Glasgow & Clyde Valley

4.5.34. This LCT occupies two units within 15 km of the Site; the nearest comprising the River Clyde is partially covered by the Site, and the Culter Water is located approximately 7.3 km to the east.

4.5.35. Landscape sensitivity is **Medium** for the River Clyde unit of the LCT, although it is acknowledged that there are areas of higher sensitivity in the tributaries, and **High** for the Culter Fell unit.

4.5.36. The turbine array ZTV predicts limited theoretical visibility to the north and east of Abington, thereafter, reducing to the north facing slopes west of Crawford, Great Hill in the Camps Water tributary, Lodge Hill southeast of Crawford, and Black Hill to the southwest. The number of turbines viewed from the valley sides would be dependent on elevation and tree cover.

4.5.37. The size and scale of the change within 5 km of the River Clyde unit would be large although this is not predicted to be from the entirety of the LCT due to landform screening but would be limited to the west-facing slopes and part of the valley floor. As distance increases, the winding nature of the valley would limit the extent of the turbine array visibility within the River Clyde unit.

4.5.38. Similarly, due to landform screening, there would be a limited extent of theoretical visibility predicted in the Culter Water unit being confined to the upper parts of the valley.

4.5.39. Changes to the landscape would be short-term during construction, long-term during operation, and reversible on completion of decommissioning. Magnitude of change is assessed as **High** within 5 km of the Site, thereafter, reducing to **Low** and **Negligible** levels.

4.5.40. Overall, the effect on the character of the landscape is judged as **significant (Major)** within 5 km of the Site, thereafter, reducing to **not significant (Minor and Negligible)** levels due to the influence of screening by landform and vegetation.

LCT 213: Plateau Moorlands – Glasgow & Clyde Valley

4.5.41. Most of the Site is located within this LCT which forms a large area of moorland surrounding the south side of Glasgow.

4.5.42. Overall, landscape sensitivity of this LCT is **Low**.

4.5.43. The turbine array ZTV indicates widespread theoretical visibility within 4.5 km of the Site, reducing thereafter to elevated areas only. With the introduction of the Proposed Development, the size and scale of the change would be large within 4.5 km, with the extension of turbines further eastwards within the LCT. Due to its openness, turbines would be visible albeit the scale would reduce on account of the large-scale landscape in which the turbine array would be located. Changes in character would be short-term during construction, long-term during operation, and reversible following decommissioning. Magnitude of change is **High** within 4.5 km, reducing to **Low** levels elsewhere in the LCT due to a combination of distance, presence of other wind farm developments.

4.5.44. Overall, the effect is **significant (Major)** within 4.5 km, reducing to **not significant (Minor)** elsewhere in the LCT due to intervening screening by landform.

LCT 217: Southern Uplands – Glasgow & Clyde Valley

4.5.45. This LCT is located to the south of the Southern Upland Fault Line encompassing the Lowther Hills and Southern Uplands. The southern side of the Site is partially located within this LCT.

4.5.46. Overall, landscape sensitivity of this LCT is **Low**.

4.5.47. The turbine array ZTV indicates widespread theoretical visibility of the Proposed Development within 5 km, thereafter, reducing to summits, north facing slopes and interconnecting ridgelines with distance. The extent of actual visibility would reduce further as a result of forestry although it is acknowledged that some of these areas would be clear-felled during the lifespan of the Proposed Development. Clyde wind farm and extension is a key feature in this LCT.

4.5.48. Potential effects on character would mainly be associated with the turbine array which would have greatest visibility within the LCT. The solar PV array would be much more screened by adjacent hillsides and have a small visual envelope within the LCT. The size and scale of the change would be medium on account of the large-scale and openness of the landscape and presence of other wind turbines both within the LCT (Clyde + Extension) and in neighbouring

LCTs. Changes occurring would be limited in comparison to the overall size of the LCT, would be short-term during the construction phase, long-term during operation and reversible following decommissioning. Magnitude of change is therefore assessed as **Low**.

4.5.49. Overall, the effect on the character of the landscape is judged as **not significant (Minor)** for an area of the LCT approximately within 5 km, extending eastwards to 9 km, thereafter, levels of effect would reduce to **not significant (Negligible)** levels overall for the LCT.

LCT 218: Rounded Landmark Hills

4.5.50. This LCT forms a distinct feature of rounded high hills that sits separate from the Southern Uplands, north of the Southern Upland Fault and Clyde Valley between 2.8 – 11.5 km to the northeast of the Site.

4.5.51. Overall, landscape sensitivity of this LCT is **High**.

4.5.52. The turbine array ZTV indicates theoretical visibility would occur from the summits and southwest facing slopes of Dungavel Hill 510 m AOD, and a continuous area comprising the southwest facing slopes Lochlyoch Hill 529 m AOD, Tinto 711 m AOD, and Scaut 586 m AOD.

4.5.53. The Proposed Development would occupy an area between Priestgill and Middlemuir Wind Farms extending wind farm development to the southwest of the LCT. The size and scale of the change would be medium on account of the distance from the Site, elevation of view and indirect nature of the change predicted. The geographical coverage of where the change would affect would be limited to south facing slopes and the summits of hills, from the southern part of the LCT between 2.8 and 8.4 km.

4.5.54. The addition of the Proposed Development to the landscape would have limited effect on the key characteristics of the LCT or scale of Tinto when viewed from the surrounding landscape. Changes would be short-term during construction, long-term during operation and reversible following decommissioning. Magnitude of change would therefore be **Low**.

4.5.55. Overall, the effect on the character of the landscape is judged as **not significant (Minor)** within 2.8 – 8.4 km covering an elevated area of the southern extent of the LCT where uninterrupted views of the Proposed Development would be experienced in combination with other operational wind farms. Thereafter, the effect would reduce with distance and screening by landform to **not significant (Negligible)** effects.

Visual Assessment

4.5.56. The visual assessment for the Existing Scenario considers the effects of changes to the views that people would see from the surrounding area as a result of the introduction of the Proposed Development to the existing landscape. The assessment was carried out using the methodology set out in **Technical Appendix 4.1 (EIAR Volume 4)**, and detailed in **Technical Appendix 4.3 (EIAR Volume 4)**. Accompanying graphics include baseline figures and the ZTVs **(Figures 4.2 - 4.8, EIAR Volume 3a**) and visualisations (**Figures 4.14a-4.28f, EIAR Volume 3b**).

Analysis of the Zone of Theoretical Visibility of the turbines

4.5.57. The ZTV (shown on Figure 4.2a and 4.3 and subsequent figures, (**EIAR Volume 3a**) is an analysis of the theoretical visibility of the proposed turbines based on a 'bare earth' model and as such represents the maximum visibility of the turbines. The actual visibility is expected to be less in some parts of the study area due to screening afforded by vegetation/woodland and buildings.

4.5.58. The ZTV illustrates that theoretical visibility of the turbines is generally curtailed by the rounded landmark hills to the northeast of the Site, and the Southern Uplands to the east, west and south. Theoretical visibility is generally widespread within 5 km reducing to facing slopes and summits within 10 km, in particular, to the east and west; thereafter, reducing to summits and the upper hill slopes within the Southern Uplands. To the northwest, theoretical visibility is predicted to be widespread along the M74 motorway corridor, reducing on account of intervening field boundaries, forestry and woodland, and the built environment closer to Glasgow.

4.5.59. The ZTV to hub height of the turbine array (**Figure 4.4, EIAR Volume 3a**) indicates that hubs would be visible across the same areas as the tip ZTV within 10 km, with a slight decrease in the number of turbines visible at one time, and with some reduction around the edges. The greatest difference in visibility would be across the Southern Uplands where local variations in topography may screen hubs but not tips.

4.5.60. It is noted that the Study Area includes many well-wooded landscapes with frequent shelterbelts, roadside vegetation, and plantations. Actual visibility of the Proposed Development would therefore be considerably more limited than indicated by the ZTV and is explored through the visual assessment.

Theoretically Visibility of Solar PV Arrays

4.5.61. The ZTV for the solar arrays is shown on **Figure 4.2b (EIAR Volume 3a**), using a series of points around the edges and within the solar development area modelled to the height of the solar panels (2.86 m). Analysis is run to 5 km, as ground level structures are likely to be more difficult to make out beyond this distance. This can be used as a proxy for theoretical visibility of other ground-level elements such as the battery storage plant, substation and tracks.

4.5.62. **Figure 4.2b (EIAR Volume 3a)** shows the solar ZTV based on a bare-ground run using digital terrain data, which does not take account of screening by vegetation in the landscape.

4.5.63. The ZTVs indicate that visibility would be as follow:s

- Widespread within 1 km of the Site;
- Along the floor and slopes of the River Clyde valley to the northeast;
- On high ground east and west covering of the M74 motorway; and
- High ground south of the Site and west of Crawford.

Visual Effects

4.5.64. Viewers within the Study Area who would be affected by the changes in views and visual amenity include local residents, tourists, walkers and recreational route users, road users etc. The assessment of visual effects considers the changes that people would see in views from various locations around the Study Area, using representative viewpoints, as well as considering views from settlements and from along routes. The assessments are set out in detail in **Technical Appendix 4.3 (EIAR Volume 4)** and summarised below.

Summary of Findings of the Visual Assessment

Viewpoints

4.5.65. A total of fifteen viewpoints or viewing locations were selected to represent the views experienced by people at that location or vicinity (see **Technical Appendix 4.3: Visual Assessment**). A total of seven viewpoints were predicted as receiving a potential significant effect as follows:

- VP3: M74 Southbound, B7078 near Parkhead – 2.7 km (from nearest turbine) to the north west of the Proposed Development;
- VP4: M74 within Site – 358 m km to the north west;

- VP5: Abington Services – 2.0 km to the south east;
- VP6: Castle Hill – 4.9 km to the south east;
- VP7: Crawfordjohn – 2.5 km to the west;
- VP9: A702 near Hartside – 5.4 km to the east; and
- VP11: Tinto Hill – 8.5 km to the north east.

4.5.66. The sensitivity of the above viewpoints varies between **High** (for residential and recreational receptors (Viewpoints 6, 7 and 11), **Medium** for roads and motorway services (Viewpoints 3, 5 and 9), and **Low** for the M74 motorway.

4.5.67. All viewpoints identified as receiving a significant effect would be located close to the Site between 358 m – 8.5 km),

4.5.68. The turbine array would be the most noticeable component of the Proposed Development visible from viewpoint locations. Views of the turbines would vary with unobstructed visibility occurring around the periphery of the Site where other components such as the solar PV array would also be visible. The substation and BESS would be partially screened once broadleaf and scrub planting have established. Further away, partial views of turbines above intervening landform would screen the lower lying components of the Proposed Development. Receptors views from the viewpoints are considered to be significant on account of the extent of the overall view that would be affected by the turbine array combined with the size and scale of the change, which would be long-term and reversible following decommissioning.

4.5.69. Viewpoints 4, 5, 6, and 7 are all judged to receive a **High** magnitude of change to their views, due to proximity to the Proposed Development and open views experienced. This would result in a **significant (Major)** effect.

4.5.70. Viewpoints 3, 9 and 11 are judged to receive a **Medium** magnitude of change as a result of distance and/or screening by landform reducing the prominence of the turbines within the view. This would result in a **significant (Moderate)** effect.

4.5.71. The remaining eight viewpoints are judged to receive a **Low** magnitude of change resulting in a not significant (Minor) effect. This is due to a combination of factors including the longer distance to the nearest turbine which would contribute to reducing the size and scale of the change of view, and partial screening by landform ranging between the turbine bases and towers to full turbines. These factors would also reduce the extent of the Proposed Development occupying the view.

Settlements

4.5.72. Two settlements were identified as receiving close views of the turbine array as follows:

- Crawfordjohn – 2.1 km west of the nearest turbine; and
- Roberton – 3.5 km east of the nearest turbine.

The effect on views from Crawfordjohn were judged to be significant from some properties within the village and on account of the high sensitivity assigned to views from residents. The assessment of properties in Crawfordjohn is covered in Technical Appendix 4.7 RVAA (EIAR Volume 3).

From properties where the turbines are visible, the vertical extent of the turbines would include towers and hubs with the northern turbines being fully to partially screened by intervening landform.

Roberton was also judged to receive a significant effect (Moderate) from the southern part of the village close to the junction with the A702 road and from elevated modern properties. From these locations, the turbines would be seen above the foreground landform at a relatively close distance. The northerly part of the village would not receive views due to screening from landform and is judged to receive not significant effect.

Routes

4.5.73. A total of eight routes were identified as potentially receiving significant effects to views from the Proposed Development due to proximity to the Site. Six were judged to receive a significant effect on views as follows.

4.5.74. Two of the roads, the M74 motorway and B7078 road run parallel to one another and pass through the Site.

4.5.75. Sensitivity for the M74 motorway is judged as **Low**, and the B7078 road **Medium**.

4.5.76. When passing through the Site, road users would receive close views of the turbine and solar PV arrays, supporting infrastructure including the substation and BESS within the restored Thirstone Quarry. Overtime, the substation and BESS would be partially visible through screening by broadleaf and scrub planting. Magnitude of change would be **High** for both roads within the Site resulting in a **significant (Major)** effect.

4.5.77. Away from the Site, the main effect would occur when travelling southbound along both roads towards the Site where the turbine array would be the most noticeable component of the Proposed Development. This would first become visible heading south from Lesmahagow at not significant levels, transitioning to **significant (Moderate – Major)** within approximately 5 km of the nearest turbine due to the extent of the southbound view affected and size and scale of the turbines.

4.5.78. The A702 road passes the eastern boundary of the Site in a northeast to southwest direction.

4.5.79. Sensitivity for the A702 road is judged as **Low**.

4.5.80. The turbine array is predicted to become visible to the northeast of Lamington, increasing in the number of turbines visible when travelling southbound. South of Wandel, other project components would become visible such as the solar PV array when approaching Abington occupying the foreground fields to the north and northwest. Magnitude of change is judged as **Medium** within 2 km of the Site, reducing to **Low** and **Negligible** levels as the distance increases, changes would be long-term and reversible resulting in a **significant (Moderate)** effect, reducing to **not significant levels** beyond 2 km. Overtime, some partial filtering of views of the solar PV array would occur as a result of 865 m of new hedgerows which would be planted adjacent to the road. This would provide some filtering of the foreground with the remaining solar PV array being visible above the hedgerow beyond.

4.5.81. The B740 road extends between the B7078 road and Sanquhar, orientated northeast to southwest and approximately 780 m is within the Site.

4.5.82. Sensitivity for the B740 road is judged as **High**.

4.5.83. When passing through the Site, road users would receive close views of the turbine array, and supporting infrastructure including the substation and BESS within the restored Thirstone Quarry. Overtime, the substation and BESS would be partially visible through screening by broadleaf and scrub planting.

4.5.84. The turbine array would also be visible in northbound views southwest of Crawfordjohn and are predicted over a 4.6 km stretch of the road and seen intermittently in conjunction with more distant views of Clyde Wind Farm to the east and southeast, and Middle Muir Wind Farm to the north. Past Crawfordjohn, the turbines would become larger increasing the size and scale of the change and would be entirely visible on leaving the hills and beyond shelterbelt planting at the edge of the Site. Magnitude of change is judged as **High** within 4.7 km, resulting in a significant (Major) effect. Thereafter, magnitude would reduce to **Medium** around Crawfordjohn, and **Low** and **Negligible** levels west of the village resulting in a

significant (Moderate) effect at Crawfordjohn, reducing to **not significant** levels with distance.

4.5.85. Two footpaths were identified and assessed, both of which are within 5 km of the nearest turbines, the SHT 57 Roberton to Douglas north and east 1.5 – 5.2 km, and SHT 58 Douglas to Wanlockhead west of the Proposed Development 1.3 – 5.4 km.

4.5.86. Sensitivity for both SHTs are judged as **High**.

4.5.87. Both footpaths cross open ground predominantly comprising moorland, and the turbine array would occupy a large part of the view and seen in conjunction with nearby Middle Muir wind farm. SHT 58 would also pass between the Proposed Development to the east, and Middle Muir to the west. Both footpaths would receive sequential visibility of the other project components including the solar PV array, substation and BESS within Thirstone Quarry, and supporting infrastructure, the latter being partially screened over time by broadleaf and scrub planting in the former quarry. This would result in a **High** magnitude of change and **significant (Major)** effect for the majority of their length.

4.5.88. The remaining two route receptors, the B7055 road and the West Coast Main Line were judged to receive a **not significant (Minor)** effect on views due to screening by landform, and in the case of the railway line, the speed trains travel at combined with screening by adjacent cuttings.

Cumulative Assessment

4.5.89. The assessment of cumulative effects is set out in **Technical Appendix 4.4 (EIAR Volume 4)**, and considers the additional effects of the introduction of the Proposed Development with cumulative wind farms. There are several wind farms consented, and in-planning within approximately 25 km of the Proposed Development, as set out in Table 4.4.1 in **Technical Appendix 4.4 (EIAR Volume 4)** and shown on **Figure 4.9 a-b (EIAR Volume 3a)**. Scoping sites are shown on the figure but are not assessed due to their uncertainty.

4.5.90. The cumulative assessment in **Technical Appendix 4.4 (EIAR Volume 4)** considered the potential additional effects of the Proposed Development in two scenarios:

- a Consented Scenario with consented wind farms present in the baseline (in addition to existing wind farms), i.e. a likely future scenario; and
- an In-Planning Scenario with undetermined proposals in planning present (in addition to the above), i.e. a less certain future scenario.

4.5.91. In the Consented Scenario, i.e. with both existing and consented wind farms included in the baseline, there would be a further concentration of turbines around existing sites and clusters discussed previously, the exception to this would be Priestgill which occupies an area between the Site and Clyde Wind Farm and appear as a separate development.

4.5.92. In the Consented Scenario, Priestgill would follow the pattern of development around Clyde but would extend turbines northwards and more visible within the River Clyde valley. The introduction of the Proposed Development would therefore have similar effects to those identified for the Existing Scenario in the LVIA (i.e. no change in findings of effect).

4.5.93. The In-planning Scenario, i.e. with existing, consented and in-planning sites in the baseline, Bodinglee and Little Gala would extend turbines closer to the Site creating a larger cluster alongside the Proposed Development. There would be a noticeable difference in layout design between the developments so that they would be read as separate to one another.

4.5.94. The addition of the Proposed Development would further increase the number of turbines directly affecting the fabric of the LCT as well as being seen. The experience of the landscape would continue to be one of renewable energy projects. In this context, the likely effect attributable to the Proposed Development on the character of the landscape and visual amenity would be somewhat less than predicted in the LVIA, but still within the same level bracket.

4.5.95. Within the wider landscape, the in-planning scenario would follow a similar patternof turbines discussed for the Existing and Consented scenario with sites being located around the periphery, or within existing and consented sites creating a much larger cluster of wind turbines. This would include an infilling of the gap between Dungeval and Bankend Rig by Bankend Rig III to the northwest of the Site. Grayside would be located close to the northern edge of Clyde Wind Farm to the southeast of the Site, Lethans Extension would increase the size of the Lethan and Glenmuckloch cluster, and Sandy Knowe Extension to the original Sandy Knowe Wind Farm all to the southwest of the Site. Rowancraig would form a standalone wind farm to the southwest of the Site and Daer and Rivox would be south of Clyde forming a cluster closer to but separate from Clyde Wind Farm.

4.5.96. There are no instances in which the effects of the Proposed Development in the context of those wind farms is judged to be increased above the LVIA findings.

Combined Cumulative Effects

4.5.97. The assessment of additional cumulative effects in **Technical Appendix 4.4 (EIAR Volume 4)** follows current guidance and considers the effect of the introduction of the Proposed Development to the landscape in addition to other wind farms, and considers two possible cumulative scenarios. It is acknowledged that this does not provide a view on the role of the Proposed Development in the overall combined effect of all wind farm developments that may occur depending on which proposed wind farms are consented and built.

4.5.98. The future pattern of development is likely to lie somewhere between no additional development, and a maximum of all currently proposed (and potentially more proposals not currently in the planning system) being consented and built. In the minimum scenario, the future pattern of development would be very similar to the current pattern, as assessed in the LVIA. In the maximum development scenario, existing wind farm clusters may be enlarged, others may be introduced, and clusters may start to coalesce. Whilst this may be evident when looking at maps of developments, it would not necessarily be evident on the ground when moving around the landscape.

4.5.99. An LVIA assesses the effect on landscape character resulting from introducing the Proposed Development into the landscape. Several developments of the same type lead to an accumulation of effect on landscape character. In an assessment of cumulative effects on landscape character the increasing influence of turbines on LCTs may be described with terminologies reflecting a succession of landscape change. Terms may include ‘landscapes with occasional wind farms’, through to ‘landscapes with wind farms’, and ‘wind farm landscapes’.

4.5.100. **Consented Scenario**: With consented wind farms present as well as existing wind farms, Priestgill would slightly enlarge Clyde Wind Farm and Extension and appear as part of a larger wind farm. There would be essentially neither change in the pattern of development nor the role of the Proposed Development in the perception of wind energy development in the study area when compared with the Existing Scenario. The southern fringe of the Southern Uplands range would remain ‘with occasional wind farms’ with the introduction of the Proposed Development.

4.5.101. **In-planning Scenario**: With in-planning wind farms present as well as consented and existing wind farms, Little Gala and Bodinglee would form a separate group northwest of Middle Muir Wind Farm introducing wind farms to an area not currently developed. Within the wider landscape, although the groups across the Southern Uplands and hills to the north would be larger, there would be essentially little change in the overall pattern of development. The role of the Proposed Development as additional turbines to the south of Little Gala and Bodinglee in the perception of wind energy development in the study area would be relatively little altered. The southern fringe of the Southern Uplands would remain 'with occasional wind farms' with following the introduction of the Proposed Development.

Aviation Lighting Assessment

4.5.102. In agreement with the Civil Aviation Authority (CAA), the Proposed Development would be lit with eight turbines, 1, 3, 4, 9, 16, 17, 19 and 22, each having medium intensity 2000 candela (cd) steady red lights on the top of the hub (a second light on each hub would be installed as backup, but would not be lit when the primary light is functional). No mid-tower lights would be used. The hub lights would come on at half an hour after sunset and would be switched off at half an hour before sunrise (to be on during nautical twilight). Agreed mitigation includes the reduction of intensity of the lights during conditions of clearer visibility, such that the lights would only operate at full intensity of 2000 cd when visibility is less than 5 km; at other times they would be at 10%, i.e. 200 cd. Meteorological data for the local area suggests that the 2000 cd lights would be at 2000cd for 7-10% of the time and at 200cd for 90-93% of the time. The lights used would be designed to emit a horizontal beam of light with reduced upward and downward spill of light, such that the brightness of the light emitted is decreased for viewers close to the turbines viewing the lights from below.

4.5.103. The assessment of the effects of the lighting on views after dark considered each viewpoint and selected routes and assessed the appearance of the proposed lighting relative to existing lights in the views and the change to the night time viewing experience. Off-road locations are likely to have very few viewers, but the potential for people to be out at night is also considered for off-road viewpoints.

4.5.104. The assessment of aviation lights established that of the 15 viewpoints assessed, only Viewpoint 6: Castle Hill (**Figures 4.19a-f, (EIAR Volume 3b**) would receive a **significant (Moderate)** effect. A total of 8 lit turbines would be seen from the summit of this hill which has a Medium sensitivity as people visiting the summit during the hours of darkness are likely to have some appreciation of the dark skies. The remaining turbines would be seen as dark structures or silhouettes. Due to the higher elevation, the aviation lights would be viewed at their strongest intensity and at approximately 5.2 km between 0 to 3 degrees. Views of aviation lights would be within the context of lights from foreground Abington, and vehicles travelling on the M74 motorway, and A702 road.

Implications for Designated Landscapes

4.5.105. There are numerous designated landscapes within approximately 20 km of the Proposed Development as shown on **Figure 4.13 (EIAR Volume 3a)**. The implications of the findings of the LVIA for the designated landscapes are considered in **Technical Appendix 4.5 (EIAR Volume 4)**.

4.5.106. Many of the designated landscapes have limited or no ZTV coverage, and are scoped out of detailed consideration as having no likelihood that their special qualities and reasons for designation would be affected by the Proposed Development. Those considered further are located within South Lanarkshire include:

- Leadhills and Lowther Hills SLA;
- Middle Clyde Valley SLA;
- Upper Clyde Valley SLA; and
- Douglas Water SLA.

Leadhills and Lowther Hills SLA

4.5.107. Approximately 328 ha of the Proposed Development site falls within most northerly part of the designated area and this includes Black Hill 385 m Above Ordnance Datum (AOD). Two turbines (20 and 22), two hardstandings, 1.4 km of access track, 463 solar panels, a borrow pit search area and two inverters are located within this 328 ha of the Leadhills and the Lowther Hills SLA designation.

4.5.108. The landscape description of the SLA places the area as part of the Lowther Hills range which in itself is part of the 'Southern Uplands Landscape Character Type' (LCT) which extends into Dumfries and Galloway. This is characterised by steep hills with smooth rolling summits in contrast with the lower moors and plateaus to the north and west. Distinctive glacial valleys with steep slopes, crags, screes and waterfalls are largely derived from the underlying geology and glacial erosion. These features are in common with the general character of the Southern Uplands LCT. Because of the introduction of extensive coniferous forestry and of windfarms, parts of the Southern Uplands LCT have been redefined as 'sub' types such as for example Southern Uplands with Forestry. This refinement demonstrates the dynamic and evolving or changing nature of our landscapes.

4.5.109. Special qualities of this SLA include lack of extensive forestry or windfarm development which engenders a sense of emptiness. The mining heritage associated with the small-scale mining industry readily visible around Leadhills, is one of the special qualities attributed to the SLA.

4.5.110. Turbines of the Proposed Development located outside, and turbines within the SLA, are visible from a relatively large part of the SLA.

4.5.111. No other special qualities, cultural artefacts, extensive moorland etc are impacted upon and whilst there is some loss of the sense of emptiness in the northeastern part of the SLA, this does not substantively affect the integrity of the designation. The special qualities are not present in equal measure across the designated area. For this reason, the assessment concludes a **Low** magnitude of change and **not significant (Minor)** overall effect.

Middle Clyde Valley SLA

4.5.112. This SLA is located approximately 10.5 km at its closest point to the northwest of the Site.

4.5.113. The ZTV indicates the turbine array would be the most visible part of the Proposed Development and would be widespread within the SLA. Although it should be noted that this would be beyond 10.5 km and actual visibility would be substantially reduced by woodland and built development within the SLA.

4.5.114. Potential effects on the special qualities would be indirect and the Proposed Development would feature within distant views from parts of the SLA and be viewed to the east of Middlemuir wind farm, both of which are more distant than the nearby wind farms of Douglas West and Andershaw to the southeast.

4.5.115. The addition of the Proposed Development is not considered to compromise the special qualities of the Middle Clyde SLA due to distance and influence of screening.

4.5.116. For this reason, the assessment concludes a **Low** magnitude of change and **not significant (Minor)** overall effect.

Upper Clyde Valley and Tinto SLA

4.5.117. This SLA abuts the Site to the east and covers a large part of the northeastern side of the study area.

4.5.118. The ZTV indicates that theoretical visibility of the turbine array and to a lesser extent the solar array would be widespread within 6 km from the Site. This is predicted within the River Clyde Valley, high ground to the south, and the prominent summits of Dungavel Hill 510 m AOD and Tinto Hill 711 m AOD to the northeast.

4.5.119. Potential effects on the special qualities would be indirect and associated with views beyond the SLA boundary. The Proposed Development would be viewed to the east of Middle Muir wind farm and experienced in the context of other nearby wind farms mainly from a localised area within the River Clyde Valley and from elevated areas of the Tinto Hills. The turbine array would be seen against the 'enclosing hills of the Southern Uplands' to the south but in the context of other wind farm development.

4.5.120. Overall, the special qualities of the SLA are not considered to be compromised by the addition of the Proposed Development to the landscape beyond the designation boundary.

4.5.121. For this reason, the assessment concludes a **Low** magnitude of change and **not significant (Minor)** overall effect.

DOUGLAS VALLEY SLA

4.5.122. This SLA is located 2.1 km to the northwest of the Proposed Development and covers the Douglas Valley.

4.5.123. Due to the landform of the river valley, theoretical visibility is predicted to be limited to the upper parts of both sides of the valley covering the summits and south facing slopes some of which are forested, on the north side of the valley facing the Proposed Development, and in the southern periphery of the designation including Earls Hill 329 m AOD and Pagie Hill 388 m AOD.

4.5.124. Potential effects on the special qualities of the designation would be indirect and from a limited area along the periphery. The special qualities listed above tend to focus features and perceptual experience from within the valley rather than the periphery. The addition of the Proposed Development to the landscape would not compromise these special qualities on account of screening by landform, and forestry and woodland. Areas of the SLA affected would experience the Proposed Development alongside Middle Muir wind farm.

4.5.125. For this reason, the assessment concludes a **Low** magnitude of change and **not significant (Minor)** overall effect.

Residential Visual Amenity Assessment

4.5.126. An assessment of the effects on the visual aspects of residential amenity is set out in **Technical Appendix 4.7**. There are 24 property groups within 2.5 km of the Proposed Development, as shown on **Figure TA4.7.1**. Grouped properties have similarity of location, setting, outlook and screening.

4.5.127. The residential visual amenity assessment (RVAA) considered the change to visual amenity at each property, including consideration of likely views from the property, its curtilage (garden) and approach. Properties for which a High magnitude of change is identified are considered further with respect to whether or not the effect would reach what in current guidance is called a 'Residential Visual Amenity Threshold' . It is noted that although the Proposed Development includes solar arrays, BESS, and other ground level infrastructure elements, it is the turbines that are most likely to affect visual aspects of residential amenity. At night, aviation lighting will theoretically be visible from some of the properties considered, although with strong downward angles at which the lights will emit light at limited intensities, such that the lights will be perceived as less bright at these locations have low brightness, including some properties for which the angle of view is -4° or below such that the lights would theoretically not be visible be bright (see also **Technical Appendix 4.6**).

4.5.128. The assessment of the properties around the Site found that there would be **Medium** to **High** magnitude of change to the views from most properties within approximately 2.5 km. Those with a high magnitude of change, include:

- 1 Bodinglee;

- 2 Maidencots Cottage / Meiklemarr;
- 3 Maidencots Farm;
- 4 Netherton Farm / Cottage;
- 6 Duneaton Cottage;
- 10 Gilkerscleuch Mains Farm Cottage;
- 11 Firholme;
- 12 Crawfordjohn Mill Farm;
- 13 Crawfordjohn Mill Farm;
- 17 Crawfordjohn;
- 18 Blairhill – Dail Bhreagha / Blairhill House / Townhead Cottage;
- 21 Greenfield Farm;
- 22 Blackburn Farm;
- 23 Thirstane Cottage; and
- 24 Redshaw.

4.5.129. All of these properties would receive close views of the turbine array and are located to the south and west of the Site. Turbines would be visible above nearby ridgelines to the south of the Site and around Crawfordjohn to the west, to more open views of the entire turbine array for properties close to the B7078 road and surrounding elevated land.

4.5.130. Two properties are judged to receive a **Medium** magnitude of change on account of screening by landform as follows:

- 7 Craighead Farm; and
- 16Crossknowe Farm.

The remaining properties would receive a Low to Negligible magnitude of change due to screening by landform and woodland as follows:

- 8 Springdale House / Rigdale / Drakelaw / Gilkerscleugh / Broadwood;
- 9 Woodfield House;
- 14 Nether Balgray Farm;
- 15 Manse View Cottage / The Stables / Lindisfarne;
- 19 Burnside – Burnside Cottage / Holmview Cottage; and
- 20 Over Balgray.

4.5.131. No property was judged that the RVAA threshold would be reached due to a combination of factors including distance from the turbine array and screening from landform and woodland.

4.6 Mitigation and Residual Effects

4.6.1. As stated above, mitigation of landscape and visual effects has been undertaken through design modifications and input to the design process (as set out in Chapter 3 and the Design and Access Statement). All effects identified are therefore residual effects.

4.6.2. There are some measures that would be beneficial to the landscape character of the Site and in providing screening to the substation, BESS and solar PV array related to the Outline Biodiversity Enhancement Management Plan set out in **Technical Appendix 6.6 (EIAR Volume 4)**. However, these measures would not provide total screening of these elements of the Proposed Development.

4.7 Summary

4.7.1. Table 4.5 provides a summary of the predicted effects on landscape and visual receptors scoped into the LVIA.

Table 4. 5: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect		Mitigation	Outcome/Residual Effect
Construction / Decommissioning			
Landscape Character			
Site		Embedded in Design Construction Environment Management Plan	Significant
Operation			
Landscape Character			
LCT 201: Plateau Farmland – Glasgow & Clyde Valley		Embedded in Design	Not significant
LCT 207: Upland River Valley – Glasgow & Clyde Valley	Duneaton Water Unit		Significant
	Douglas Water Unit		Not significant
	Nethan Water Unit		Not significant
LCT 208: Broad Valley Upland			Significant
LCT 209: Upland Glen – Glasgow & Clyde Valley			Significant
LCT 213: Plateau Moorland – Glasgow & Clyde Valley			Significant
LCT 217: Southern Uplands – Glasgow & Clyde Valley			Not significant
LCT 218: Rounded Landmark Hills			Not significant
Viewpoints			
VP1: Devonburn Road	Daytime	Embedded in Design	Not significant
	Night-time		Not significant
VP2: B7078 Carlisle Road	Daytime		Not significant
	Night-time		Not significant
VP3: M74 Southbound, B7078 near Parkhead	Daytime		Significant
	Night-time		Not significant
VP4: M74 within Site	Daytime		Significant
	Night-time		Not significant
VP5: Abington Services	Daytime		Significant
	Night-time		Not significant
VP6: Castle Hill	Daytime		Significant
	Night-time		Significant
VP7: Crawfordjohn	Daytime		Significant
	Night-time		Not significant

Table 4. 5: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect		**Mitigation**	**Outcome/Residual Effect**
VP8: B740 Spango	Daytime		Not significant
	Night-time		Not significant
VP9: A702 near Hartside	Daytime		Significant
	Night-time		Not significant
VP10: B7055 Greenhill	Daytime		Not significant
	Night-time		Not significant
VP11: Tinto Hill	Daytime		Significant
	Night-time		Not significant
VP12: Cairn Table	Daytime		Not significant
	Night-time		Not significant
VP13: Lowther Hill	Daytime		Not significant
	Night-time		Not significant
VP14: Culter Fell	Daytime		Not significant
	Night-time		Not significant
VP15: B7016 east of Biggar	Daytime		Not significant
	Night-time		Not significant
Settlements			
Crawfordjohn	Embedded in Design		Significant
Roberton			Significant
Routes			
M74 motorway	Daytime	Embedded in Design	Significant
	Night-time		Not significant
A702 Road	Daytime		Significant
	Night-time		Not significant
B740 road	Daytime		Significant
	Night-time		Not significant
B7055 road	Daytime		Not significant
	Night-time		Not significant
B7078 road	Daytime		Significant
	Night-time		Not significant
West Coast Main Line	Daytime		Not significant
	Night-time		Not significant
SHT 57: Roberton to Douglas	Daytime		Significant
	Night-time		Significant
SHT 58: Douglas to Wanlockhead	Daytime		Significant
	Night-time		Significant
Cumulative Assessment			
Landscape Character			Not significant

Table 4. 5: Summary of Potential Significant Effects of the Proposed Development		
Likely Significant Effect	**Mitigation**	**Outcome/Residual Effect**
Visual Amenity		Not significant
Designated Landscapes		
Leadhills and Lowther Hills SLA	Embedded in Design	Significant
Middle Clyde Valley SLA		Not significant
Upper Clyde Valley SLA		Not significant
Douglas Water		Not significant

5 Cultural Heritage

5.1 Executive Summary

5.1.1 This chapter considers the environmental effects of the Proposed Development on cultural heritage (historic environment sites and features, archaeology and built heritage), describing the results of a desk-based assessment and field surveys undertaken by CFA Archaeology Ltd (CFA). The assessment also takes into account comments provided in EIA Scoping responses by Historic Environment Scotland (HES) and by West of Scotland Archaeology Service (WoSAS) in their capacity as archaeological advisors to South Lanarkshire Council (SLC) and in post-scoping consultation with HES.

5.1.2 The baseline assessment has established that there are five designated assets within the Site boundary. These assets have been avoided through design and there will be no direct construction impacts on these assets.

5.1.3 There are a further 42 non-designated heritage assets that lie within the Site. These assets have mostly been avoided by the design of the renewable energy park layout and, where appropriate, mitigation has been proposed that would address direct effects upon these and upon previously unrecorded cultural heritage assets. Taking account of the current land-use and historic landscape character of the Site and its surroundings, the potential for further archaeological discoveries within the Site is assessed as being moderate.

5.1.4 The assessment has considered the effect of the Proposed Development on the settings of heritage assets within the Site and in the wider landscape. Four impacts have been identified as being significant in EIA terms: effects of moderate significance on the setting of three scheduled monuments; Wildshaw Hill, cairn 500 m WSW of summit (**SM 4511**), Netherton, cairn 800 m SW of (**SM 4513**) and Thirstone, stone circle 1,300 m NNW of (**SM 5094**), assets of national importance and high sensitivity; and a possible burial cairn Knock Leaven cairn (**WoSAS 10454**) determined by WoSAS to be potentially of national importance and assessed on that basis as being of high sensitivity. While there will be an impact of moderate significance on these assets it is assessed that the understanding, appreciation and experience of the assets would be adequately retained such that the integrity of their setting would not be significantly adversely affected.

5.1.5 Four significant cumulative effects resulting from the addition of the Proposed Development to the emerging baseline of consented, and in planning applications have been identified: on Auchensaugh Hill, cairn (**SM 4324**), Wildshaw Hill, cairn 500 m WSW of summit (**SM 4511**), Netherton, cairn 800 m SW of (**SM 4513**), Thirstone, stone circle 1,300 m NNW of (**SM 5094**) and Knock Leaven Cairn (**WoSAS 10454**).

5.2 Introduction

5.2.1 This chapter considers the likely significant effects on cultural heritage (hereafter 'heritage assets') associated with the construction, operation and decommissioning of the Proposed Development. The specific objectives of the chapter are to:

- describe the cultural heritage baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment (**Technical Appendix 5.1, EIAR Volume 4**);

- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

5.2.2 The assessment has been carried out by Linn Glancy MA, MA (Hons) ACIFA of CFA Archaeology Ltd (CFA), a Registered Organisation (RO) of the Chartered Institute for Archaeologists (CIfA), based in Musselburgh, East Lothian. Linn Glancy is a Consultant with 25 years post-graduate experience as an Archaeologist, 17 years of which as a Consultant, and is an Associate of the Chartered Institute for Archaeologists (ACIfA).

5.2.3 This chapter is supported by the following figures and technical appendices:

- EIAR Volume 3a: Figures
  - Figure 5.1: Cultural Heritage: Inner Study Area
  - Figure 5.2: Cultural Heritage : Outer Study Area, Tip Height ZTV
  - Figure 5.3: Cultural Heritage; Outer Study Area, Solar Array ZTV
  - Figure 5.4: Cultural Heritage: Cumulative Developments
  - Figures 5.5 to 5.15 Cultural Heritage Visualisations (Listed in Table 5.2)
- EIAR Volume 4: Technical Appendices
  - Technical Appendix 5.1: Cultural Heritage Assessment Methodology
  - Technical Appendix 5.2: Cultural Heritage Assets In The Inner Study area
  - Technical Appendix 5.3: Cultural Heritage Assets in the Outer Study Area With Predicted Visibility of The Proposed Development; and
  - Technical Appendix 5.4: Designated Assets In The Outer Study Area With No Visibility Of The Proposed Development.

5.2.4 Figures and technical appendices are referenced in the text where relevant.

5.3 Assessment Methodology

Scope of Assessment

5.3.1 The chapter considers effects on:

- Scheduled monuments (SM) and other archaeological features;
- Listed buildings (LB) and other buildings of historic or architectural importance;
- Inventory gardens and designed landscapes (GDL); and
- Conservation areas (CA).

5.3.2 For effects scoped out see **paragraphs 5.3.6 – 5.3.9**.

5.3.3 The chapter assesses cumulative effects as arising from the addition of the Proposed Development to other cumulative developments, which are the subject of a valid planning application. Operational, under construction and consented developments are considered as part of the baseline. Developments close to the end of their operational life will be included as part of the baseline to present the 'reasonable worst case scenario'.

5.3.4 The assessment is based on the Proposed Development as described in **Chapter 2: Development Description (EIAR Volume 2**).

5.3.5 The scope of the assessment has been informed by consultation responses detailed in **Technical Appendix 1.1: Consultation Register (EIAR Volume 4)** and the following guidelines/policies:

- The Ancient Monuments and Archaeological Areas Act 1979.

- Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997
- National Planning Framework for Scotland 4 (NPF4) (2023).
- Historic Environment Policy for Scotland (HEPS) (2019).
- South Lanarkshire Local Development Plan2 (January 2021)
- Planning Advice Note 2/2011: Planning and Archaeology (PAN2/2011). Standards and guidance for Historic Environment Desk-Based Assessment (CIfA, 2014; updated 2020).
- Code of Conduct: Professional Ethics in Archaeology (CIfA, 2014; revised 2021).
- Designation Policy and Selection Guidance (Historic Environment Scotland (HES, 2020)
- Managing Change in the Historic Environment: Setting (HES, 2020)
- Environmental Impact Assessment Handbook (Scottish Natural Heritage (SNH) & HES, 2018)
- Principles of Cultural Heritage Assessment (IEMA, 2021).

Potential Effects Scoped Out

5.3.6 Assessment of the effect of the Proposed Development on the settings of World Heritage Sites, Inventory Gardens and Designed Landscapes and Inventory Historic Battlefields has been scoped out. There are no assets with these designations within 10 km of the Proposed Development and no assets with these designations beyond 10 km have been identified with the potential to be subject to adverse effects on their setting as a result of the Proposed Development.

5.3.7 Category C listed buildings are of local value (low sensitivity) and generally have localised settings. Category C listed buildings which lie outwith the blade tip height ZTV and beyond 5 km of the outermost turbines have been excluded from the assessment. No Category C listed buildings beyond 5 km have been identified with the potential to be subject to adverse effects on their setting as a result of the Proposed Development.

5.3.8 Heritage assets described in the HER as being potentially of national importance (NSR codes C and V) beyond 5 km of the outermost turbines have also been excluded from the assessment. No such assets beyond 5 km have been identified with the potential to be subject to adverse effects on their setting as a result of the Proposed Development.

5.3.9 Assessment of the settings of designated heritage assets that fall outside of the zone of theoretical visibility (ZTV) and which has no third party viewpoints where the asset would be seen in combination with the Proposed Development have been scoped out.

Method of Baseline Characterisation

Extent of the Study Area

5.3.10 Two study areas have been used for the assessment:

- The Inner Study Area: the Proposed Development site, defined by the application boundary, within which turbines, solar arrays, a BESS, a substation and associated infrastructure are proposed, forms the study area for the identification of heritage assets that could receive direct or indirect effects arising from the construction of the Proposed Development.
- The Outer Study Area: a wider study area extending 10 km around the outermost finalised proposed turbine locations (and including the Inner Study Area) was used for the identification of cultural heritage assets (including those within the Inner Study Area) whose settings may be affected by the Proposed Development (including cumulative

effects). The wider ZTV was also assessed to identify any designated assets beyond 10 km that have settings that may be especially sensitive to the Proposed Development.

Desk Study

5.3.11 A detailed desk-based assessment was conducted covering the Inner Study Area, using a range of documentary, archival, and bibliographic sources. Up-to-date information was obtained on the locations and extents of heritage assets with statutory protection and non-statutory designations within the study area. Sources consulted for the assessment include:

- South Lanarkshire Historic Environment Record (HER): a digital database extract was obtained in July 2023 for all assets within 10 km of the Proposed Development;
- The National Record of the Historic Environment (NRHE) database (Canmore) (HES, 2024a): checked for any information additional to that contained in the HER;
- Historic Environmental Scotland Spatial Data Warehouse (HES, 2024b): for up-to-date data on the locations and extents of scheduled monuments, listed buildings, conservation areas, inventory gardens and designed landscapes, and historic battlefields.
- Map Library of the National Library of Scotland: for historic Ordnance Survey maps and other historic maps;
- Aerial photography and satellite imagery (Google Earth, Bing maps, ESRI World Imagery);
- Historic Land-Use Assessment Data for Scotland (HLAMap) (HES, 2024c): for information on the historic land use character of the Inner Study Area; and,
- Scottish Remote Sensing Portal (Scottish Government, 2024): for 1 m DTM Lidar data covering the Inner Study Area.

Field Survey

5.3.12 A reconnaissance walk-over field survey was carried out of the solar area between 27 and 29 November 2023 and a targeted walkover survey was carried out of the wind farm area between 15 and 19 April 2024, with the following aims:

- to locate and record the baseline character and condition of heritage assets identified through the desk-based assessment;
- to identify any further heritage assets not revealed through the desk-based study that could be affected by the Proposed Development;
- to identify any areas of archaeological potential within the Inner Study Area; and
- to assess and record the heritage value of the heritage assets identified through the desk-based assessment and field survey.

5.3.13 The BESS and substation sit within the area of the Thirestone Quarry, as this area has been quarried it contains no potential for archaeology and therefore was not subject to field survey.

5.3.14 No intrusive archaeological interventions have been carried out as part of this assessment.

5.3.15 Both field surveys were undertaken by a team of two expirienced archaeologists who hold current CIfA membership.

5.3.16 Site visits to selected heritage assets in the Outer Study Area were undertaken on 29 April 2024 to assess the potential impact of the Proposed Development on their settings. Site visits included those assets specifically identified by consultees (HES) as requiring assessment and those identified through analysis of the blade tip height ZTV where it was considered, on the basis of professional judgement, that the impact on their settings could be significant.

Method of Assessment

5.3.17 The assessment methodology, including criteria for assessing sensitivity of receptors, magnitude of change and cumulative effects, as well as overall significance criteria, is detailed in **Technical Appendix 5.1: Cultural Heritage Assessment Methodology**.

Limitations and Assumptions

5.3.18 The desk-based assessment draws on the records in the South Lanarkshire HER, provided in a digital Geographic Information System (GIS) dataset in July 2023. It is assumed that the data provided was accurate and up to date at the time it was acquired. It is unlikely that there have been significant changes to the dataset since it was acquired, and it is assumed to be a reliable and accurate reflection of the recorded cultural heritage baseline for the purpose of this assessment.

5.3.19 Designated heritage assets within the Outer Study Area (**EIAR Volume 3a: Figure 5.2 and Figure 5.3**) have been identified from the HES database and were downloaded from the HES website in March 2024. This data is assumed to have been accurate and up to date at the time of its acquisition.

5.4 Baseline Conditions

Current Baseline

Character of the Inner Study Area

5.4.1 The Site (**Figure 5.1, EIAR Volume 3a**) is located to the north and northwest of Abington, in South Lanarkshire. The proposed turbine array, solar array and associated infrastructure are sited in areas of moorland and rough grazing, the proposed BESS and substation sit within an area which is currently an opencast quarry. The Site is bisected by the routes of the M74 and the B7078 which run parallel through the Site from east to west.

5.4.2 The HLA map[1] classifies three small areas within the Inner Study Area as Medieval/Post Medieval Settlement and Agriculture which it describes as "*The remains of settlement and field systems that pre-date the agricultural improvements of the 18th or 19th century survival in marginal areas, with ruinous buildings, small kilns, curvilinear boundaries and rig cultivation*." These areas collate with the areas of sites **38**, **41**, and **42** which are discussed below. The HLA classifies the majority of the land use within the area as Rough Grazing "*Hill ground or low-lying land that shows no evidence of recent agricultural improvements can be used for rough grazing or rough grassland*" or areas of Rectilinear Fields and Farms "*rectilinear field boundaries and associated farm steadings and other buildings are typical of agricultural improvements since the 1700s. Recent amalgamation of these fields is common*". In addition there are small areas of Unenclosed Improved Pasture, Opencast/Mining/Quarry Site and Plantation. The HLA was completed in 2015 and has not been subsequently updated. Since 2015 the southwest of the Site has been planted with plantation forestry.

Historic maps

5.4.3 Blaeu's map (1654) is the first map to show the area but the map is schematic and does not record any detail other than the routes of the rivers and the names of settlements. Nethertoun

[1] HLAmap https://map.hlamap.org.uk/ accessed May 2024

(sic) is recognisable as Netherton within the Inner Study Area and the larger settlement of Abingtoun (sic), Abbington is recorded to the south of the Site

5.4.4 Roys Military Survey (1747 – 55) shows the area in a little more detail although the majority of the Site appears to be upland moorland with the exception of the low ground near Abington (Ebbingtone [sic]) which appears to have been ploughed. Roy also records the route of the Black Burn which passes through the south of the Site.

5.4.5 Thomson (1832) shows a little more topographic detail, recording the rivers and hills within the Site of which 'Black Hill (sic)' is named within the Inner Study Area. On Thomsons map Netherton is shown as a group of five buildings 'Nethertown' (sic), the Iron Age fort, Black Hill, fort 650 m NW of Craighead (SM 2606) is recorded as 'Camp'.

5.4.6 Within the Inner Study Area, the Ordnance Survey first edition 6-inch maps (1861) depict enclosures, sheepfolds, trackways and quarry pits. At this time the Inner Study Area appears largely to have been used as rough grazing with areas of improved enclosed pasture in the west of the Inner Study Area, subsequent Ordnance Survey Maps (1897, 1910) show little change within the area. The major changes to the area come with the construction of the M74and the Abington Motorway Servicess, in the early 1990s. The remainder of the Inner Study Area has little change with the exception of the excavation of Thirstone Quarry and establishment of an area of commercial plantation woodland planted in the southwest of the Site.

Aerial Photography and Lidar Imagery

5.4.7 Modern aerial photography and satellite imagery of the Site (Bing Maps, Google Earth and ESRI World Imagery) and Lidar imagery available through the Scottish Governments lidar data sets covered the majority of the Inner Study Area. Examination of these datasets added an additional 25 heritage assets (**Technical Appendix 5.2, EIAR Volume 4**) to those previously recorded by the HER. These assets largely relate to post medieval agriculture and include sheepfolds, possible structures and farmsteads. Review of these datasets also confirmed the survival and extent of some of the heritage assets previously recorded in the HER.

Field Survey

5.4.8 The field survey carried out for the turbine area concentrated on a 100 m buffer of the turbine and turbine infrastructure layout. No new heritage assets were recorded during the course of this survey. The extent and condition of heritage assets recorded in the HER and during the baseline collection were recorded where the assets fell in or close to the 100 m buffer.

5.4.9 The field survey carried out for the solar area comprised a reconnaissance survey of the entire solar area. Additional heritage assets recorded during the course of this survey were remains of post medieval assets of low sensitivity. The extent and condition of heritage assets recorded in the HER and during the baseline collection, where the assets fell in or close to the 100 m buffer, were recorded.

Previous Investigations

5.4.10 The HER has eight records of previous archaeological work within the Inner Study Area. These include six phases of mitigation in advance of the Thirstone Quarry and its extensions (Ev 3724, Ev 4988, Ev 4989, Ev 5544, Ev 5545, Ev 5661) which recorded no archaeological features and two investigations in advance of the construction of the M74, one (Ev1086) focussed on the probable site of a cremation cemetery of which it found no substantial evidence and the second (Ev 326) recorded assets along the route of the M74.

*Heritage Assets within the Inner Study Area (**Figure 5.1; Technical Appendix 5.2**)*

DESIGNATED HERITAGE ASSETS

5.4.11 There are five scheduled monuments within the Inner Study Area:

- Black Hill, fort 650m NW of Craighead (**SM 2606**)
- Craighead, platform settlement 1200m WNW of (**SM 4485**)
- Netherton, cairn 800m SW of (**SM 4513**)
- Craighead, barrow and cairn 820m NW of (**SM 4517**)
- Thirstone, stone circle 1300m NNW of (**SM 5094**)

5.4.12 There are no listed buildings within the Inner Study Area, and no part of the Inner Study Area falls within a conservation area, inventory garden and designed landscape, or inventory historic battlefield.

NON-DESIGNATED HERITAGE ASSETS

5.4.13 Forty-two non-designated heritage assets have been identified within the Inner Study Area. Numbers in brackets and in bold in the following text refer to these heritage assets which are shown on **Figure 5.1**, and described in detail in **Technical Appendix 5.2: Heritage Assets in the Inner Study Area (EIAR Volume 4).**

Known History of the Site

PREHISTORIC PERIOD

5.4.14 The earliest evidence of human activity within the Inner Study Area dates from the Bronze Age where there is evidence of settlement, funerary and ritual activities.

5.4.15 Bronze Age funerary and ritual activities are represented by three of the scheduled monuments within the Inner Study Area, Thirstone, stone circle 1300 m NNW of (**SM 5094**); Netherton, cairn 800 m SW of (**SM 4513**); and Craighead, barrow and cairn 820 m NW of (**SM 4517**). A further two non-designated funerary monuments are located within the Inner Study Area. A probable burial cairn (**20**) located on the lower southwest slopes of Black Hill this asset is recorded by the HER as a NSR site of schedulable quality and as such is an asset of heritage value at a national level and of high sensitivity. The second non-designated asset is an enclosed cremation cemetery (**5**) which was excavated and removed during the construction of the M74, little if anything is likely to survive of this asset and as such this is an asset of at most heritage value at a local level and of low sensitivity.

5.4.16 Evidence of settlement in the Bronze Age comes from the scheduled monument Craighead, platform settlement 1200 m WNW of (**SM 4485**) a settlement of 11 platforms scooped into the south facing slopes of Black Hill, the HER extends this area to include a further 10 platforms making a settlement of 21 platforms (**23**) on these slopes. Two further possible settlement sites of Bronze Age date comprise a possible hut circle (**6**) in the moorland next to Wildshaw Burn and a platform settlement (**29**) on the lower northeast facing slopes of Black Hill. Hut circles and platform settlements are generally interpreted as being farming homesteads of late Bronze Age to Iron Age date, whether these were static homes surrounded by farmland, or represent episodic occupation, is subject to debate[2]. The area of platform settlements (**23**) including the scheduled monument (**SM 4485**) are assessed to be assets of heritage value at a national level and of high sensitivity. The hut circle (**6**) and platform

[2] SCARF https://scarf.scot/national/scarf-bronze-age-panel-report/3-lifeways-and-lifestyles/3-3-settlement-landuse-and-resources/ (Accessed May 2024)

settlement (**29**) are vestigial circular features and their exact date and function are unknown. Presuming they are prehistoric settlement sites these are assessed to be potentially of heritage value at a regional level and of medium sensitivity.

5.4.17 Three burnt mounds (**37, 38** and **39**) are located along the course of a spring burn. The burnt mounds are likely to be of Bronze Age or later date. Their exact function is poorly understood but it may be that they were part of domestic cooking practices in the Bronze Age[3]. As possible prehistoric activity sites these are assessed to be potentially of value at a regional level and of medium sensitivity.

5.4.18 Two areas of small clearance cairns (**10** and **31**) are recorded within the Inner Study Area. Field survey found eight scattered cairns at Thirstone of the 19 cairns recorded in the HER (**10**) and it was concluded that some may have been removed during the construction of the M74 and others may be hidden by peat and moss accumulation. At the Moor Plantation (**31**), field survey recorded eight clearance cairns; one more than recorded in the HER. These cairns represent the remains of a phase of land clearance and improvement and given the relatively small size of these cairns they may date from the Bronze Age. The use of clearance cairns continues throughout much of prehistory and into the post medieval period although latterly the cairns tend to be much larger than earlier clearance cairns. As the remains of possibly prehistoric land clearance these two areas of clearance cains are assessed to be of heritage value at a local level and of low sensitivity.

5.4.19 Evidence for Iron Age activity within the Inner Study Area is demonstrated by the scheduled monument, Black Hill, fort 650 m NW of Craighead (**SM 2606**), the remains of a substantial fort located on a southeast spur of Black Hill providing evidence of settlement, defence and society of this period. As a scheduled monument this is an asset of heritage value at a national level and of high sensitivity.

5.4.20 To the northwest of the scheduled monument Black Hill, fort 650m NW of Craighead (**SM 2606**), is the remains of a turf and stone field bank (**26**). Given the proximity of this bank to the fort, there is speculation in the HER that this bank is contemporary with the fort. Equally, it could instead be an example of post medieval land management. If associated with the fort this asset is likely to be of heritage value at a regional level and of medium sensitivity, if this is instead a post medieval field boundary it would be an asset of heritage value at a local level and of low sensitivity.

Medieval Period to Modern

5.4.21 There is no evidence of medieval activity recorded within the HER in the Inner Study Area. There is however evidence in the wider surrounding area including the Abington, motte & bailey 1600 m N of (**SM 2609**) which sits to the immediate east of the Inner Study Area and would have been a political and fiscal hub during the period. Given the topography and historic landuse of the Inner Study Area it is most likely that most if not all of the Inner Study Area was under agricultural use throughout the medieval period.

5.4.22 Within the Inner Study Area the majority of assets date to the post medieval to modern period and are representative of the agricultural use of the landscape, predominantly for sheep farming and also of quarrying activities throughout this period.

5.4.23 There are 14 sheepfolds and pens (**7, 8, 11 ,12, 13, 15, 16, 17, 18, 19, 21, 25, 32** and **34**); three enclosures (**2, 4, 22**); and an agricultural shed (**35**) within the Inner Study Area.

[3] SCARF https://scarf.scot/national/scarf-bronze-age-panel-report/3-lifeways-and-lifestyles/3-3-settlement-landuse-and-resources/3-3-1-burnt-mounds/ Accessed May 2024

The poorly preserved enclosures (**16** and **22**)and the modern sheep dip and pen (**34**) and agricultural shed (**35**) are assets of limited heritage value and negligible sensitivity.The remaining assets are all evidence of stock management within the Inner Study Area and, as components of the local historical landscape, they are assessed to be of heritage value at the local level and of low sensitivity.

5.4.24 Two quarry pits (**1, 27**) are recorded within the Inner Study Area by the HER and a third (**30**) was recorded from LIDAR. The desk based assessment and field survey also identified many more small quarry pits located across the Inner Study Area, mostly small borrow pits probably used for the construction of field walls or tracks. Also within the Inner Study Area is the large modern Thirstone Quarry. Thirstone Quarry and the small borrow pits have not been included individually as assets, these are of little heritage value and at most of negligible sensitvity. The three numbered quarrys (**1, 27, 30**) are examples of early small quarry pits and are assessed as being assets of heritage value at a local level and of low sensitivity.

5.4.25 The possible turf and stone footings of three small agriculture buildings (**16, 24** and **28**) are recorded within the Inner Study Area. They have some archaeological potential relating to agricultural practices and domestic life in the late 18th and 19th centuries and are components of the local historic landscape. As such, they are assessed as being of value at a local level and to be of low sensitivity.

5.4.26 A Limekiln (**3**) has partly survived the construction of the M74 which was built to its immediate north. The kiln survives as a façade and a draw arch. As a remnant of the local historical landscape, it is assessed to be of heritage value at the local level and of low sensitivity.

5.4.27 Three plantation enclosures (**14** and **33**) are recorded within the Inner Study Area. Two plantation enclosures (**14**) lie side by side and are the remnants of two circular banked features containing trees. The third (**33**) is comprised of two large concentric circular earth and stone banked enclosures, which are shown on first edition Ordnance Survey (1864) as filled with trees, although none now survive . As land management components of the local historical landscape, the plantation enclosures are assessed to be of heritage value at the local level and of low sensitivity.

5.4.28 In the east of the Inner Study Area there are three areas of post medieval rig and furrow cultivation and field banks of varying degrees of preservation on the slopes of Knock Leaven (**40**) and Black Hill (**41** and **42**). As examples of relict cultivation these form part of the local historic landscape and are assessed to be of heritage value at local level and of low sensitivity.

Archaeological Landscape

5.4.29 The landscape contains visible traces of successive phases of occupation or activity. A range of upstanding features are present which reflect changing settlement and activity patterns since the prehistoric era. The earlier features have survived due to the relatively low level of later activity within the Site, the most significant factor in their survival being the absence of intensive modern agriculture.

5.4.30 The earliest upstanding features present are the Bronze Age burial cairns and platform settlements, hut circles and burnt mounds. These are generally slight features with little presence in the wider landscape.

5.4.31 Environmental sequencing[4] from a pollen core taken in advance of the construction of the Clyde Wind Farm to the southeast of the Site enabled a reconstruction of the past environment. The interpretation of the pollen core showed that during the Late Bronze Age (the sequence did not provide information earlier than the Late Bronze Age) the landscape comprised largely open wet grassland with heath cover. Scrub woodland was present consisting mainly of birch and hazel. Given the proximity of the Clyde Wind Farm to the Site it is likely that the landscape of the Inner and Outer Study Areas would have been similar during the Late Bronze Age.

5.4.32 The Iron Age is represented in this landscape by large imposing hillforts. It is also possible that some of the platform settlements and hut circles within the Inner Study Area are also of Iron Age date.

5.4.33 Evidence for medieval to post-medieval activity is present in the form of sheepfolds stock enclosures, rig and furrow and quarry pits. The modern period has continued to see the area largely used for rough grazing. The most recent manmade elements to the landscape include the M74 motorway (which also contributes a constant traffic noise to the landscape), the B7078 road, the existing 400 kV OHL, the operational Middle Muir and Andershaw Wind Farms, the Red Moss Hotel and associated truckstop layby, Abington Service Station and areas of commercial plantation forestry.

Archaeological Potential

5.4.34 The desk-based assessment and field surveys have shown that the sites from the prehistoric period onwards are preserved within the Inner Study Area. Furthermore, the fact that Thirstone Stone circle (**SM 5094**) was only partly above ground when discovered with a number of the stones recorded from probing in the peat, indicates that there may be hitherto undiscovered archaeological remains preserved beneath the current ground surface.

5.4.35 Taking into account the current land-use and the evidence for occupation and settlement within the Inner Study Area, the archaeological potential is assessed as being of moderate potential for hitherto undiscovered archaeological remains to survive subsurface. Such assets are most likely to be of post-medieval date and associated with pastoral farming practices, but given the number of prehistoric assets in the surrounding area may also be of prehistoric date.

*Designated Heritage assets within the Outer Study Area (**Figures 5.2 and 5.3; Technical Appendices 5.3 and 5.4**)*

5.4.36 Within 10 km of the application boundary, there are 65 scheduled monuments of heritage value at national level and of high sensitivity. Thirty of these (including the five scheduled monuments in the Inner Study Area) have predicted theoretical visibility of the Proposed Development.

5.4.37 Within 10 km of the Site there are two category A listed buildings of heritage value at national level and of high sensitivity. Neither category A listed building would have predicted theoretical visibility of the Proposed Development, nor are there any views of cultural significance towards these assets which would be effected by the Proposed Development.

5.4.38 Within 10 km of the Proposed Development there are 40 category B listed buildings of heritage value at regional level and of medium sensitivity. Twenty-three have predicted theoretical visibility of the Proposed Development.

[4] Cox S, and N Marshall, 2023, View of 'Sae lofty and wide' (socantscot.org)

5.4.39 Within 10 km of the Proposed Development there are three conservation areas of heritage value at a regional level and of medium sensitivity, two of which (**Lamington CA 392** and **Leadhills CA 393**) have predicted theoretical visibility of the Proposed Development.

5.4.40 Within 5 km of the Proposed Development there are two category C listed buildings of value at a local level and of low sensitivity. Both have predicted theoretical visibility of the Proposed Development.

5.4.41 Within 5 km of the Proposed Development there are 17 NSR sites of schedulable quality of value at a national level and of high sensitivity. Nine have predicted theoretical visibility of the Proposed Development.

Future Baseline

5.4.42 If the Proposed Development was not to proceed, there would likely be no change to the baseline condition of the various heritage assets that presently exist within the Inner Study Area. Current agricultural land-use would most likely continue and there would be no change to the character of the heritage assets, other than the erosion of features through natural processes and agricultural activities. The current rough pasture and moorland land-use would also likely continue, limiting the potential for disturbance to heritage assets, and only natural decay (weathering and erosion) would affect the surviving upstanding remains.

5.4.43 Designated heritage assets in the Outer Study would be subject to normal statutory requirements and planning constraints.

Summary of Sensitive Receptors

Scoped Out Receptors

5.4.44 World Heritage Sites, Inventory Gardens and Designed Lanscapes and Inventory Battlefields have been scoped out of this assessment. There are no examples of these designations within the 10 km Outer Study Area of the Proposed Development and no examples of these designations have been identified beyond the 10 km Outer Study Area that have the potential to be subject to significant impacts on setting as a result of the Proposed Development.

Scoped In Receptors

5.4.45 A summary of the receptors identified as being sensitive to the Proposed Development and which have been 'scoped in' to the assessment is presented as **Table 5.1**, together with the justification for inclusion. Gazetteers of these assets are included in **Technical Appendices 5.2, 5.3 and 5.4**.

Table 5.1: Summary of Receptor Sensitivity

Receptor	Sensitivity	Justification
Scheduled monuments up to 10 km from the turbine and solar arrays and any scheduled monuments beyond this distance identified as being potentially sensitive to impacts from the Proposed Development. Listed in Technical Appendix 5.3: Cultural Heritage Assets in the Outer Study Area With Predicted Visibility of The	High	These are statutorily protected monuments. They are protected under the Ancient Monuments and Archaeological Areas Act 1979. The consent of Scottish Ministers is required before any works are carried out which would have the effect of demolishing, destroying, damaging, removing, repairing, altering, adding to, flooding or covering up a scheduled monument. In addition, effects of the Proposed Development works upon the setting of a scheduled monument form an important consideration in the granting or refusal of planning consent to conduct development works.

Table 5.1: Summary of Receptor Sensitivity		
Receptor	**Sensitivity**	**Justification**
Proposed Development and Technical Appendix 5.4: Designated Assets In The Outer Study Area With No Visibility Of The Proposed Development.		
Category A listed buildings up to 10 km from the turbine and solar arrays and any Category A listed buildings beyond this distance identified as being potentially sensitive to impacts from the Proposed Development. A list of these is provided in Technical Appendix 5.4: Designated Assets In The Outer Study Area With No Visibility Of The Proposed Development.	High	Buildings which are statutorily protected as buildings of special architectural or historic interest. They are protected under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (1997 Act). Planning authorities and Scottish Ministers are required to have special regard for the desirability of preserving listed buildings and their settings and any features of special architectural or historic importance they possess.
Category B listed buildings up to 10 km from the turbine and solar arrays. Listed in Technical Appendix 5.3: Cultural Heritage Assets in the Outer Study Area With Predicted Visibility of The Proposed Development and Technical Appendix 5.4: Designated Assets In The Outer Study Area With No Visibility Of The Proposed Development.	Medium	Buildings which are statutorily protected as buildings of special architectural or historic interest. They are protected under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (1997 Act). Planning authorities are required to have special regard for the desirability of preserving listed buildings and their settings and any features of special architectural or historic importance they possess.
Category C listed buildings up to 5 km from the turbine and solar arrays. A list of these is provided in Listed in Technical Appendix 5.3: Cultural Heritage Assets in the Outer Study Area With Predicted Visibility of The Proposed Development	Low	Buildings which are statutorily protected as buildings of special architectural or historic interest. They are protected under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (1997 Act). Planning authorities are required to have special regard for the desirability of preserving listed buildings and their settings and any features of special architectural or historic importance they possess.
Conservation areas up to 10 km from the Proposed Development. Listed in Technical Appendix 5.3: Cultural Heritage Assets in the Outer Study Area With Predicted Visibility of The Proposed Development and Technical Appendix 5.4: Designated Assets In The	Medium	Areas proposed by Local Development Plans as areas of special architectural or historic interest and contain key features which it is desirable to conserve, sustain and enhance. Planning authorities are required to consider planning applications affecting the appearance, character or setting of conservation areas under the Planning (Listed buildings and Conservation Areas) (Scotland) Act 1997.

Table 5.1: Summary of Receptor Sensitivity		
Receptor	**Sensitivity**	**Justification**
Outer Study Area With No Visibility Of The Proposed Development.		
NSR Sites up to 5 km from the Proposed Development. Listed in Technical Appendix 5.3: Cultural Heritage Assets in the Outer Study Area With Predicted Visibility of The Proposed Development and Technical Appendix 5.4: Designated Assets In The Outer Study Area With No Visibility Of The Proposed Development.	High	NSR Sites which are considered by the local planning authority (WoSAS) to be potentially of schedulable quality (NSR Sites Code V and C).
Other non-designated historic environment assets within the Site. A list of these is provided in Technical Appendix 5.1: Cultural Heritage Assets in the Inner Study Area	Negligible to Medium	A range of other non-designated archaeological sites, monuments and areas of historic interest which do not have statutory protection but are curated by the local planning authority.

5.5 Assessment of Likely Effects

Potential Construction Effects

5.5.1 Any ground-breaking activities associated with the construction of the Proposed Development, (such as those required for turbine bases and crane hardstandings, solar panels, battery storage, substation, access tracks, cable routes, compounds, borrow pits, etc.) have the potential to disturb or destroy features of cultural heritage interest within the Site any such impacts would be a permanent and irreversible. Other construction activities, such as vehicle movements, materials storage, soil and overburden storage and landscaping also have the potential to cause permanent and irreversible effects.

5.5.2 The Proposed Development layout has been designed to avoid impacts on heritage assets as far as possible (**Figure 5.1, EIAR Volume 3a**), but four heritage assets would be directly affected by construction works associated with the Proposed Development. These are:

- A sheep dip and enclosure (**34**) of negligible sensitivity, would be removed to be replaced by the solar array this would be a high magnitude adverse impact . The resulting effect would be of negligible significance (not significant in EIA terms). No mitigation recommended.
- An agricultural shed (**35**) of negligible sensitivity, would be removed to be replaced by the solar array this would be a high magnitude adverse impact. The resulting effect would be of negligible significance (not significant in EIA terms). No mitigation recommended.
- A historic field system (**40**) to the northeast of Knock Leaven would be impacted by the construction of turbine 16, its access track and an area of hardstanding (between

291182, 626416 and 291328, 626024) which would cross the denuded and ploughed down remains of a former field system, detected in lidar imagery but barely visible on the ground. The impact on the field system and field banks (**40**) would be of low magnitude, resulting in in an effect of minor significance (**not significant** in EIA terms) through the removal of part of this denuded field system. Proposed mitigation measures at the construction stage to offset the effect are outlined in **Section 5.6: Mitigation**.

- A historic field system (**41**) to the north of Black Hill would be impacted by the construction of a borrow pit, an access track, and turbine 22 and its area of hardstanding (between 289785, 625437 and 290444, 624892) which would cross the very denuded and ploughed down remains of a former field system, detected in lidar imagery but barely visible on the ground. The impact on the field system and field banks (**41**) would be of low magnitude, resulting in in an effect of minor significance (**not significant** in EIA terms) through the removal of part of this denuded field system. Proposed mitigation measures at the construction stage to offset the effect are outlined in **Section 5.6: Mitigation**.

5.5.3 In addition to direct construction effects identified above four assets have been identified which have the potential to be accidentally affected by the Proposed Development

- Thirstone, stone circle (**SM 5094**) is located within the turbine array area, there is therfore potential for accidental damage to the asset from construction traffic traversing the scheduled area. Without mitigation this could result in an impact of up to high magnitude on this asset of high sensitivity resulting in an effect of high significance (**significant** in EIA terms) through damage to this stone circle. Proposed mitigation measures at the construction stage to mitigate this potential effect are outlined in **Section 5.6: Mitigation**.
- A clearance heap and quarry (30) is located within the area of the solar array, there is therfore potential for accidental damage to the asset from construction traffic traversing the asset. Without mitigation this could result in an impact of up to high magnitude on this asset of low sensitivity resulting in an effect of minor significance (**not significant** in EIA terms) through damage to the asset. Proposed mitigation measures at the construction stage to mitigate the potential effect are outlined in **Section 5.6: Mitigation**.
- An area of clearance cairns (**31**) is located within the area of the solar array, there is therfore potential for accidental damage to the asset from construction traffic traversing the asset.. Without mitigation this could result in an impact of up to high magnitude on this asset of low sensitivity resulting in an effect of minor significance (**not significant** in EIA terms) through damage to the asset. Proposed mitigation measures at the construction stage to mitigate the potential effect are outlined in **Section 5.6: Mitigation**.
- A plantation enclosure (**33**) is located within the area of the solar array, there is therfore potential for accidental damage to the asset from construction traffic traversing the asset.. Without mitigation this could result in an impact of up to high magnitude on this asset of low sensitivity resulting in an effect of minor significance (**not significant** in EIA terms) through damage to the asset. Proposed mitigation measures at the construction stage to mitigate the potential effect are outlined in **Section 5.6: Mitigation**.

5.5.4 It has been assessed that there is moderate potential for hitherto undiscovered archaeological remains to be present subsurface.

5.5.5 Taking into account the assessed low sensitivity of most of the known archaeological remains in the Site and that five prehistoric scheduled monuments of high sensitivity are located within the Site and assuming potential impacts of high magnitude arising from construction works, it is assessed that, without mitigation, any adverse direct effects on buried archaeological remains could be of moderate significance (**significant** in the context of the EIA regulations). Propoposed mitigation measures at the construction stage are outlined in **Section 5.6: Mitigation**.

Potential Operational Effects

5.5.6 The Proposed Development could result in adverse effects on the settings of cultural heritage assets within the Outer Study Area (which includes the Inner Study Area), although such effects would diminish with increasing distance from the Site. At distances greater than 10 km, it is considered that, in most instances, the Proposed Development would not appreciably alter characteristics of the settings of the heritage assets that contribute to their cultural significance. Neither would it appreciably alter how a heritage asset is understood, appreciated and experienced.

5.5.7 Technical Appendix 5.3: Cultural Heritage Assets in the Outer Study Area With Predicted Visibility of The Proposed Development (EIAR Volume 4) contains tabulated assessments of the predicted effects on the settings of designated heritage assets with cogitation of the degree of predicted theoretical visibility of the Proposed Development based on analysis of blade tip height and hub height ZTVs, without screening.

5.5.8 Assets with no predicted visibility of the Proposed Development and for which no views towards or across them have been identified as being important aspects of their setting are listed in **Technical Appendix 5.4 Designated Assets In The Outer Study Area With No Visibility Of The Proposed Development (EIAR Volume 4)**.

5.5.9 There are no designated heritage assets beyond 10 km from the application boundary that have been identified, either through appraisal of the blade tip ZTV or notified through consultation with HES, that require consideration of potential impacts on their settings.

5.5.10 The assessment of operational effects on the settings of heritage assets has been carried out with reference to the layout of the Proposed Development and the locations of the cultural heritage assets shown on **Figure 5.2** and **Figure 5.3 (EIAR Volume 3a).** The criteria detailed in **Technical Appendix 5.1, Table 5.1.3, Table 5.1.4** and **Table 5.1.5** have been used to assess, in combination with professional judgement, the nature and magnitude of the effects set out in the Technical Appendices. All operational effects are presumed permenant for the operational lifetime of the Proposed Development, these effects may be reversable upon decommissioning, if the Proposed Development is removed.

5.5.11 The following discussion addresses those assets where potentially significant adverse effects have been identified through the tabulated assessment, and those assets identified by HES as requiring detailed consideration, even where the significance of the predicted effect is assessed as being not significant in EIA terms. The assessments are supported with cultural heritage visualisations (**Table 5.2, Figures 5.5 – 5.16, EIAR Volume 3b**). The visualisations are referenced in the tabulated assessment set out in **Technical Appendix 5.3**, where relevant, and are referenced where relevant in the assessment below.

5.5.12 In addition to the visualisations listed in **Table 5.2** the Landscape and Visual, visualisationFigures 4.24 a-f: Tinto Hill has been referred to where relevant toTinto Cairn, cairn on summit of Tinto Hill (**SM4660**).

5.5.13 There are twelve designated heritage assets within the Study Areas (**Table 5.2**) that HES requested be focused upon in the assessment. Each of these is discussed in detail below. The tabulated assessment in **Technical Appendix 5.3 (EIAR Volume 4)** has identified one other heritage asset a NSR site of schedulable quality Knock Leaven Cairn (**WoSAS 10454**), where a significant adverse effect is anticipated, that requires detailed discussion.

Table 5.2: Cultural Heritage Assets Given Detailed Assessment

Reference No.	Designation Title	Visualisations Figure No.
SM 5094	Thirstone, stone circle 1300m NNW of	5.5
SM 4513	Netherton, cairn 800m SW of	5.6
SM 2606	Black Hill, fort 650m NW of Craighead	5.7
SM 4485	Craighead, platform settlement 1200m WNW of	5.8
SM 4517	Craighead, barrow and cairn 820m NW of	5.9
SM 2609	Abington, motte and bailey 1600m N of	5.10
SM 4234	Auchensaugh Hill, cairn	5.11
SM 4511	Wildshaw Hill, cairn 500m WSW of summit	5.12
SM 4254	Fagyad Hill, cairn	5.13
SM 264	Arbory Hill, fort	5.14
SM 4261	Dungavel Hill, cairn	5.15
SM 2835	Wandel, Roman fortlet and camp 460m SW of	5.16
WoSAS 10454	Knock Leaven cairn	N/A

Inner Study Area

THIRSTONE, STONE CIRCLE (SM 5094, FIGURE 5.5)

5.5.14 The monument comprises the remains of a stone circle, a prehistoric ritual monument, situated on a low-lying terrace in an area of moorland to the east of the Wildshaw Burn. It is oval in shape, measuring approximately 52 m by 42 m and is comprised of 23 stones, none of which are upstanding but rather lie prone on the ground (ten of the stones lie beneath the ground surface).

5.5.15 As a scheduled monument, the stone circle is of heritage value at national level and is an asset of high sensitivity.

5.5.16 The stone circle is located on a gentle southwest facing slope. Views from the stone circle are far-reaching views extending across the lower ground of Red Moss and the valley of Black Burn to the surrounding hills in an arc from southeast, through south to west. The existing 400 kV OHL lies in the foreground of these views, passing 300 m to the southwest of the stone circle on a northwest to southeast alignment. Beyond the overhead line, following a similar alignment, lies the route of the B7078 and the dilapidated remains of the Red Moss Hotel and associated truckstop layby. Further to the southwest approximately 2 km from the stone circle lie the operational Middle Muir and Andershaw wind farms. There are shelter belts of coniferous trees scattered across the landscape.

5.5.17 To the north and northeast the ground rises immediately from the stone circle restricting visibility in this arc, with the summit of the small hill of Outer Law marking the furthest extent of visibility in this arc. To the northwest through north to northeast runs the route of the M74, which is largely hidden from view from the stone circle by the local topography, although the vehicles on the motorway are readily visible from the asset and the sound of these vehicles is omnipresent.

5.5.18 The view to the east is along the moorland at a similar elevation as the stone circle. Within the moorland a drystone circular sheepfold (**8**) is visible 200 m to the east. Immediately to the west of the stone circle, Wildshaw Burn runs north to south. Following the same course as the burn is a wooden utility power line.

5.5.19 As the stones are all prone, the monument is not visible from any distance. Indeed it is only distinguishable from the surrounding landscape when within its immediate vicinity. Views into the monument, therefore, add little to the understanding, appreciation and experience of this monument. As it is unclear that the stones were ever upstanding, it may be that it was never intended to have been visible from the wider landscape and that views towards the asset have at no time been of importance to its setting. Ward, who first recorded the stone circle and did the initial exploratory work on the site, concluded that the stone circle was "never actually built, but rather was laid out fairly accurately in preparation of final construction"[5]. However, Ward acknowledged that only further intrusive archaeological investigation, could prove whether stone holes exist and therefore if the stones had ever been erected.

5.5.20 It is possible that this stone circle was sited to afford it visibility of the wider landscape and possibly contemporary monuments within the landscape.

5.5.21 There are four cairns in the landscape surrounding the stone circle: three scheduled monuments, Auchensaugh Hill, cairn (**SM 4324**) 2.8 km to the west; Netherton, cairn 800m SW of (**SM 4513**) 3.1 km to the south-east; Wildshaw Hill cairn (**SM 4511**) 1.8 km to the northeast and the NSR site of schedulable quality Knock Leaven cairn (**HER 10454**) 2.7 km to the southeast. Rising topography precludes intervisibility with Wildshaw Hill cairn (**SM 4511**) and Knock Leaven cairn (**HER 10454**). The locations of Auchensaugh Hill, cairn (**SM 4324**) and Netherton, cairn 800 m SW of (**SM 4513**) are visible from the stone circle, although the cairns themselves are not visible from the stone circle. It may be that these cairns were previously visible from the stone circle but no longer are due to their diminishment through time and stone robbing, and the distance. Auchensaugh Hill cairn sitting on the skyline on the hill summit is likely to have been visible in prehistory; however Netherton cairn, sitting on the shoulder of Black Hill and backdropped by the summit, is less likely to have been visible from the stone circle.

5.5.22 Unlike many contemporary assets in the surrounding area there is no visibility of Tinto Hill Cairn (**SM 4660**) from this stone circle.

5.5.23 A further key aspect of the setting of the stone circle is its proximity to Wildshaw Burn, the location of prehistoric ritual monuments close to a water source being a relatively common trait.

5.5.24 The siting of the stone circle has been given significant consideration by the Biggar Archaeological Trust, who observed the rising and setting sun from the site over a 22 year period. In this time they concluded that at least one function of the circle was for witnessing such events and that a "major reason for the circle was calendrical prediction"[6], aligning astronomical events with pairs of stones across the circle. Ward's work largely concentrated on solar alignments when looking across the stone circle, aligning solar events using pairs of

[5] Ward, T (2014) Wildshaw burn Stone Circle and Black Mount Hill alignments to midwinter and midsummer Solstices, unpublished grey literature report, Biggar Archaeology Group, p7

[6] Ward, T (2012) The Wildshaw Burn Stone Circle, unpublished grey literature report, Biggar Archaeology Group, p7

stones across the circle as fore and back sights[7], although he adds some discussion of an alignment with the stones of the circle and the setting sun slightly to the east of the summit of Auchensaugh Hill on the vernal equinox[8].

5.5.25 Other than Biggar Archaeological Trust's work on the stone circle there is no evidence to suggest that this asset is regularly visited today.

5.5.26 From the analysis, it appears that those aspects of the setting that contribute most to the stone circle's cultural significance can be summarised as its moorland setting, the recognition of possible previous visibility of potentially contemporary assets in the wider landscape, possible solar alignments across the stone circle, and the proximity to Wildshaw Burn.

5.5.27 The introduction of the Proposed Development would result in the stone circle sitting within the area of the proposed turbines (**Figure 5.5**). Turbine T10 would be the closest of the turbines 224 m to the northwest of the scheduled area, while turbine 11 would sit 558 m to the southeast. The remaining turbines of the Proposed Development would be visible in views to the south, north and east from the stone circle. The proposed BESS and substation (**Figure 5.5I**) would be partly visible beyond the slope of the hillside 1.2 km to the southwest. The solar ZTV (**Figure 5.3**) shows that the solar arrays would not be visible from the stone circle.

5.5.28 While the setting of the stone circle would be changed by the Proposed Development it would remain possible to understand, appreciate and experience the monument's association with the locations of the possibly contemporary cairns of Auchensaugh Hill, cairn (**SM 4324**) 2.8 km to the west, and Netherton, cairn 800m SW of (**SM 4513**) with the hills on which these assets stand remaining clearly visible, although the cairns themselves would remain not visible. Additionally the potential solar alignments across the stones would remain possible to witness with sufficient separation between the stone circle and the proposed turbines. The landscape immediately surrounding the stone circle would remain managed moorland and continue in use for grazing, it would therefore remain sited in a moorland setting albeit one that also included a wind farm. Furthermore the relationship between the monument and Wildshaw Burn would survive unchanged. The turbines would introduce further modern structures into the surroundings of this asset which would be prominent features in views into this landscape. However, as a stone circle which appears never to have been upstanding, this has never been a prominent monument and it seems likely that views into it were never of importance.

5.5.29 Overall, as a result of the change to the wider surroundings, the Proposed Development would have an impact of medium magnitude on the setting of the Thirstone stone circle, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the stone circle would be adequately retained such that the integrity of its setting would not be significantly adversely affected. Overall it is assessed that this would result in an effect that is of moderate adverse significance and **significant** in EIA terms.

NETHERTON, CAIRN (SM 4513, FIGURE 5.6)

5.5.30 The monument comprises the remains of a cairn, a prehistoric burial monument, which lies in an area of rough pasture on the northwest shoulder of Black Hill. The grass covered cairn has been subject to extensive stone robbing and is now annular in shape measuring approximately

[7] Ibid, p4

[8] Ibid, p8

7 m in diameter and 0.5 m in height. As a scheduled monument, the cairn is of heritage value at national level and of high sensitivity.

5.5.31 The cairn is located on the northwest shoulder of Black Hill. There are distant views to the north, west and southwest from the cairn. To the north are the improved pasture fields and farm buildings of Netherton Hill. To the northwest, west and southwest the views are over the lower ground of Red Moss and the valley of Black Burn to the surrounding hills. The operational Middle Muir and Andershaw Wind Farms lie at the western edge of Red Moss in this view to the west and northwest. Running through the lower ground from east to west is the route of B7078 and the existing 400 kV OHL and parallel to these across the moorland is the route of the M74 motorway. Further notable features in the landscape in that they differ from moorland and native deciduous trees are shelter belts of coniferous trees along the route of the B7078 to the southeast and the areas of plantation forestry to the southwest.

5.5.32 As this cairn is now heavily denuded by stone robbing, there is limited visibility of the cairn until in its immediate vicinity. Sited on the shoulder of Black Hill, this is not a hill top cairn and may have been sited more intentionally to have overlooked the everyday activities of the people who built it rather than to have been a prominent skylined feature. A key view for this asset is therefore that between it and the lower land to the north and west.

5.5.33 In views towards the cairn from the possibly contemporary assets of Thirstone Stone Circle (**SM 5094, Figure 5.5, EIAR Volume 3b**) 3.1 km to the northwest, Wildshaw Hill cairn (**SM 4511, Figure 5.11, EIAR Volume 3b**) 3.8 km to the northwest and Auchensaugh Hill, cairn (**SM 4234, Figure 5.10, EIAR Volume 3b**) 5.6 km to the west, Netherton cairn would not have been skylined but would rather be backdropped by the rising ground of Black Hill and the higher hills beyond (Craighead Hill 429 m, Fygad Hill 418 m, Drake Law 484 m and Braid Hill 449 m); the visibility of Netherton Cairn even in prehistory when viewed from the assets at Thirstone, Wildshaw and Auchensaugh in most weather conditions is therefore likely to have been limited. Similarly when looking from Netherton Cairn it is probable that, of these assets, only Auchensaugh Hill Cairn (**SM 4234**) may have been visible due to its hill top position; however, Auchensaugh Hill Cairn is not visible today due to its denuded state.

5.5.34 Looking from Netherton Cairn one of the most prominent hills in the surrounding landscape is Tinto Hill, to the north, on the summit of which is the possibly contemporary Tinto Cairn (**SM 4660**). While there is 10.9 km between these cairns, given the visibility of Tinto Cairn today it is clear that there would have been visibility of this cairn from Netherton Cairn. However, given the location of Netherton Cairn on the shoulder of Black hill it is highly unlikely it would have been visible from Tinto Cairn (**Figures 4.24 a-f: Tinto Hill**), amongst the numerous similar hills at this distance.

5.5.35 From the analysis, it appears that those aspects of the setting that contribute most to the cairn's cultural significance can be summarised as its far reaching views over the lower moorland to the west and views to the locations of Auchensaugh Cairn and Tinto Hill cairn.

5.5.36 The cairn lies 0.47 km to the southeast of the nearest proposed turbine (T22). The visualisations (**Figure 5.6 A-J, EIAR Volume 3b**) shows that, from the cairns, 22 turbines would be visible at hub height. The BESS and substation will be visible (**Figure 5.6 F, EIAR Volume 3b**) siting in the low ground to the 1.7 km to the northwest of the cairn. The photomontage (**Figure 5.6 J, EIAR Volume 3a**) shows that there would be visibility of the solar arrays.

5.5.37 The introduction of the Proposed Development would result in the proposed turbines, the BESS and the substation being visible within the moorland to the north and northwest of the monument. However, the key views from the cairn would remain. The prominence of Tinto Cairn in views to the north would remain readily understandable albeit it through the Proposed Development. The view over the Red Moss towards the location of Auchensaugh Hill Cairn would remain. The proposed turbines would sit to the north of this view alignment and would not affect this key view. The closest turbine (T22) would be in close proximity to Netherton Cairn.

5.5.38 Overall, as a result of the change to its wider surroundings, the Proposed Development would have an impact of medium magnitude on the setting of the Netherton cairn, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the cairn would be adequately retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of moderate adverse significance and **significant** in EIA terms.

BLACK HILL, FORT 650M NW OF CRAIGHEAD (SM2606, FIGURE 5.7)

5.5.39 The remains of this Iron Age fort survive as well preserved turf-covered banks on the summit of a spur that projects southeast from Black Hill. As a scheduled monument, Black Hill Fort is of heritage value at national level and is an asset of high sensitivity.

5.5.40 The fort has been sited overlooking the bend of Duneaton Water above Craighead. To the northwest the ground rises to the summit of Black Hill which restricts views in this direction. In all other directions there are long steep slopes making the site naturally defensive. The fort appears to have been located for the extensive views along and over the valleys of Duneaton Water and the Black Burn in particular those to the west. The siting of the fort above this bend in Duneaton Water suggest it was positioned to control movement along these natural communication routes.

5.5.41 While the fort may originally have been prominent within its topographic setting, it is now a series of large earthwork banks, which are not readily distinguishable from a distance. However, as a site likely to have been intended to be prominent and visible in the landscape, views towards the fort from its surroundings are important in the appreciation of its cultural significance.

5.5.42 The aspects of the setting that contribute most to the fort's cultural significance are its naturally defensive position, views over and along the valleys of Duneaton Water and the Black Burn, and views towards the fort from the surrounding landscape.

5.5.43 Black Hill Fort lies 1.4 km to the south of the nearest proposed turbine (T22),0.36 km from the solar array area and 2.6 km from the BESS and Substation. The visualisations (**Figure 5.7, EIAR Volume 3b**) show that, from the fort, 13 turbines would be visible at hub height and a further one visible at tip height. The BESS and substation will not be visible from the fort. The photomontage (**Figure 5.7 E, EIAR Volume 3a**) shows that there would be limited visibility of the solar arrays.

5.5.44 The introduction of the Proposed Development would result in the proposed turbines being visible in the view to the north from the monument (**Figure 5.7, EIAR Volume 3b**) and the solar array would be visible in views to the northeast. However, the key views from over and along the valleys of Duneaton Water and the Black Burn would remain unchanged. The view from the fort to the north would include the turbines and to the northeast the solar array; however, they would be sufficiently distant and in a separate landscape area not to compete with the fort for prominence.

5.5.45 Overall, as a result of the change to its wider surroundings, the Proposed Development would have an impact of low magnitude on the setting of the Black Hill Fort, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the fort would be retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of minor adverse significance and **not significant** in EIA terms.

CRAIGHEAD, PLATFORM SETTLEMENT 1200M WNW OF (SM4485, FIGURE5.8)

5.5.46 The monument comprises the remains of a prehistoric settlement consisting of 11 platforms, scooped into the hillside, on which would have stood round houses, on the southern slopes of Black Hill. As a scheduled monument, the platform settlement is of heritage value at national level and is an asset of high sensitivity.

5.5.47 This asset would have been the settlement of a probably pastoral community. The proximity of the site to good agricultural land, the water source of Duneaton Water and the relatively sheltered location of the settlement in the valley of Duneaton Water are of key importance to the siting of this asset. Views from the asset are restricted to the valley of Duneaton Water.

5.5.48 The aspects of the setting that contribute most to the platform settlements cultural significance can be summarised as its proximity to good agricultural land and the Duneaton Water and also to potentially contemporary assets on Black Hill.

5.5.49 Craighead, platform settlement 1200m WNW of (**SM 4485**) lies 0.87 km to the south of the nearest proposed turbine (T22), 0.75 km from the area of the solar array and 2.1 km from the BESS and Substation. The wireline (**Figure 5.8**) shows that, from the settlement, four turbines would be visible at hub height and a further four visible at tip height, the BESS and the substation would not be visible. The solar ZTV (**Figure 5.3, EIAR Volume 3a**) shows that the solar arrays would not be visible.

5.5.50 The introduction of the Proposed Development would result in the proposed turbines being visible in the view to the north from the monument (**Figure 5.8, EIAR Volume 3b**). However, the key views over the surrounding agricultural land, the Duneaton Water and its relationship with contemporary assets on Black Hill, would not have elements of the Proposed Development visible.

5.5.51 Overall, as a result of the change to its wider surroundings, the Proposed Development would have an impact of negligible magnitude on the setting of Craighead, platform settlement, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the platform settlement would be retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect of negligible adverse significance and **not significant** in EIA terms.

CRAIGHEAD, BARROW AND CAIRN 820M NW OF (SM 4517, FIGURE 5.9)

5.5.52 The remains of a barrow and cairn (two prehistoric burial monuments) lie in an area of rough pasture on Black Hill. The assets survive as a grass covered cairn round in shape measuring approximately 5.8 m in diameter and 0.8 m in height and a barrow 6.4 m by 5 m and 0.2 m in height. As a scheduled monument, the cairn and barrow are of heritage value at national level and an asset of high sensitivity.

5.5.53 The burial monuments are located on a saddle on Black hill between the summit of the hill and the spur on which the Iron Age Black Hill fort (**SM 2606**) sits. The rising ground of Black Hill blocks views from the assets to the west. The location affords the site views to the north over the improved pasture and farm buildings of Netherton Farm beyond which are the rising hills including Tinto Hill on which a potentially contemporary summit cairn, Tinto cairn (SM 4660) is visible. To the south, the view is over the valley of Duneaton Water to the rising hills and, to the east, the view is over the slopes of Black Hill also to Duneaton Water and the hills of Craighead and Fagyad on which stands Fagyad Cairn (**SM 4254**). The proximity of the monuments to the other potentially contemporary assets on Black Hill including Craighead, platform settlement 1200m WNW of (**SM 4485**) and Netherton Cairn (**SM 4513**) may also be of importance to this sitting.

5.5.54 Those aspects of the setting that contribute most to the cairn and barrow's cultural significance can be summarised as the views over the agricultural land to the north and south, the view to Tinto Cairn and the proximity to other possibly contemporary assets on Black Hill.

5.5.55 Craighead, barrow and cairn 820m NW of (**SM 4517**) lies 1.1 km to the south of the nearest proposed turbine (T9), 0.42 km from the area of the solar array and 2.4 km from the BESS and Substation. The wireline (**Figure 5.9**) shows that, from the fort, seven turbines would be visible at hub height and a further three visible at tip height, the BESS and the substation would not be visible. The solar ZTV (**Figure 5.3**) shows that the solar arrays would be visible.

5.5.56 The introduction of the Proposed Development would result in the proposed turbines being visible in the view to the north from the monument (**Figure 5.9**). However, the key views, the relationship with contemporary assets on Black Hill, the view to Tinto Hill cairn and the view over the lower surrounding ground would remain.

5.5.57 Overall, as a result of the change to their wider surroundings, the Proposed Development would have an impact of negligible magnitude on the setting of Craighead, barrow and cairn, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understanding, appreciation and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the barrow and cairn would be retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of negligible adverse significance and **not significant** in EIA terms.

Assets in the Outer Study Area

ABINGTON, MOTTE AND BAILEY 1600M N OF (SM2609, FIGURE 5.10)

5.5.58 The remains of this medieval motte and bailey survive as well preserved earthworks surmounted by a large early 20th century memorial stone (to the Abington Postmaster) on the west bank of the River Clyde. As a scheduled monument, Abington, motte and bailey is of heritage value at national level and is an asset of high sensitivity.

5.5.59 Abington, motte and bailey is located low in the Clyde Valley on the west bank of the River Clyde. It has been sited to make use of the natural defences of its location. On the south-east there is a steep drop of some 10 m down to the River Clyde and a lesser stream protecting the south-west flank. The motte is tucked into the angle between the two watercourses. The motte would likely have controlled movement along the strategic north to south communication route of the Clyde Valley.

5.5.60 The asset is now sited in a narrow strip of land between the River Clyde and the A702 road, where it widens to a dual carriageway, as it meets the Abington Services roundabout. Beyond the A702 to the west are the buildings of the Abbington Services.

5.5.61 While the motte and bailey may originally have been prominent within its topographic setting it is now little more than earthwork and it is not readily distinguishable from any distance from the surrounding arable land on which it stands. However, as a site likely to have been intended to be prominent and visible in the landscape, views towards the motte and bailey from its surroundings are important to appreciation of its cultural significance.

5.5.62 Those aspects of the setting that contribute most to the motte and bailey's cultural significance can be summarised as its naturally defensive position, the views over and along the Clyde Valley, and the views towards this motte and bailey from the surrounding landscape.

5.5.63 Abington, motte and bailey lies 2.2 km to the south of the nearest proposed turbine (T22), 0.17 km from the area of the solar array and 4.0 km from the BESS and Substation. The wireline (**Figure 5.10**) shows that, from the motte, seven turbines would be visible at hub height with a further 11 visible to tip height, the BESS and the substation would not be visible. The solar ZTV (**Figure 5.3**) shows that the solar array would be visible.

5.5.64 The introduction of the Proposed Development would result in the proposed turbines and the solar array being visible in the view to the west from the monument (**Figure 5.10**). However they would be viewed across the A702 and through the buildings of the Abington Service Station. The key views from and to Abington, motte and bailey, along the Clyde Valley would remain unchanged.

5.5.65 Overall, as a result of the change to its wider surroundings, the Proposed Development would have an impact of negligible magnitude on the setting of Abington, motte and bailey, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the motte and bailey would be retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of negligible adverse significance and **not significant** in EIA terms.

AUCHENSAUGH HILL, CAIRN (SM 4324) (FIGURE 5.11)

5.5.66 The monument comprises the remains of a cairn, a prehistoric burial monument, situated on the summit of Auchensaugh Hill. The cairn is round in shape measuring c.15 m in diameter, the cairn has been subject to stone robbing and now stands at c.0.9 m in height. A modern marker cairn (partially built from robbed stone) lies on its northeast side. As a scheduled monument, the cairn is of heritage value at national level and is an asset of high sensitivity.

5.5.67 The cairn is located on the summit of a small yet prominent hill. There are distant panoramic views in all directions from the cairn. To the east, southeast and south the views are over the lower ground of Red Moss and the valley of Black Burn to the surrounding hills. The operational Middle Muir and Andershaw Wind Farms lie in the foreground of this view to the south from the cairn, the closest turbine of which sits approximately 940 m to the south of the cairn. Close to this turbine an electric substation is also visible. Running through the lower ground from the east through to the north of the cairn is the route of the B7078 and a 400 kV OHL. Further notable features in the landscape in that they differ from moorland and native deciduous trees are shelter belts of coniferous pine trees along the route of the B7078 to the southeast and areas of plantation forestry to the southwest.

5.5.68 The prominent location on the summit of a hill was probably chosen in order that the cairn might overlook the everyday activities of the people who built it. A key view for this asset would therefore be that between it and the lower land of the nearby valleys. As the cairn is now heavily denuded by stone robbing there is limited visibility of the cairn from any distance; however, given its summit position, it may be that before its diminishment that this would have been a prominent and recognisable feature in the wider surroundings, in particular in views from the east and southeast over the low ground of Red Moss. There is no evidence to suggest that the cairn is regularly visited today.

5.5.69 There are a number of possibly contemporary assets in the surrounding landscape with which reciprocal views may have been of importance.

5.5.70 Looking from Auchensaugh Cairn one of the most prominent hills in the surrounding landscape is Tinto Hill, to the northeast, on the summit of which is the possibly contemporary Tinto Cairn, cairn on summit of Tinto Hill (**SM 4660**). While there is 12 km between these cairns given the visibility of Tinto Cairn today it is clear that there would have been visibility of this cairn from Auchensaugh in prehistory. However it is less likely that the cairn on Auchensaugh hill would have been visible from Tinto amongst the numerous similar hills at this distance (**Figure 4.24**).

5.5.71 Southeast of Auchensaugh Cairn at a distance of 5.6 km is Netherton, cairn (**SM 4513**) which is located on the shoulder of Black Hill. This cairn is heavily denuded and is not visible until in close proximity and as such is not currently visible from Auchensaugh Cairn. In prehistory, in views towards Netherton Cairn from Auchensaugh, Netherton would not have been skylined but would rather be backdropped by the rising ground of Black Hill and the higher ground of Craighead Hill beyond. The visibility of Netherton Cairn, even in prehistory when viewed from Auchensaugh in most weather conditions, is likely to have been very limited. While Auchensaugh Cairn is no longer visible from Netherton Cairn, given its prominent hilltop position, it is likely that is would have been visible in views from Netherton Cairn in prehistory.

5.5.72 Wildshaw Hill, cairn 500m WSW of summit (**SM 4511**) is located approximately 4.5 km to the northeast of Auchensaugh Cairn on the shoulder of Wildshaw hill at 342 m AOD. The intervening hills, in particular the summit of Outer Law at 362 m AOD, block intervisibility between these two cairns, this absence of visibility has been checked on viewshed analysis (Google Earth) and is evident on the visualisations (**Figures 5.11 and 5.12, EIAR Volume 3b**)

5.5.73 Those aspects of the setting that contribute most to the cairn's cultural significance are its prominent topographical location which provides it far reaching views in all directions and, in particular, the views towards this cairn from potentially contemporary monuments in the surrounding landscape and views from this cairn to Tinto Hill Cairn.

5.5.74 Auchensaugh Cairn lies 2.3 km to the northwest of the nearest proposed turbine (T17), 6.2 km from the solar array and 4.0 km from the BESS and Substation. The visualisations (**Figure 5.11 A-F**) show that, from the cairn, 22 turbines would be visible at hub height. The BESS and Substation would be visible on the low ground to the southeast. The photomontage (**Figure 5.11 F**) shows that there would be limited visibility of the solar arrays from the cairn.

5.5.75 The introduction of the Proposed Development would result in the proposed turbines, the BESS and the substation being visible within the moorland to the southeast of the monument. However, the key views from the Auchensaugh cairn would remain. The prominence of Tinto Hill Cairn in views to the northeast would remain unchanged. The reciprocal view over the Red Moss between Auchensaugh Hill and Black Hill would remain, though as today the cairns would remain no longer visible. The proposed turbines would sit to the north of this view alignment and would not affect this key view. Views towards Auchensaugh cairn from the low ground to the southeast would remain unaffected by the Proposed Development and the turbines would be sufficiently distant not to compete for prominence with Auchensaugh Hill.

5.5.76 Overall, as a result of the change to its wider surroundings, the Proposed Development would have an impact of low magnitude on the setting of Auchensaugh Hill cairn, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the cairn would be retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of minor adverse significance and **not significant** in EIA terms.

Wildshaw Hill, cairn 500m WSW of summit (SM4511, Figure 5.12)

5.5.77 The monument comprises the remains of a cairn, a prehistoric burial monument, situated in an area of open moorland to the southwest of the summit of Wildshaw Hill. The grass covered cairn is round in shape measuring approximately 10.7 m in diameter and 1 m high and has been subject to stone robbing with a central depression where the stones have been removed. As a scheduled monument, the chambered cairn is of heritage value at national level and is an asset of high sensitivity.

5.5.78 The cairn is located on a low shoulder to the southwest of the summit of Wildshaw Hill at 342 m AOD. Located in the valley of Mill Burn views to the west and southwest are restricted by the higher hills of Outer Law 362 m AOD, Wedder Law 361 m AOD and Jack's Law 351 m AOD. Views to the north and northeast are restricted by the rising ground of Wildshaw Hill 375 m AOD and to the east by Backstane Hill 359 m AOD. Long views from this cairn are restricted to those to the northwest over the upland moorland towards Bodinglee Law and to the south and southeast over the low moorland of the Red Moss Valley which includes the M74 motorway, beyond which is the B7078, to the rising ground of Black Hill and commercial plantation forestry covered hills beyond.

5.5.79 Given the location of this cairn and, as it is a grass covered cairn denuded by stone robbing, there is limited visibility of the cairn until in its immediate vicinity. Sited on a low shoulder of Wildshaw Hill, this is not a hill top cairn, its position suggests that it may have been sited more intentionally for its proximity to the source of the Mill Burn and to overlook the everyday activities of the people who built it in. A key view for this asset would therefore be over the moorland to the southeast and northwest along the burn.

5.5.80 There are also a number of possibly contemporary assets in the surrounding landscape with which reciprocal views may have been of importance.

5.5.81 Netherton cairn (**SM 4513**) 3.8 km to the southeast is located on a lower shoulder of Black Hill, a highly denuded cairn views into this asset are no longer possible. Neither Netherton cairn or Wildshaw cairn are skylined and as both are backdropped by ground it is unlikely that either was highly prominent in reciprocal views even in prehistory.

5.5.82 Thirstone, stone circle (**SM 5094**) is located 1.8 km and Auchensaugh Hill, cairn (**SM 4324**) is located 4.5 km to the southwest of Wildshaw Hill cairn. The intervening hills, in particular the summit of Outer Law at 362 m AOD, block intervisibility between these assets and Wildshaw Burn (**Figure 5.5, 5.11 and 5.12, EIAR Volume 3b**).

5.5.83 Unlike many contemporary assets in the surrounding area there is no visibility of Tinto Hill Cairn (**SM 4660**) from this cairn.

5.5.84 Those aspects of the setting that contribute most to the cairn's cultural significance are as its position relatively low by the source of Mill Burn and the views over the moorland along the course of the burn.

5.5.85 The cairn lies 0.45 km to the northeast of the nearest proposed turbine (T1), 3.6 km from the solar array and 2.3 km from the BESS and Substation. The visualisations (**Figure 5.12 A-H, EIAR Volume 3b**) shows that, from the cairns, 22 turbines would be visible at hub height. The visualisations (**Figures 5.12 E- F, EIAR Volume 3a**) show little to no visibility of the BESS and Substation from the cairn. The photomonatage (**Figure 5.12F, EIAR Volume 3a**) shows that there would be some visibility of the solar array.

5.5.86 The introduction of the Proposed Development would result in the proposed turbines being visible within the moorland to the south and southeast of the monument. However it would remain possible to understand, appreciate and experience the setting of this cairn located in a relatively hidden low position near the Mill Burn, with key views out of the cairn along the burn to the moorland.

5.5.87 Overall, as a result of the change to its wider surroundings, the Proposed Development would have an impact of medium magnitude on the setting of Wildshaw Hill, cairn, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the cairn would be adequately retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of moderate adverse significance and **significant** in EIA terms.

Fagyad Hill, cairn (SM 4254, Figure 5.13)

5.5.88 The monument comprises the remains of a cairn, a prehistoric burial monument, which lies in an area of rough pasture near the summit of Fagyad Hill. The cairn survives as a grass covered stoney round approximately 5.5 m in diameter and 0.4 m high. As a scheduled monument, the cairn is of heritage value at national level and is an asset of high sensitivity.

5.5.89 The cairn is located on a long plateau to the west northwest of the summit of Fagyad Hill, the plateau slightly slopes to the west. This location blocks views to the east by the rising ground of the summit. This location however affords the cairn extensive views to the west over and along the valleys of Duneaton Water and the Black Burn to the west and across to Black Hill and the moorland beyond.

5.5.90 Located to the northwest of the summit of the hill, this cairn appears to have been intentionally built not to take the more prominent position on the hillock's summit, and would not have been skylined in views towards the Hill. This location however affords the cairn views across to Black Hill on which sit the possibly contemporary sites Craighead, platform settlement 1200m WNW of (**SM 4485**) and Craighead, barrow and cairn 820m NW of (**SM 4517**). Looking along the summit of Faygad Hill and Craighead Hill, Tinto Hill and its summit cairn Tinto Hill Cairn (**SM 4660**). The wireline (**Figure 5.13, EIAR Volume 3b**) suggests that this cairn may also have had views to Auchensaugh Cairn (**SM 4234**), Wildshaw Cairn (**SM 4511**) and Knock Leaven Cairn but not with either Netherton Hill Cairn (**SM 4513**) or Thirestone Stone Circle (**SM 5094**).

5.5.91 Those aspects of the setting that contribute most to the cairn's cultural significance are the views to and from the valleys of Duneaton Water and Black Burn and the reciprocal views from the potentially contemporary assets on Black Hill.

5.5.92 Fagyad Hill Cairn lies 2.9 km to the southeast of the nearest proposed turbine (T2),1.2 km from the area of the solar array and 4.1 km from the BESS and the substation. The wireline (**Figure 5.13**) shows that, from the fort, 13 turbines would be visible at hub height and a further one visible at tip height, the BESS and substation would not be visible. The solar ZTV (**Figure 5.3, EIAR Volume 3a**) shows that the solar arrays would be visible.

5.5.93 The introduction of the Proposed Development would result in the proposed turbines and solar array being visible in the view to the northwest from the monument (**Figure 5.13, EIAR Volume 3b**). However, the key views to the west over and along the valley of Duneaton Water and Black Burn would remains as would the views to the contemporary assets on Black Hill and to the north and Tinto Hill Cairn.

5.5.94 Overall, as a result of the change to its wider surroundings, the Proposed Development would have an impact of low magnitude on the setting of Fagyad Hill cairn, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the cairn would be retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of minor adverse significance and **not significant** in EIA terms.

Arbory Hill, fort (SM264, Figure 5.14)

5.5.95 The remains of this Iron Age fort survive as well preserved turf-covered banks on the summit of Arbory Hill. As a scheduled monument, Arbory Fort is of heritage value at national level and is an asset of high sensitivity.

5.5.96 As a summit fort, located at a height of 429 m AOD the prominent views from Arbory Hill are to the north through west to south over and along the Clyde Valley to the lower hills beyond. Views to the east are restricted to the immediate higher hills. It is the view over the communication route of the Clyde Valley which is presumed to have been of most importance to this fort as it gives the location both strategic and defensive value

5.5.97 While the fort may originally have been prominent within its topographic setting it is now little more than a low earthwork banks and it is not readily distinguishable from any distance from the hill on which it stands. However, as a site likely to have been intended to be prominent and visible in the landscape, views towards the fort from its surroundings are important to appreciation of its cultural significance.

5.5.98 Those aspects of the setting that contribute most to the fort's cultural significance are its naturally defensive summit position, the views over and along the Clyde Valley, and the views towards this fort from the surrounding landscape.

5.5.99 Arbory Fort lies 3.9 km to the south of the nearest proposed turbine (T22), 1.9 km from the area of the solar array and 5.5 km from the BESS and Substation. The wireline (**Figure 5.14, EIAR Volume 3b**) shows that, from the fort, 22 turbines would be visible at hub height and the solar ZTV (**Figure 5.3, EIAR Volume 3a**) shows that the solar arrays would be visible.

5.5.100 The introduction of the Proposed Development would result in the proposed turbines being visible in the view to the west from the monument (**Figure 5.14, EIAR Volume 3b**). However, the key views from Arbory Fort, along the Clyde Valley would remain unchanged. The view from the fort to the west would include the turbines and the solar array; however, they would be sufficiently distant and in a separate landscape area so as not to compete with the fort for prominence.

5.5.101 Overall, as a result of the change to its wider surroundings, the Proposed Development would have an impact of negligible magnitude on the setting of Arbory Hill, fort, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the fort would be retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of negligible adverse significance and **not significant** in EIA terms.

Dungavel Hill, cairn (SM 4261, Figure 5.15)

5.5.102 The monument comprises the remains of a cairn, a prehistoric burial monument, which lies in an area of rough pasture near the summit of Dungavel Hill. The cairn was round in shape measuring approximately 5 m in diameter and 0.5 m high and has been extensively quarried away on its south side. As a scheduled monument, the cairn is of heritage value at national level and is an asset of high sensitivity.

5.5.103 The cairns is located on the plateau of the summit of the rounded Dungavel Hill, to the northeast of the summit. This location affords the cairn extensive views over the low agricultural land of the Clyde Valley to the north beyond which to the northwest is Tinto Hill. Views to the south and west from the cairn are somewhat obscured by the summit of Dungavel Hill.

5.5.104 Located to the northeast of the summit of the hill, this chambered cairn appears to have been intentionally built not to take the more prominent position on the hillock’s summit, and would not have been a prominent feature when viewed from the south. It instead appears to have been sited for views from and to the Clyde Valley to the north and perhaps intentionally to capture the view to Tinto Hill and its potentially contemporary summit cairn, Tinto cairn (**SM 4660**). The visualisation (**Figure 5.15, EIAR Volume 3b**) confirms no reciprocal visibility with the potentially contemporary assets to the southwest (Auchensaugh Cairn, Thirestone Stone Circle, Wildshaw Cairn or Knock Leaven) though there is visibility of Netherton Cairn and Faygad Hill Cairn.

5.5.105 Those aspects of the setting that contribute most to the cairn’s cultural significance are the views to and from the Clyde Valley to the north, the view to Tinto and the reciprocal views from the potentially contemporary Tinto Cairn.

5.5.106 Dungavel Hill Cairn lies 4.9 km to the north of the nearest proposed turbine (T9), 4.7 km from the area of the solar array and 6.6 km from the BESS and Substation. The wireline (**Figure 5.15, EIAR Volume 3b**) shows that, from the fort, 13 turbines would be visible at hub height and a further one visible at tip height, the BESS and substation would not be visible. The solar ZTV (**Figure 5.3**) shows that the solar arrays would not be visible.

5.5.107 The introduction of the Proposed Development would result in the proposed turbines being visible in the view to the south from the monument (**Figure 5.15, EIAR Volume 3b**). However, the key views to the north over the Clyde Valley and towards Tinto Hill cairn would remain unchanged.

5.5.108 Overall, as a result of the change to its wider surroundings, the Proposed Development would have an impact of negligible magnitude on the setting of Dungavel Hill, cairn, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the cairn would be retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of negligible adverse significance and **not significant** in EIA terms.

Wandel, Roman fortlet and camp 460m SW of (SM 2835, Figure 5.16)

5.5.109 The monument comprises the remains of a Roman fortlet, camp and road which survives largely as cropmarks with a small area surviving as low earthworks on its east side and in the southeast corner of the scheduled area. As a scheduled monument, the Roman fortlet and camp is of heritage value at national level and is an asset of high sensitivity.

5.5.110 The monument is located on low agricultural land on the east bank of the River Clyde, today the west coast mainline and the route of A702 run along the west edge of the scheduled area between the monument and the River Clyde. Located on low ground views to the north and south are along the Clyde Valley to the east and west the ground rises from the valley floor to the hills that line the valley.

5.5.111 Sited on the low east bank of the River Clyde this is not a naturally defensive location and the monument appears rather to have been sited for the important position it holds on the key communication route of the Clyde Valley

5.5.112 Those aspects of the setting that contribute most to the monuments cultural significance are its location on the key communication route of the Clyde Valley and the views along this valley to the north and south.

5.5.113 Wandel, Roman fortlet and camp 460m SW of (**SM2835**) lies 3.0 km to the northeast of the nearest proposed turbine (T22), 1.0 km from the area of the solar array and 4.9 km from the BESS and Substation. The wireline (**Figure 5.16**) shows that, from the settlement, six turbines would be visible at hub height and a further four visible at tip height, the BESS and Substation would not be visible. The solar ZTV (**Figure 5.3**) shows that there would be limited visibility of the solar arrays from the southwest corner of the scheduled area.

5.5.114 The introduction of the Proposed Development would result in the proposed turbines being visible in the view to the southwest from the monument (**Figure 5.16, EIAR Volume 3b**). However, the key views over and along the communication route of the Clyde Valley would remain.

5.5.115 Overall, as a result of the change to their wider surroundings, the Proposed Development would have an impact of negligible magnitude on the setting of Wandel, Roman fortlet and camp, an asset of high sensitivity. However, in the context of the NPF4 Policy 7h) test it is considered that the ability to understand, appreciate and experience the siting of this scheduled monument and the key aspects of the setting of relevance to the Roman fortlet and camp would be retained such that the integrity of its setting would not be significantly adversely affected. Overall, it is assessed that this would result in an effect that is of negligible adverse significance and **not significant** in EIA terms.

Knock Leaven cairn (WoSAS 10454)

5.5.116 A probable prehistoric burial cairn, lies in an area of open moorland to the north of the summit of Knock Leaven. As a NSR Site of schedulable quality this cairn is of heritage value at national level and an asset of high sensitivity.

5.5.117 Although Knock Leaven is a relatively low hill, the location nevertheless affords the cairn wide views to the surrounding distant hills. Sited to the west of the summit the key views are over the lower lying ground to the north and west. Today this view is dominated by the M74 motorway. The operational Middle Muir and Andershaw Wind Farms are visible above and below the skyline to the west, while distant turbines of operational developments to the northwest of Douglas are visible along the skyline from the west to northwest.

5.5.118 The prominent location on the summit of a hill was probably chosen in order that the cairn might overlook the everyday activities of the people who built it in. A key view for this asset would therefore be that between it and the lower land of the valleys to the north and west. The elevated location also allows the cairn intervisibility with the possibly contemporary cairns of Auchensaugh Hill (**SM 4234**) to the west northwest, Netherton (**SM 4513**) to the south, and Wildshaw Hill (**SM 4511**) to the northwest. Far-reaching views beyond the immediate valley include visibility of prehistoric cairns atop Tinto Hill (SM 4660) and Cairn Table (SM 4631).

5.5.119 Those aspects of the setting that contribute most to the cairns' cultural significance are its far reaching views in all directions and the potential visual relationships with the potentially contemporary monuments in the surrounding landscape. There are four contemporary assets in the landscape surrounding the stone circle: the scheduled monuments, Wildshaw Hill cairn (**SM 4511**) 2.8 km to the north-northwest; Netherton, cairn 800m SW of (**SM 4513**) 1.4 km to the southeast; Auchensaugh Hill, cairn (**SM 4324**) 5.6 km to the northwest; and Thirstone stone circle (**SM 5094**) 2.7 km to the northwest. The locations of these assets are visible from the cairn, although the cairns and stone circle are not visible from the cairn. It may be that these assets were previously visible from the cairn but no longer are due to their diminishment through time and stone robbing, and the distance. Auchensaugh Hill cairn sitting on the skyline on the hill summit is likely to have been visible in prehistory; however Netherton cairn and Wildshaw Hill cairn backdropped by rising ground are less likely to have been visible. Equally given that Thirstone stone circle appears to have never been upstanding, it is unlikely that the stone circle would have been visible from the cairn in prehistory.

5.5.120 The cairn lies 0.24 km to the south of the nearest proposed turbine (T15), 1.2 km from the area of the solar array and 1.4 km from the BESS and Substation. The turbine hub height ZTV (**Figure 5.2**) shows that all 22 turbines of the Proposed Development would be visible to hub height from this cairn. The solar ZTV (**Figure 5.3**) shows that the solar arrays would be visible.

5.5.121 The introduction of the Proposed Development would result in the majority of the turbines being in the lower moorland to the northwest. Two of the proposed turbines would be in relatively close proximity to the north (T15 0.24 km) and northeast (T16, 0.46 km) of the cairn. However these turbines sit between the cairn and the M74 motorway which dominates current views in this direction from the cairn.

5.5.122 Overall, as a result of the change to their wider surroundings, the Proposed Development would have an impact of medium magnitude on the setting of the Knock Leaven cairn an asset of high sensitivity. It would however remain possible for any visitor to understand, experience and appreciate the siting of this asset and the key aspects of the setting of relevance to the cairn, as such, the integrity of these key aspects of the monument's setting would be retained. Overall it is assessed that this would result in an effect that is assessed as moderate adverse significance and **significant** in EIA terms.

Potential Decommissioning Effects

5.5.123 Decommissioning activities, such as vehicle movements, materials storage, soil and overburden storage and landscaping have the potential to disturb or destroy features of cultural heritage interest within the Site any such impacts would be a permanent and irreversible.

5.5.124 Four assets have been identified which have the potential to be accidently effected during the decommissioning of the Proposed Development

- Thirstone, stone circle (**SM 5094**) is located within the turbine array area, there is therfore potential for accidental damage to the asset from decommissioning traffic traversing the scheduled area. Without mitigation this could result in an impact of upto high magnitude on this asset of high sensitivity resulting in an effect of high significance (**significant** in EIA terms) through damage to this stone circle. Proposed mitigation measures at the construction stage to mitigate the potential effect are outlined in **Section 5.6: Mitigation**.
- A clearance heap and quarry (30) is located within the area of the solar array, there is therfore potential for accidental damage to the asset from decommissioning traffic traversing the asset. Without mitigation this could result in an impact of upto high magnitude on this asset of low sensitivity resulting in an effect of minor significance (**not significant** in EIA terms) through damage to the asset. Proposed mitigation measures at the construction stage to mitigate the potential effect are outlined in **Section 5.6: Mitigation**.
- An area of clearance cairns (**31**) is located within the area of the solar array, there is therfore potential for accidental damage to the asset from decommissioning traffic traversing the asset.. Without mitigation this could result in an impact of upto high magnitude on this asset of low sensitivity resulting in an effect of minor significance (**not significant** in EIA terms) through damage to the asset. Proposed mitigation measures at the construction stage to offset the effect are outlined in **Section 5.6: Mitigation**.
- A plantation enclosure (**33**) is located within the area of the solar array, there is therfore potential for accidental damage to the asset from decommissioning traffic traversing the asset.. Without mitigation this could result in an impact of upto high magnitude on this asset of low sensitivity resulting in an effect of minor significance (**not significant** in EIA terms) through damage to the asset. Proposed mitigation measures at the construction stage to mitigate the potential effect are outlined in **Section 5.6: Mitigation**.

5.5.125 Decomissioning of the Proposed Development would have a beneficial effect in that it would remove operational effects on the setting of cultural heritage assets in the surrounding area.

Potential Cumulative Construction Effects

5.5.126 Construction of the Proposed Development would not give rise to any cumulative construction effects on cultural heritage assets.

Potential Cumulative Operational Effects

5.5.127 The Proposed Development could, in combination with other energy developments in the area that are operational, consented but not yet built, or are the subject of valid planning applications, result in adverse cumulative effects on the setting of cultural heritage assets. Operational and under construction developments are considered as part of the baseline and are taken to be such for the assessment of effects on the settings of heritage assets described above. Developments that are consented but not yet under construction and those that are the subject of valid planning applications are considered as being potential additions to the baseline and are considered in the cumulative impact assessment. Those energy developments that are at the scoping stage, with the exception of the proposed Redshaw Substation to the west of the Proposed Development, are excluded because there is insufficient information of the size and scale of the development proposed and uncertainty over whether they would be progressed to a formal application.

5.5.128 **Figure 5.4 (EIAR Volume 3a)** shows the Proposed Development and designated heritage assets within 10 km, along with the locations of other operational and consented or under construction wind farms, and those that are currently proposed (in planning). From this, it can be seen that a cumulative effect on cultural heritage is likely to arise from the addition of the Proposed Development to a baseline that includes the operational Andershaw, Birkhill, Middle Muir, Clyde, Clyde Extension, Dalquhandy, Galawhistle, Hagshaw Hill Phase 2, JJ's Farm, Middle Muir, and Nether Fauldhouse Farm Wind Farms.

5.5.129 Based on the list of cumulative developments (**Chapter 4: Landscape and Visual Impact Assessment, EIAR Volume 2**), those other developments that are either consented but not yet under construction or are in planning and most likely in combination with the Proposed Development to give rise to cumulative effects on heritage assets are:

- Bodinglee Wind Farm - application stage (37 turbines 230 m to tip);
- Priestgill Wind Farm - consented development (7 turbines, 145 m to tip); and
- Redshaw 400 kV substation – scoping stage.

5.5.130 Where visible from the designated heritage assets described above (**Table 5.2**), the three cumulative developments listed above are shown on the wireframes provided to support the assessment (**Figures 5.5 – 5.16, EIAR Volume 3b**). Those further afield, but which do not have the potential for an adverse cumulative effect on the settings of cultural heritage assets affected by the Proposed Development, are also shown on the wireframes.

5.5.131 Cumulative impacts are assessed for the six designated assets and one NSR site of schedulable quality (**Table 5.3**) which have been assessed in detail above (**paragraphs 5.5.5 – 5.5.120**) where the predicted operational impact of the Proposed Development on its own is of greater than negligible significance. It is considered that the remaining assets within the Outer Study Area (**Technical Appendix 5.3, EIAR Volume 4**) have no potential to be subject to significant cumulative operational impacts as a result of the Proposed Development in combination with any of the three cumulative developments considered and they are therefore not considered further.

Table 5.3: Cultural Heritage Assets Given Detailed Assessment for Cumulative Effects

Reference No.	Designation Title	Visualisations Figure No.
SM 5094	Thirstone, stone circle 1300m NNW of	5.5
SM 4513	Netherton, cairn 800m SW of	5.6
SM 2606	Black Hill, fort 650m NW of Craighead	5.7
SM 4234	Auchensaugh Hill, cairn	5.11
SM 4511	Wildshaw Hill, cairn 500m WSW of summit	5.12
SM 4254	Fagyad Hill, cairn	5.13
WoSAS 10454	Knock Leaven cairn	N/A

Assets in Inner Study Area

THIRSTONE, STONE CIRCLE (SM 5094, FIGURE 5.5)

5.5.132 **Figure 5.5 (EIAR Volume 3b)** shows that the Proposed Development would be seen together with, and in front of, the proposed Bodinglee Wind Farm in the view to the southwest through to northwest from Thirestone stone circle, the proposed Redshaw 400 kV substation would also sit in the view to the northwest. The consented Preistingill Wind Farm would not be visible from Thirstone stone circle.

5.5.133 The southern turbines of the proposed Bodinglee Wind Farm would sit behind and beyond Auchensaugh Hill and its summit cairn Auchensaugh Hill Cairn (**SM 4234**) when viewed from Thirstone Stone Circle. The proposed Redshaw 400 kV substation would sit slightly to the north of the view from Thirstone Stone Circle to Auchensaugh Hill, with view between the assets remaining clear. The northern turbines of the proposed Bodinglee Wind Farm would sit on and beyond the moorland to the northwest of Thirstone Stone Circle.

5.5.134 The cumulative impact on the setting of the Thirstone stone circle from adding the Proposed Development to a baseline including the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation is assessed as being of medium magnitude and moderate adverse significance (**significant** in EIA terms). As these developments would effectively form two groups one to the southwest and one to the northwest of the stone circle, the combined effect of the Proposed Development with the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation would be no greater than that assess for the Proposed Development alone (moderate significance: **significant** in EIA terms).

5.5.135 While the Proposed Development, the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation would be visible in views to Auchensaugh Cairn from Thirstone stone circle, it would remain possible for the visitor to understand, appreciate and experience the setting of the stone circle albeit in a landscape which would include additional modern energy developments, with Andershaw and Middle Muir Wind Farms and the existing 400 kV OHL forming part of the baseline landscape. As such, in the context of the NPF4 Policy 7h) test it is considered that the scheduled monument would be adequately retained such that the integrity of setting would not be significantly adversely affected by the cumulative impact.

NETHERTON, CAIRN (SM 4513, FIGURE 5.6)

5.5.136 **Figure 5.6 (EIAR Volume 3b)** shows that the proposed Bodinglee Wind Farm and the Redshaw 400 kV substation would be seen beyond and through the Proposed Development in views to the northwest from Netherton Cairn, while Priestgill Wind Farm would not be seen in the same view direction when viewed from Netherton Cairn (**SM 4513**). The consented Preistgill Wind Farm would be visible from Netherton Cairn at a distance of 4.9 km to the northeast.

5.5.137 The cumulative impact on the setting of the Netherton Cairn from adding the Proposed Development to a baseline including the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation is assessed as being of medium magnitude and moderate adverse significance (**significant** in EIA terms). As these developments would effectively be seen beyond the Proposed Development, the impact would be no greater than that assessed for the Proposed Development alone (moderate significance: **significant** in EIA terms). Furthermore the consented Preistgill Wind Farm, lies in a different part of the viewshed from Netherton Cairn and would not interact visually with the Proposed Development.

5.5.138 While the Proposed Development, the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation would be visible in views from Netherton Cairn it would remain possible for the visitor to understand, appreciate and experience the setting of the cairn albeit in a landscape which would include additional modern energy developments, Andershaw and Middle Muir Wind Farm and the existing 400 kV OHL forming part of the baseline landscape. As such, in the context of the NPF4 Policy 7h) test it is considered that the scheduled monument would be adequately retained such that the integrity of setting would not be significantly adversely affected by the cumulative impact.

BLACK HILL, FORT 650M NW OF CRAIGHEAD (SM2606, FIGURE 5.7)

5.5.139 **Figure 5.7 (EIAR Volume 3b)** shows that the proposed Bodinglee Wind Farm and the Redshaw 400 kV substation would be seen beyond and through the Proposed Development in views to the northwest from Black Hill Fort. The proposed the Redshaw 400 kV substation and the consented Preistgill Wind Farm would not be visible from Black Hill Fort.

5.5.140 The cumulative impact on the setting of the Black Hill Fort from adding the Proposed Development to a baseline including the proposed Bodinglee Wind Farm is assessed as being of low magnitude and minor significance (**not significant** in EIA terms). As this development would effectively be seen beyond and through the Proposed Development the impact would be no greater than that assessed for the Proposed Development alone (minor significance: **not significant** in EIA terms). Furthermore the proposed the Redshaw 400 kV substation and the consented Preistgill Wind Farm would not be visible from Black Hill Fort.

5.5.141 While the Proposed Development and the proposed Bodinglee Wind Farm would be visible in views from Black Hill Fort it would remain possible for the visitor to understand, appreciate and experience the setting of the fort albeit in a landscape which would include additional modern energy developments, with Andershaw and Middle Muir Wind Farms forming part of the baseline landscape. As such, in the context of the NPF4 Policy 7h) test it is considered that the scheduled monument would be adequately retained such that the integrity of setting would not be significantly adversely affected by the cumulative impact.

KNOCK LEAVEN CAIRN (WOSAS 10454)

5.5.142 The proposed Bodinglee Wind Farm and the Redshaw 400 kV substation would be seen beyond and through the Proposed Development in views to the northwest from Knock Leaven Cairn. The consented Preistgill Wind Farm would also be visible to the east from Knock Leaven Cairn.

5.5.143 The cumulative impact on the setting of the Knock Leaven Cairn from adding the Proposed Development to a baseline including the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation and the consented Preistgill Wind Farm is assessed as being of medium magnitude and moderate significance (**significant** in EIA terms). As these developments would effectively be seen beyond the Proposed Development the impact would be no greater than that assessed for the Proposed Development alone (moderate significance: **significant** in EIA terms).

5.5.144 While the Proposed Development, the proposed Bodinglee Wind Farm, the proposed Redshaw 400 kV substation and the consented Preistgill Wind Farm would be visible in views from Knock Leaven Cairn it would remain possible for the visitor to understand, appreciate and experience the setting of the cairn albeit in a landscape which would include additional modern energy developments, with Andershaw and Middle Muir Wind Farms and the existing 400 kV OHL forming part of the baseline landscape as does the M74 motorway. As such, the integrity of the setting of the cairn would not be compromised and its cultural significance would not be appreciably diminished by the cumulative impact.

Assets in the Outer Study Area

AUCHENSAUGH HILL, CAIRN (SM 4324) (FIGURE 5.11)

5.5.145 **Figure 5.11 (EIAR Volume 3b)** shows that the Proposed Development and the proposed Bodinglee Wind Farm would not be seen in the same view direction when viewed from

Auchensaugh. The proposed Bodinglee Wind Farm would sit to the north and west of the cairn while the Proposed Development would sit to the east . The proposed Redshaw 400 kV substation would also sit in the view to the east. The consented Preistgill Wind Farm would be visible from Auchensaugh Cairn at a distance of 10.1 km behind the Proposed Development.

5.5.146 The cumulative impact on the setting of the Auchensaugh Hill Cairn (**SM 4234**) from adding the Proposed Development to a baseline including the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation is assessed as being of medium magnitude and moderate adverse significance (**significant** in EIA terms). As these other proposed developments would start to encircle the cairn, the combined effect of the Proposed Development with the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation would be greater than that assessed for the Proposed Development alone (minor significance: **not significant** in EIA terms). Furthermore, the consented Preistgill Wind Farm lies at a sufficient distance beyond the Proposed Development that it would not increase the cumulative impact on Auchensaugh Hill Cairn.

5.5.147 While the Proposed Development, the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation would be visible in views from and to Auchensaugh Cairn it would remain possible for the visitor to understand, appreciate and experience the setting of the cairn albeit in a landscape which would include additional modern energy developments, with Andershaw and Middle Muir Wind Farms and the existing 400 kV OHL forming part of the baseline landscape. As such, in the context of the NPF4 Policy 7h) test it is considered that the scheduled monument would be adequately retained such that the integrity of setting would not be significantly adversely affected by the cumulative impact.

WILDSHAW HILL, CAIRN 500M WSW OF SUMMIT (SM 4511, FIGURE 5.12)

5.5.148 **Figure 5.12 (EIAR Volume 3b)** shows that the proposed Bodinglee Wind Farm and the Redshaw 400 kV substation would be seen to the north and northwest of Wildshaw Cairn (**SM 4511**) and would not be seen in the same view direction as the Proposed Development. There would be very limited visibility of the tips of three of the consented Priestgill Wind Farm turbines at a distance of 6.6 km to the southeast.

5.5.149 The cumulative impact on the setting of the Wildshaw Cairn from adding the Proposed Development to a baseline including the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation is assessed as being of medium magnitude and moderate significance (**significant** in EIA terms). Furthermore there would be limited visibility of the consented Preistgill Wind Farm and it would not increase the cumulative impact on Wildshaw Hill Cairn.

5.5.150 While the Proposed Development, the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation would be visible in views from Wildshaw Hill Cairn it would remain possible for the visitor to understand, appreciate and experience the setting of the cairn albeit in a landscape which would include additional modern energy developments, with Andershaw and Middle Muir Wind Farms and the existing 400 kV OHL forming part of the baseline landscape. As such, in the context of the NPF4 Policy 7h) test it is considered that the scheduled monument would be adequately retained such that the integrity of setting would not be significantly adversely affected by the cumulative impact.

FAGYAD HILL, CAIRN (SM 4254, FIGURE 5.13)

5.5.151 **Figure 5.13 (EIAR Volume 3b)** shows that the proposed Bodinglee Wind Farm and the Redshaw 400 kV substation would be seen beyond and through the Proposed Development in views to the northwest from Fagyad Hill Cairn. The consented Priestgill Wind Farm would not be visible from Fagyad Hill Cairn

5.5.152 The cumulative impact on the setting of the Fagyad Hill Cairn from adding the Proposed Development to a baseline including the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation is assessed as being of low magnitude and minor significance (**not significant** in EIA terms). As these developments would effectively be seen beyond the Proposed Development the impact would be no greater than that assessed for the Proposed Development alone (minor significance: **not significant** in EIA terms). Furthermore the consented Preistgill Wind Farm would not be visible from Fagyad Hill Cairn

5.5.153 While the Proposed Development, the proposed Bodinglee Wind Farm and the proposed Redshaw 400 kV substation would be visible in views from Fagyad Hill Cairn it would remain possible for the visitor to understand, appreciate and experience the setting of the cairn albeit in a landscape which would include additional modern energy developments, with Andershaw and Middle Muir Wind Farms and the existing 400 kV OHL forming part of the baseline landscape. As such, in the context of the NPF4 Policy 7h) test it is considered that the scheduled monument would be adequately retained such that the integrity of setting would not be significantly adversely affected by the cumulative impact.

5.6 Mitigation

Mitigation by Design

5.6.1 The results of the desk-based assessment and field survey were digitised as GIS data, showing the locations (and where relevant, the extent) of heritage assets. The layout of the Proposed Development, including the positioning of proposed turbines, the solar array and the siting of other infrastructure, has subsequently been designed to avoid or minimise construction effects and to minimise effects on the settings of heritage assets as far as possible. The layout shown on **Figure 5.1: Cultural Heritage: Inner Study Area** (**EIAR Volume 3a**) therefore embeds design mitigation into the siting of the proposed turbines, the solar array and the ancillary infrastructure.

5.6.2 Cultural heritage constraints were further taken into account in the design iterations of the turbine layout following consultation with HES.

- Layout 2: Scoping Layout (24 turbines) - Turbine 10 was removed, in order to preserve the line of sight between Wildshaw Hill cairn (**SM 4511**) and Auchensaugh Hill cairn (**SM 4324**) scheduled monuments;
- Layout 3: Further Environmental Constraints Layout (23 turbines) Turbine 23 was removed, in part to reduce the potential for adverse impact on the settings of the scheduled monuments Netherton, cairn 800m SW of (**SM4513**) and Auchensaugh Hill, cairn (**SM4234**).
- Layout 4: Turbine 11 was removed to reduce the potential for adverse impacts on the setting of Thirstone, stone circle 1300m NNW of (**SM 5094**).

Mitigation during Construction

5.6.3 NPF4 (2023) provides a mitigation hierarchy: avoid, minimise, restore and offset.. Avoidance and minimisation measures can be achieved through design, whilst compensatory measures offset effects that have not been avoided or minimised.

5.6.4 Historic Environment Policy for Scotland (HEPS) requires the recognition, care and sustainable management of the historic environment and the emphasis in Planning Advice Note (PAN)

2/2011: Planning and Archaeology (PAN2) is for the preservation of important remains in situ where practicable and by record where preservation is not possible. The mitigation measures presented below take this policy advice and planning guidance into account and provide various options for protection or recording and ensuring that, where practical, surviving assets are preserved intact to retain the present historic elements of the landscape.

5.6.5 All mitigation works presented in the following paragraphs would take place prior to, or, where appropriate, during, the construction of the Proposed Development. The scope of works would be detailed in one or more Written Scheme(s) of Investigation (WSI) developed in consultation with the West of Scotland Archaeology Service (WoSAS) as archaeological advisors to SLC.

5.6.6 A professionally qualified Archaeological Contractor would be appointed to act as an Archaeological Clerk of Works (ACoW). The role of the ACoW would be to provide advice to the appointed Construction Contractor regarding micro-siting of development components, where there is a possibility of intersecting with identified heritage assets, and to undertake archaeological monitoring of topsoil stripping operations in areas designated and approved by the Council's Archaeological Advisors (WoSAS). The activities of the ACoW would be carried out according to the scope of work and terms specified under the WSI and approved by WoSAS.

Preservation In Situ

5.6.7 The scheduled monument Thirstone Stone circle (**SM 5094**) sits within the area of the proposed turbines and, as a scheduled monument, this is an asset of high sensitivity. No construction works would take place in close proximity to this scheduled area and no direct construction impacts would affect this asset. However, to ensure no accidental construction impacts on this asset from plant traversing the area, this asset would be marked out for avoidance during the construction phase. A buffer of 50 m around the scheduled area would be fenced off and the fence would be left in place for the duration of the construction phase and removed on completion of the Proposed Development.

5.6.8 Within the solar array area, three heritage assets (**30, 31** and **33**) have been identified as lying close to, though avoided by, the solar panels. As the remains of historic quarrying, farm clearance and a plantation enclosure, these assets are of low sensitivity, although they add value to the character of the historic landscape.

5.6.9 These heritage assets (**30, 31** and **33**) would be marked out for avoidance during the construction phase. The features would be identified by placing high visibility markers 5 m from the outer limit of the visible remains, facing the working area. Any required micro-siting of the solar panels would be managed to avoid the visible remains and the demarcated areas. The markers would be left in place for the duration of the construction phase and removed on completion of the Proposed Development.

Watching Briefs

5.6.10 The Applicant would submit fo the Council’s approval in consultation with WoSAS the scope of the archaeological watching brief in advance of development works. The scope of the agreed works would be confirmed in a WSI to be signed-off prior to the commencement of the construction works, including enabling works.

5.6.11 Taking account of the avoidance through the design, and the character of identified cultural heritage baseline, it is proposed that watching briefs would be carried out at the following locations:

- Asset (**40**): turbine 16, its access track and an area of hardstanding are within an area containing remains of a historic field system to the northeast of Knock Leaven (between 291182, 626416 and 291328, 626024). The purpose of the watching brief here would be to record the character of any field banks crossed and identify any evidence for historic cultivation (rig and furrow) that may remain as buried features and recover any artefactual evidence that may be present or any underlying archaeological features of earlier date.
- Asset (**41**): A borrow pit search area, an access track, and turbine 22 and its area of hardstanding cross an area containing remains of a historic field system north of Black Hill (between 289785, 625437 and 290444, 624892). The purpose of the watching brief here would be to record the character of any field banks crossed and identify any evidence for historic cultivation (rig and furrow) that may remain as buried features and recover any artefactual evidence that may be present or any underlying archaeological features of earlier date.

5.6.12 Based on the results of the desk-based study and the field survey, there are no other specific areas where construction works could be expected to encounter buried archaeological remains. However, it has been assessed that there is moderate potential for hitherto undiscovered archaeological remains to be present within the Site and without mitigation there could be a direct construction impact of up to moderate significance. Therefore, if required under the terms of a condition of consent, the scope of any other required archaeological watching brief(s) would be agreed through consultation with WoSAS in advance of development works commencing and would be set out in the WSI.

Post-excavation assessment and reporting

5.6.13 If new, archaeologically significant discoveries are made during archaeological monitoring, and it is not possible to preserve the discovered remains in situ, provision would be made for the excavation, where necessary, of any archaeological deposits encountered. The provision would include the consequent production of written reports on the findings, with post-excavation analysis and publication of the results of the works, where appropriate.

Construction Guidelines

5.6.14 Written guidelines would be issued for use by all construction contractors, outlining the need to avoid causing unnecessary damage to known heritage assets. The guidelines would set out arrangements for calling upon retained professional support if buried archaeological remains of potential archaeological interest (such as building remains, human remains, artefacts, etc.) should be discovered during any construction activities.

5.6.15 The guidelines would make clear the legal responsibilities placed upon those who disturb artefacts or human remains.

Mitigation during Operation

5.6.16 As the as-built infrastructure would be used to facilitate maintenance, repair and replacement activities, no mitigation is required in relation to cultural heritage during the operational lifetime of the Proposed Development.

Mitigation during Decommissioning

5.6.17 The scheduled monument Thirstone Stone circle (**SM 5094**) sits within the area of the proposed turbines and, as a scheduled monument, this is an asset of high sensitivity. No decommissioning works would take place in close proximity to this scheduled area. However, to ensure no accidental construction impacts on this asset from plant traversing the area, this asset would be marked out for avoidance during the decommissioning phase. A buffer of 50 m around the scheduled area would be fenced off and the fence would be left in place for the duration of the decommissioning phase and removed on completion of the decommissioning.

5.6.18 These heritage assets (**30, 31** and **33**) would be marked out for avoidance during the decommissioning phase. The features would be identified by placing high visibility markers 5 m from the outer limit of the visible remains, facing the working area. Any required micro-siting of the solar panels would be managed to avoid the visible remains and the demarcated areas. The markers would be left in place for the duration of the decommissioning phase and removed on completion of the decommissioning.

5.7 Assessment of Residual Effects

Residual Construction Effects

5.7.1 Taking account of the mitigation proposals set out above, the following residual construction effects have been identified:

- Residual effect of no more than minor significance (**not significant** in EIA terms) on the remains of two areas of relict field systems (**40** and **41**), as a consequence of investigation and recording to a standard acceptable to WoSAS.
- Residual effects of no more than minor significance (**not significant** in EIA terms) on any buried archaeological remains revealed through archaeological watching briefs and investigated and recorded to a standard acceptable to WoSAS.

5.7.2 Furthermore following mitigation there will be no potential for accidental construction effects on Thirstone stone circle (**SM 5094**) or the non-designated assets (**30, 31** and **33**) and there will be no residual effects on these assets.

Residual Operational Effects

5.7.3 During its operational lifetime, the residual effects of the Proposed Development on the settings of heritage assets in the wider study area would be the same as the predicted effects.

5.7.4 Four impacts of moderate significance (**significant** in EIA terms) have been identified affecting the setting of:

- Wildshaw Hill, cairn 500m WSW of summit (**SM 4511**),
- Netherton, cairn 800m SW of (**SM 4513**)
- Thirstone, stone circle 1300m NNW of (**SM 5094**), and
- Knock Leaven cairn (**WoSAS 10454**)

5.7.5 No further mitigation is possible to offset the impact on these assets and the residual effect will remain one of moderate significance (**significant** in EIA terms) but these effects would not significantly adversely affect the integrity of the setting of the assets concerned. It would remain possible for any visitor to the monuments to understand and appreciate and experience the setting of these assets albeit in a landscape that contains further renewable energy infrastructure.

5.7.6 All other impacts, affecting the settings of heritage assets in the surrounding landscape, would give rise to effects that are either of minor or negligible significance (**not significant** in EIA terms).

Residual Decommissioning Effects

5.7.7 Following mitigation there will be no direct decommissioning effects on cultural heritage assets.

5.7.8 All operational effects identified would be fully reversible upon decommissioning of the Proposed Development.

Residual Cumulative Construction Effects

5.7.9 No cumulative construction effects are predicted hence there would be no residual cumulative construction effects.

Residual Cumulative Operational Effects

5.7.10 During its operational lifetime, the residual cumulative effects of the Proposed Development on the settings of heritage assets in the wider study area would be the same as the predicted cumulative effects. Any changes to the cumulative operational effects during the operational lifetime of the development would come as a result of changes to the surrounding cumulative developments.

5.8 Monitoring

Construction Phase Monitoring

5.8.1 Post-construction monitoring would be carried out to:

- check that marking out of heritage assets within the Site has been effective and that none of the heritage assets have been disturbed during construction works; and
- check that all markers have been removed from heritage assets following completion of the Proposed Development.

Operation Phase Monitoring

5.8.2 No monitoring is required for the operational phase.

Decommissioning Phase Monitoring

5.8.3 Post-decommissioning monitoring would be carried out to:

- check that marking out of heritage assets within the Site has been effective and that none of the heritage assets have been disturbed during decommissioning works; and
- check that all markers have been removed from heritage assets following completion of the decommissioning.

5.9 Summary

5.9.1 A desk-based assessment and field surveys have been carried out to establish the cultural heritage baseline, within the application boundary (Inner Study Area) and in the wider landscape (Outer Study Area). The assessment has been informed by scoping responses provided by HES and WoSAS and further consultation undertaken with HES.

5.9.2 Five scheduled monuments are located within the Inner Study Area, all of which are prehistoric assets, one - Thirstone Stone Circle (**SM 5094**) - sits in the moorland between the M74 motorway and the B7078 road and the remaining four are located on and around Black Hill. These are all assets of heritage value at a national level and of high sensitivity.

5.9.3 Forty two non-designated heritage assets have been identified within the Inner Study Area the majority of these assets are post medieval and related to sheep farming; however, there are a number of assets recorded in the HER of possible prehistoric date including a possible burial cairn, recorded in the HER as a non-statutory register (NSR) site potentially of national importance. The majority of the non-designated heritage assets within the Inner Study Area are either of heritage value at a local level, and of low sensitivity, or are of little or no intrinsic heritage value, and of negligible sensitivity.

5.9.4 An assessment of the identified cultural heritage resource within the Site, and consideration of the current and past land-use, indicates that there is moderate potential of hitherto unidentified archaeological remains of prehistoric or post-medieval date being present within the Site. It is probable that any remains that do survive are most likely to be of post-medieval date and associated with farming activities. It is possible that, without mitigation, there could be an impact of up to moderate significance on previously unrecorded cultural heritage assets. A programme of mitigation will be put in place in agreement with WoSAS; this is most likely to comprise targeted archaeological watching briefs. Following mitigation, the residual effect on previously unrecorded archaeological remains will be of no more than minor significance (**not significant** in EIA terms)

5.9.5 The layout of the Proposed Development has been designed as far as possible to avoid direct effects on the identified heritage assets within the Site. There will be no direct impacts on the scheduled monuments. Direct adverse construction impacts on four heritage assets have been identified. For two assets of negligible sensitivity (**34** and **35**) a direct adverseconstruction impact of negligible significance has been identified and no mitigation is proposed. Two areas of relict historic landscapes (**40** and **41**), each of low sensitivity, will be subject to direct adverse construction impacts of minor significance. These effects would be offset through a programme of mitigation to recover any archaeological information that may be present at the affected locations. Following mitigation, the residual effect on the relict historic landscapes (**40** and **41**) will be of no more than minor significance (**not significant** in EIA terms).

5.9.6 Within 10 km of the Proposed Development, there are 65 scheduled monuments (five of which are within the application boundary and thirty with predicted theoretical visibility of the Proposed Development); two category A listed buildings (neither with predicted theoretical visibility); 40 category B listed buildings (**32** with predicted theoretical visibility) and three conservation areas (two with predicted theoretical visibility).

5.9.7 Within 5 km of the Proposed Development there are 17 NSR Sites (nine with predicted theoretical visibility), and two category C listed buildings (all with some degree of predicted theoretical visibility).

5.9.8 An effect of moderate significance (**significant** in EIA terms) is predicted on the setting of three scheduled monuments - Wildshaw Hill, cairn 500m WSW of summit (**SM 4511**), Netherton, cairn 800m SW of (**SM 4513**) and Thirstone, stone circle 1300m NNW of (**SM 5094**), assets of national importance and high sensitivity, and a possible burial cairn Knock Leaven cairn (**WoSAS 10454**) determined by WoSAS to be potentially of national importance and assessed on that basis as being of high sensitivity. The effects, which would not adversely affect the features' cultural significance, would last for the duration of the operational phase of the Proposed Development individually and cumulatively with other operational, consented, or proposed developments.

5.9.9 Taken in the context of existing operational wind farms in the wider landscape, significant cumulative effects are predicted arising from the Proposed Development in combination with the proposed (at application) Bodinglee Wind Farm and Redshaw 400 kV substation (at scoping). The predicted effects would occur on the setting of Auchensaugh Hill, cairn (**SM 4324**), Wildshaw Hill, cairn 500m WSW of summit (**SM 4511**), Netherton, cairn 800m SW of (**SM 4513**) and Thirstone, stone circle 1300m NNW of (**SM 5094**) and Knock Leaven Cairn (**WoSAS 10454**).The combined developments would not however adversely affect the heritage value or cultural significance of these assets.

Table 5. 4: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Construction			
Potential high adverse direct construction impact on Thirstone Stone Circle from construction traffic traversing the Site	Fencing of off the scheduled area with a 50m buffer implemted around the scheduled area.	To be agreed through consultation with WoSAS in advance of development works commencing and would be set out in the WSI.	No impact
Potential moderate adverse direct construction impact on previously undiscovered subsurface archaeological features	Archaeological watching brief(s)	To be agreed through consultation with WoSAS in advance of development works commencing and would be set out in the WSI.	Not Significant
Operation			
Moderate adverse impact on the setting of Wildshaw Hill, cairn 500m WSW of summit (SM 4511)	None proposed	N/A	Significant
Moderate adverse impact on the setting of Netherton, cairn 800m SW of (SM 4513)	None proposed	N/A	Significant
Moderate adverse impact on the setting of Thirstone, stone circle 1300m NNW of (SM 5094)	None proposed	N/A	Significant
Moderate adverse impact on the setting of Knock Leaven cairn (WoSAS 10454)	None proposed	N/A	Significant

Table 5. 4: Summary of Potential Significant Effects of the Proposed Development			
Likely Significant Effect	**Mitigation Proposed**	**Means of Implementation**	**Outcome/Residual Effect**
Decommissioning			
Potential high adverse direct decommisioning impact on Thirstone Stone Circle from construction traffic traversing the Site	Fencing of off the scheduled area with a 50m buffer implemted around the scheduled area.	To be agreed through consultation with WoSAS in advance of development works commencing and would be set out in the WSI.	No impact
Cumulative Construction			
N/A	N/A	N/A	N/A
Cumulative Operation			
Moderate adverse impact on the setting of Auchensaugh Hill, cairn (SM 4324)	None proposed	N/A	Significant
Moderate adverse impact on the setting of Wildshaw Hill, cairn 500m WSW of summit (SM 4511)	None proposed	N/A	Significant
Moderate adverse impact on the setting of Netherton, cairn 800m SW of (SM 4513)	None proposed	N/A	Significant
Moderate adverse impact on the setting of Thirstone, stone circle 1300m NNW of (SM 5094)	None proposed	N/A	Significant
Moderate adverse impact on the setting of Knock Leaven cairn (WoSAS 10454)	None proposed	N/A	Significant

6 Ecology

6.1 Executive Summary

6.1.1 Chapter 6 Ecology of the EIA Report considers the potential for significant effects upon important ecological features (IEFs) associated with the construction, operation and decommissioning of the Proposed Development.

6.1.2 Baseline conditions to inform the design and assessment of the Proposed Development have been established through desk study, ecological field surveys in accordance with industry standard guidance and consultation with nature conservation bodies and specialist species recording groups.

6.1.3 Red Moss Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) are located in the northwest of the Site and extend beyond the Site boundary to the west (**Figure 6.1** (EIAR Volume 3a)). It should be noted that no development will be undertaken in this part of the Site.

6.1.4 Baseline studies have established that a range of habitats are present within the Site; the main habitats of interest are blanket bog and wet modified bog. Furthermore, the Site and adjacent habitats are used by badger (setts, feeding signs, prints, latrines and dung), otter (couch, spraint and feeding signs), trout and seven species of foraging / commuting bat. Potential for roosting bat and hibernating reptiles was also recorded. The risk to all species, including high collision risk bat species, is considered to be low based on the activity recorded.

6.1.5 Standard mitigation and pre-construction checks (as directed by an appointed suitably qualified Ecological Clerk of Works (ECoW)) will enable the protection of protected habitats and species during construction works associated with the Proposed Development.

6.1.6 In addition to habitat reinstatement following the cessation of construction works, the Proposed Development also provides a clear opportunity to deliver long-term beneficial habitat enhancement measures for habitats and species, away from operational infrastructure, including specific management for blanket bog enhancement and riparian broadleaved woodland planting.

6.1.7 Residual effects upon any important ecological features are predicted to be not significant as a result of the Proposed Development alone, or in combination, with any other wind farm development.

6.2 Introduction

6.2.1 This Chapter of the Environmental Impact Assessment (EIA) Report (EIAR) evaluates the potential effects associated with the construction, operation and decommissioning of the M74 West Renewable Energy Park (the 'Proposed Development') on Important Ecological Features (IEFs), including designated sites, terrestrial and aquatic habitats, and protected (non-avian) species.

6.2.2 The assessment has been carried out by MacArthur Green. All staff contributing to this chapter have undergraduate and/or postgraduate degrees in relevant subjects, have extensive professional ecological impact assessment experience, hold professional membership of and/or abide by the Chartered Institute of Ecology and Environmental (CIEEM) Code of Professional Conduct.

6.2.3 The specific objectives of the chapter are to:

- describe the ecology baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

6.2.4 This chapter is supported by the following figures and technical appendices:

- Volume 3a: Figures
  - Figure 6.1: Site Location and Ecological Designated Sites and Ancient Woodland within 5 km
  - Figure 6.2: Carbon and Peatland Map 2016 within 500 m
  - Figure 6.3: National Vegetation Classification Survey Area and Survey Results
  - Figure 6.4: Potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs) Survey Area and Survey Results
  - Figures 6.5: Protected Species Survey Area and Survey Results
  - Figures 6.5C: Protected Species Survey Area and Survey Results - Confidential
  - Figure 6.6: Bat Survey Area, Anabat Locations and Preliminary Bat Roost Assessment Results
  - Figure 6.7: Seasonal Bat Site Activity 2023 - Common Pipistrelle
  - Figure 6.8 Seasonal Bat Site Activity 2023 - Soprano Pipistrelle
  - Figure 6.9: Seasonal Bat Site Activity 2023 – *Nyctalus* spp.
  - Figure 6.10: Electrofishing Locations and Survey Results
  - Figure 6.11: Proposed Outline Biodiversity Enhancement and Management Plan Area
- Volume 4: Technical Appendices
  - Technical Appendix 6.1: National Vegetation Classification & Habitats Survey Report
  - Technical Appendix 6.2: Protected Species Survey Report
  - Technical Appendix 6.2C: Protected Species Survey Report Confidential Annex D
  - Technical Appendix 6.3: Bat Survey Report
  - Technical Appendix 6.4: Fisheries Report
  - Technical Appendix 6.5: Species Protection Plan
  - Technical Appendix 6.6: Outline Biodiversity Enhancement Management Plan
  - Technical Appendix 6.7: Ecological Impact Assessment Methodology

6.2.5 Figures and technical appendices are referenced in the text where relevant.

6.2.6 The Confidential Annex of **Technical Appendix 6.2C** (EIAR Volume 4) and **Figure 6.5.2** (Volume 3a) will not be made publicly available due to the sensitive information they contain pertaining to the locations of protected species. They will however be issued to the Scottish Ministers, NatureScot and South Lanarkshire Council to inform their own appraisals of the Proposed Development.

6.3 Assessment Methodology

Scope of Assessment

6.3.1 The assessment presented within this chapter considers the potential effects of construction and operation (including cumulatively) of the Proposed Development upon those ecological features identified during the review of desk-based information and field surveys.

6.3.2 This chapter considers effects (both temporary and permanent) on:

- Designated nature conservation sites – effects include direct (i.e., derived from land-take or disturbance to habitats or protected species) and indirect (i.e., habitat fragmentation and modification, including through changes caused by effects to supporting systems such as groundwater or overland flow);
- Terrestrial habitats – effects include direct (i.e., derived from land-take) and indirect (i.e., habitat fragmentation and modification, including through changes caused by effects to supporting systems such as groundwater or overland flow);
- Aquatic habitats – effects are limited to the ecological impacts of changes in water conditions through potential pollution effects (hydrological effects are considered in **Chapter 8: Hydrology, Hydrogeology and Geology**); and,
- Protected species and other notable species – effects considered include direct (i.e., loss of life; loss of key habitat; displacement from key habitat; barrier effects preventing movement to/from key habitats; and general disturbance) and indirect (i.e., loss/changes of/to food resources; population fragmentation; degradation of key habitat e.g., as a result of pollution).

6.3.3 The chapter assesses cumulative effects as arising from the addition of the Proposed Development to other cumulative developments, which are the subject of a valid planning application. Operational, under construction and consented developments are considered as part of the baseline. Developments close to the end of their operational life will be included as part of the baseline to present 'worst case scenario'.

6.3.4 The scope of the assessment has been informed by consultation responses detailed in **Technical Appendix 1.1**: Consultation Register of **Chapter 1: Introduction** (EIAR Volume 4) and the following key industry standard guidelines, national and local policies of relevance to ecology.

Legislation

6.3.5 The following key pieces of legislation have been considered in carrying out the assessment:

- European Union Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (‘Habitats Directive’);
- European Union Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (‘Water Framework Directive’);
- Environmental Impact Assessment Directive 85/337/EEC, as amended (‘EIA Directive’) (as subsequently codified by Directive 2011/92/EU, as amended by Directive 2014/52/EU);
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Conservation of Habitats and Species Regulations 2017 apply in Scotland in relation to reserved matters, including consents granted under Sections 36 and 37 of the Electricity Act 1989*;
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)*;
- The Electricity Act 1989;
- The Water Environment and Water Services (Scotland) Act 2003 (WEWS);
- Nature Conservation (Scotland) Act 2004 (as amended);
- Wildlife and Natural Environment (Scotland) Act 2011 (WANE);
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011;
- Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003;

- Wildlife and Countryside Act 1981 (as amended); and,
- Protection of Badgers Act 1992.

  * The Conservation of Habitats and Species Regulations 2017 and The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) will hereafter collectively be referred to as the 'Habitats Regulations'.

Planning Policy

6.3.6 The following key pieces of planning policy of relevance to ecology have been considered in carrying out this assessment:

- Scottish Government (2023[1]) National Planning Framework 4;
- Joint Nature Conservation Committee (JNCC) and Department for Environment, Food and Rural Affairs (DEFRA) (2012[2]). UK Post-2010 Biodiversity Framework.
- Scottish Executive (2004[3]). Scottish Biodiversity Strategy: It's in Your Hands.
- Scottish Government (2000[4]). Planning Advice Note (PAN)60: Planning for Natural Heritage;
- Draft Planning Guidance: Biodiversity[5] (November 2023);
- Planning Advice Note 1/2013-Environmental Impact Assessment[6] (August 2013);
- Scottish Government (2022a[7]). Onshore Wind Policy Statement 2022.
- Scottish Biodiversity Strategy to 2045[8]. Tackling the Nature Emergency in Scotland.
- Scottish Government (2023[9]). National Planning Framework (NPF)4;

  Scottish Government (2016[10]) Draft Peatland and Energy Policy Statement; and
- South Lanarkshire Local Development Plan (LDP2)[11].

Guidance

6.3.7 The following key pieces of guidance have also been considered in carrying out this assessment:

- Chartered Institute for Ecology and Environmental Management (CIEEM) (2018) (updated 2022[12]) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine;

[1] Scottish Government (2023) National Planning Framework 4. Available at:https://www.gov.scot/publications/national-planning-framework-4/. Accessed on: 6 July 2023

[2] Joint Nature Conservation Committee and DEFRA (on behalf of the Four Counties' Biodiversity Group) (2012). UK Post-2010 Biodiversity Framework (July 2012). Available at: https://jncc.gov.uk/our-work/uk-post-2010-biodiversity-framework/. Accessed on: 6 July 2023

[3] Scottish Executive (2004). Scottish Biodiversity Strategy: It's in Your Hands.

[4] Scottish Government (2000). Planning Advice Note (PAN) 60: Planning for Natural Heritage.

[5] https://www.gov.scot/publications/scottish-government-draft-planning-guidance-biodiversity/ [Accessed May 2024]

[6] https://www.gov.scot/publications/planning-advice-note-1-2013-environmental-impact-assessment/ [Accessed May 2024]

[7] Scottish Government (2022a). Onshore Wind Policy statement – available at Onshore wind: policy statement 2022 - gov.scot (www.gov.scot)

[8] Scottish Government (2022b). Scottish Biodiversity Strategy to 2045. Tackling the Nature Emergency in Scotland. Scottish Government, Edinburgh.

[9] Scottish Government (2023). National Planning Framework 4. https://www.gov.scot/publications/national-planning-framework-4/

[10] Scottish Government (2016). Draft Peatland and Energy Policy Statement. Available at: https://www.gov.scot/publications/peatland-and-energy-draft-policy-statement/. Accessed on: 6 July 2023

[11] South Lanarkshire Council Local Development Plan (LDP2). Available at: https://www.southlanarkshire.gov.uk/info/200145/planning_and_building_standards/39/development_plans/2

[12] CIEEM (2018*). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1*. Chartered Institute of Ecology and Environmental Management, Winchester.

- Collins, J. (2023[13]). Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th edition);
- South Lanarkshire Biodiversity Strategy 2024-2030[14]
- European Commission (2020) Guidance document on wind energy developments and EU nature legislation[15].
- JNCC and Defra (on behalf of the Four Countries' Biodiversity Group) (2012[16]) UK Post-2010 Biodiversity Framework.
- Joint Nature Conservation Committee (JNCC) (2013[17]) Guidelines for selection of biological Sites of Special Scientific Interest (SSSI).
- NatureScot, Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter & Bat Conservation Trust (BCT) (2019, with minor updates 2021[18]). Bats and Onshore Wind Turbines – Survey, Assessment and Mitigation.
- NatureScot (2024[19]) General Pre-application and Scoping Advice to Developers of Onshore Wind Farms.
- NatureScot (2022[20]) General pre-application and scoping advice for solar farms;
- Scottish Badgers (2018[21]) Surveying for Badgers: Good Practice Guidelines. Version 1.
- Scottish Executive (2000[22]) Nature conservation: implementation in Scotland of EC Directives on the conservation of natural habitats and of wild flora and fauna and the conservation of wild birds ('The Habitats and Birds Directives'). Revised guidance updating Scottish Office Circular no. 6/1995.
- Scottish Environment Protection Agency (SEPA) (2017[23]) Land Use Planning System Guidance Note 4 - Planning guidance on on-shore windfarm developments.
- SEPA (2017[24]) Land Use Planning System Guidance Note 31 - Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems.

[13] Collins, J. (2023[13]) Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th edition). Bat Conservation Trust.
[14] South Lanarkshire Council Biodiversity Strategy. Available at: https://www.southlanarkshire.gov.uk/downloads/file/16574/biodiversity_strategy_2024_-_2030
[15] European Commission (2020). Guidance document on wind energy developments and EU nature legislation. Available at: https://ec.europa.eu/environment/nature/natura2000/management/docs/wind_farms_en.pdf. Accessed: 6 July 2023
[16] Joint Nature Conservation Committee and DEFRA (on behalf of the Four Counties' Biodiversity Group) (2012). UK Post-2010 Biodiversity Framework (July 2012). Available at: https://jncc.gov.uk/our-work/uk-post-2010-biodiversity-framework/. Accessed on: 6 July 2023
[17] Joint Nature Conservation Committee (2013). Guidelines for selection of biological Sites of Special Scientific Interest (SSSI). Available at: https://jncc.gov.uk/our-work/guidelines-for-selection-of-sssis/. Accessed on: 6 July 2023
[18] NatureScot, Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter & Bat Conservation Trust (BCT) (2019, updated 2021). Bats and Onshore Wind Turbines – Survey, Assessment and Mitigation;
[19] NatureScot (2024). General Pre-application and Scoping Advice to Developers of Onshore Wind Farms. NatureScot pre-application guidance for onshore wind farms | NatureScot [Accessed 08/08/2024)
[20] NatureScot (2022) General pre-application and scoping advice for solar farms | NatureScot.[Accessed June 2024]
[21] Scottish Badgers (2018). Surveying for Badgers: Good Practice Guidelines. Version 1. Available at: https://www.scottishbadgers.org.uk/wp-content/uploads/2020/12/Surveying-for-Badgers-Good-Practice-Guidelines_V1-2020-2455979.pdf. Accessed on: 6 July 2023
[22] Scottish Executive (2000). Nature conservation: implementation in Scotland of EC Directives on the conservation of natural habitats and of wild flora and fauna and the conservation of wild birds. Revised guidance updating Scottish Office Circular no. 6/1995. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/foi-eir-release/2020/01/foi-201900008726/documents/foi-201900008726-information-released-a/foi-201900008726-information-released-a/govscot%3Adocument/FOI%2B-%2B201900008726%2B-%2BInformation%2Breleased%2B-%2BCircular%2B6-1995%2BNature%2BConservation%2B-%2B%2527The%2BHabitats%2Band%2BBirds%2BDirectives%2527%2B%2528Updated%2BJune%2B2000%2529..PDF. Accessed on: 6 July 2023
[23] Scottish Environment Protection Agency (2017). Land Use Planning System Guidance Note 4 – Planning guidance on on-shore windfarm developments. Available at: https://www.sepa.org.uk/media/136117/planning-guidance-on-on-shore-windfarms-developments.pdf. Accessed on: 6 July 2023
[24] Scottish Environment Protection Agency (2017). Land Use Planning System Guidance Note 4 – Planning guidance on on-shore windfarm developments. Available at: https://www.sepa.org.uk/media/136117/planning-guidance-on-on-shore-windfarms-developments.pdf. Accessed on: 6 July 2023

- Scottish Government (2001[25]). European Protected Species, Development Sites and the Planning Systems: Interim guidance for local authorities on licensing arrangements.
- Scottish Government (2006[26]). European Protected Species – terms of guidance: Chief Planner letter.
- Scottish Government (2017a[27]) Planning Advice Note 1/2013 - Environmental Impact Assessment, Revision 1.0.
- Scottish Government (2017b[28]) Planning Circular 1/2017: Guidance on The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.
- Scottish Government (2020[29]) Scottish biodiversity strategy post-2020: statement of intent.
- SNH (2015[30]) Scotland's National Peatland Plan.
- SNH (2016a[31]) Planning for Development: What to consider and include in deer assessments and management at development sites (Version 2).
- SNH (2016b[32]) Planning for Development: What to consider and include in Habitat Management Plans. Version 2.
- SNH (2018a[33]). Advising on carbon-rich soils, deep peat and priority peatland habitat in development management.
- SNH (2018b[34]) Environmental Impact Assessment Handbook – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland.
- Scottish Renewables, SNH, SEPA, Forestry Commission (Scotland), HES, AEECoW (2019[35]) Good Practice During Windfarm Construction (4th Edition).

Features and Potential Effects Scoped Out

6.3.8 On the basis of the professional judgement of the EIA team, experience from other relevant projects and policy guidance[19] or standards, there are some protected species (e.g. moths

[25] Scottish Government (2001). European Protected Species, Development Sites and the Planning Systems: Interim guidance for local authorities on licensing arrangements. Available at: https://www.webarchive.org.uk/wayback/archive/20150220012946/http://www.gov.scot/Publications/2001/10/10122/File-1. Accessed on: 6 July 2023

[26] Scottish Government (2006). European Protected Species – terms of guidance: Chief Planner letter. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/correspondence/2006/05/european-protected-species-chief-planner-letter/documents/ec-directive-92_43_eec-conservation-natural-habitats-wild-flora-fauna-pdf/ec-directive-92_43_eec-conservation-natural-habitats-wild-flora-fauna-pdf/govscot%3Adocument/EC%2BDirective%2B92_43_EEC%2BOn%2Bthe%2BConservation%2Bof%2BNatural%2BHabitats%2Band%2Bof%2BWild%2BFlora%2Band%2BFauna.pdf. Accessed on: 6 July 2023

[27] Scottish Government (2017a). Planning Advice Note 1/2013 – Environmental Impact Assessment, Revision 1.0. Available at: https://www.gov.scot/publications/planning-advice-note-1-2013-environmental-impact-assessment/. Accessed on: 6 July 2023

[28] Scottish Government (2017b). Planning Circular 1/2017: Guidance on The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017. Available at: https://www.gov.scot/publications/planning-circular-1-2017-environmental-impact-assessment-regulations-2017/. Accessed on: 6 July 2023

[29] Scottish Government (2020). Scottish biodiversity strategy post-2020: statement of intent. Available at: https://www.gov.scot/publications/scottish-biodiversity-strategy-post-2020-statement-intent/. Accessed on: 6 July 2023

[30] SNH (2015). Scotland's National Peatland Plan. Available at: https://www.nature.scot/doc/scotlands-national-peatland-plan-working-our-future. Accessed on: 6 July 2023

[31] SNH (2016a). Planning for Development: What to consider and including in deer assessments and management at development sites (Version 2). Available at: https://www.nature.scot/doc/guidance-planning-development-what-consider-and-include-habitat-management-plans. Accessed on: 6 July 2023

[32] SNH (2016b). Planning for Development: What to considered and including in Habitat Management Plans. (Version 2). Available at: https://www.nature.scot/doc/guidance-planning-development-what-consider-and-include-habitat-management-plans. Accessed on: 6 July 2023

[33] SNH (2018a). Advising on carbon-rich soils, deep peat and priority peatland habitat in development management. Available at: Advising on carbon-rich soils, deep peat and priority peatland habitat in development management. Accessed on: 6 July 2023

[34] SNH (2018b). Environmental Impact Assessment Handbook – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland. Scottish Natural Heritage. Available at: https://www.nature.scot/doc/handbook-environmental-impact-assessment-guidance-competent-authorities-consultees-and-others. Accessed on: 6 July 2023

[35] Scottish Renewables, SNH, SEPA, Forestry Commission (Scotland), HES, AEECoW (2019). Good Practice During Windfarm Construction (4th Edition). Available at: https://www.nature.scot/doc/guidance-good-practice-during-wind-farm-construction. Accessed on: 6 July 2023

and other invertebrates, and amphibians) that, with standard mitigation, are unlikely to experience any significant environmental effects.

6.3.9 Furthermore, generally common and widely distributed habitats or species which do not fall within the following categories were scoped out of the detailed assessment:

- Habitats listed in Annex I to the Habitats Directive, and species listed in Annex II to the Habitats Directive (i.e. European Union Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora);
- Wild deer population;
- Migratory salmonids and resident fish;
- Biodiversity Action Plan (UKBAP) or Scottish Biodiversity List (SBL) Priority Habitats; and,
- Habitats or species protected by other legislation such as The Wildlife and Countryside Act 1981 (as amended), the Habitats Regulations or The Protection of Badgers Act 1992.

6.3.10 Beaver (*Castor fiber*), wildcat (*Felix sylvestris*) and great crested newt (GCN) (*Triturus cristuatus*) were scoped out of the assessment due to the absence of suitable habitat (wildcat and GCN) or the survey area being located outwith the known range or distribution (beaver).

6.3.11 Based on information provided by the Clyde Rivers Foundation (CRF), Freshwater Pearl Mussel (*Margaritifera margaritifera*) are scoped out of the assessment. CRF confirmed that Freshwater Pearl Mussel are not present in the Site; they are unlikely to be above the Falls of Clyde and may not be present any longer in the Clyde Catchment[36] or within the upper reaches of the Clyde.

6.3.12 Further ecological features and potential effects have been scoped out of the detailed assessment based on the results of the desk-based study and survey work undertaken for the Proposed Development, due to a lack of potential significant effect at a relevant species population or habitat extent scale. Details of ecological features and effects scoped out after further data searches and post-survey are provided in paragraphs 6.7.1 6.7.22.

Method of Baseline Characterisation

Extent of the Study Area

6.3.13 The area within which the desk-based research and field surveys were undertaken varies depending on the ecological features and sensitivity to impacts. Details of extents are described in the relevant sections in the Baseline Section of this Chapter below and associated Technical Appendices and their respective Figures.

6.3.14 Hereafter in this Chapter, the areas covered by field surveys are termed the 'survey area' and these same areas which are considered as part of the assessment process are then collectively referred to as the 'study area' (N.B. the study area generally equates to the application boundary and comprises the whole of the red line boundary, including the turbine array, solar array, battery energy storage system (BESS), substation, and access tracks, except for designated sites where the study area is a 5 km distance band around the Site (**Figure 6.1;** EIAR Volume 3a).

Desk Study

6.3.15 A desk-based assessment was undertaken to collate existing available ecological information in relation to the Site and surrounding environment. This comprised a search of available online datasets, desk-based assessment resources and consultation with other organisations.

[36] Based on 22 years experience working in the catchment.

6.3.16 The following data sources were considered as part of the determination of scope of baseline surveys and subsequent assessment:

- National Biodiversity Network (NBN) Atlas Scotland (NBN, 2023)[37] for protected or notable species records within 5 km of the Site, extended to 10 km for records of bat species, from the last 15 years (i.e., 2009 and onwards);
- NatureScot Sitelink (NatureScot, 2023)[38] for designated site information within 5 km of the Site;
- Ancient Woodland Inventory Scotland (NatureScot (2024)[39] for ancient woodland sites within 5 km of the Site;
- Scotland's Environment Map (SEPA, 2024) for the Carbon and Peatland Map (2016)[40];
- South Lanarkshire Local Biodiversity Action Plan 2019-2024 (South Lanarkshire Council, 2019)[41];
- The British Deer Society (2023)[42] for deer distribution survey results;
- Saving Scotland's Red Squirrels (2024)[43] for evidence of red squirrel from within 5 km of the Site;
- SEPA Water Environment Hub (SEPA, 2015)[44] for watercourse classification;
- EIA documentation for Bodinglee Wind Farm[45] (adjacent to the Site); and,
- Relevant scientific literature on protected species' distribution, habitats distribution and conservation status etc.

Field Survey

6.3.17 The following field surveys were undertaken to further establish the baseline ecological conditions at the Proposed Development (plus appropriate buffers) to inform the assessment and were undertaken in line with standard methodologies and best practice guidance:

- National Vegetation Classification (NVC) surveys, incorporating Phase 1 habitat characterisation and potential Groundwater Dependent Terrestrial Ecosystem (GWDTE) habitats (September 2023);
- Protected species surveys (August 2023), focusing on otter (*Lutra lutra*), water vole (*Arvicola amphibius*), badger (*Meles meles*), red squirrel (*Sciurus vulgaris*) and pine marten (*Martes martes*);
- Preliminary bat roost assessments (August 2023);
- Tree climbing and bat endoscope surveys (January 2024);
- Roosting assessment of identified barn (June 2024);
- Bat activity surveys (May 2023 to September 2023); and,
- Fisheries surveys, including electrofishing and habitat surveys (June 2023).

[37] NBN Atlas Scotland (2023). Online. Available at: https://nbnatlas.org/ [Accessed June 2024]. Record holders are named in Technical Appendix 6.2 (EIAR Volume 4a)

[38] NatureScot (2023). SiteLink. Online. Available at: https://sitelink.nature.scot/home [Accessed June 2024].

[39] Ancient Woodland Inventory (Scotland). Available at: https://www.spatialdata.gov.scot/geonetwork/srv/api/records/A091F945-F744-4C8F-95B3-A09E6EF6AE33 Accessed June 2024.

[40] Scottish Government (2023). Scotland's Soils. Available at: https://map.environment.gov.scot/Soil_maps/?layer=10#. Accessed: 6 June 2024.

[41] https://www.southlanarkshire.gov.uk/downloads/download/389/ [Accessed June 2024].

[42] The British Deer Society (2023). Deer Distribution Survey Results. Available online: https://bds.org.uk/science-research/deer-surveys/deer-distribution-survey/ [Accessed May 2024].

[43] Scottish Squirrels. (2023). Saving Scotland's Red Squirrels. Online. Available at: https://scottishsquirrels.org.uk/ [Accessed May 2024].

[44] https://www.sepa.org.uk/data-visualisation/water-environment-hub/ [Accessed May 2024].

[45] https://publicaccess.southlanarkshire.gov.uk/online-applications/applicationDetails.do?activeTab=documents&keyVal=RYCKJ9OP07P00 [Accessed 14 May 2024].

6.3.18 Incidental records of other protected species (such as signs or features of particular importance i.e., potential signs of adder (*Vipera berus*), common or viviparous lizard (*Zootoca vivipara*), slow worm (*Anguis fragilis*), and potential hibernacula for reptiles), notable species, or invasive non-native species (INNS), were also recorded during field surveys.

6.3.19 The full details of the survey methods, species-specific legislation and guidance and results for surveys undertaken in 2023 and 2024 are provided within **Technical Appendices 6.1 - 6.4** (EIAR Volume 4).

6.3.20 Respective survey areas shown in **Figures 6.3 – 6.11** inclusive.

Method of Assessment

6.3.21 The assessment methodology, including criteria for identifying and assessing sensitivity of IEFs, magnitude of change and cumulative effects, as well as overall significance criteria, is detailed in **Technical Appendix 6.7**.

Limitations

6.3.22 Limitations exist regarding the knowledge base on how some species, and the populations to which they belong, react to impacts. A precautionary approach is taken in these circumstances, and as such it is considered that these limitations do not affect the robustness of this assessment.

6.3.23 Ecological surveys are limited by factors which affect the presence of plants and animals, such as the time of year, migration patterns, and behaviour. The ecological surveys undertaken to inform the assessment of the Proposed Development have not therefore produced a complete list of plants and animals and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it will not be present in the future.

6.3.24 Some relatively small areas of habitats that could not be surveyed due to Health and Safety concerns (e.g., no access to verges of the M74) or were not surveyed due to the iterative design and minor changes to the red line boundary, have been based on adjacent surveyed habitats, desk-based aerial image and photography review, local knowledge and ecologist experience. The latter habitats are largely restricted to the red line boundary edge away from proposed infrastructure or road verges, and as such, the limitation is not considered to be significant.

6.3.25 No notable limitations were experienced with regards to habitats, fish, or protected species field surveys. The bat field surveys experienced some limitation due to failed Anabat detectors, however all bat detectors are susceptible to limitations and sufficient data was collected to inform a robust assessment regarding bat activity (see **Technical Appendices 6.1 - 6.4** (EIAR Volume 4) for details).

6.3.26 Whilst some general limitations have been identified, it is considered that there is sufficient information to enable a robust assessment to be taken in relation to the identification and assessment of potential effects on ecological features.

Assumptions

6.3.27 The following assumptions are included in the assessment of otherwise unmitigated effects on IEFs:

- Work on the Proposed Development, including vegetation clearance and construction of new access tracks, turbine hardstandings and other ancillary infrastructure, erection of the turbines and solar array, and site restoration is predicted to last for approximately 18 months, as set out in Chapter 2 Development Description (Table 2.4).

- All electrical cabling between turbines and the associated infrastructure would be underground in shallow trenches which would be reinstated post-construction and, in all cases, follow the access tracks.
- The construction compound and any temporary laydown areas will be temporary infrastructure. Any disturbance or earthworks around permanent infrastructure during construction would be temporary and areas reinstated or restored before the construction phase ends.
- The standard pre-construction and construction phase mitigation described in the Standard Mitigation section below will be fully applied, e.g., the presence of an ECoW, adherence to the agreed Species Protection Plan (SPP) and Construction Environmental Management Plan (6.3.27).
- Maintenance of the Proposed Development will involve vehicular access along the access tracks only. This will be small -scale work undertaken occasionally. This is unlikely to result in any operational effects on any species or habitats recorded at and around the Proposed Development.

Standard Mitigation Measures

PRE-CONSTRUCTION & CONSTRUCTION

6.3.28 General and standard mitigation measures for habitats and species, such as complying with best practice, micrositing provisions, presence of an ECoW and adherence to a detailed CEMP (**Technical Appendix 2.1** (EIAR Volume 4)) and SPP (**Technical Appendix 6.5** (EIAR Volume 4)) will be implemented.

6.3.29 Three features offering moderate or high potential to support roosting bats fell within the required turbine buffers (i.e., 200 m + rotor radius = 275.5 m), and required further survey to determine or assess the likelihood of a roost being present. However, through design, the turbines have been moved so potential roosting features (PRF) are no longer within the necessary 275.5 m buffer and no further work was required.

6.3.30 A SPP (outline SPP provided in **Technical Appendix 6.5** (EIAR Volume 4)) will be implemented during the construction phase. The SPP details measures to safeguard protected species known or likely to be in the area. The SPP includes pre-construction surveys and good practice measures during construction. Pre-construction surveys will be undertaken to check for any new protected species or features in the vicinity of the construction works. The results of the pre-construction surveys will be used to update the outline SPP ahead of construction starting. The SPP will remain a live document to be updated as required and in agreement with the ECoW where changes to the distribution and status of protected species and features are recorded.

6.3.31 Any micrositing of infrastructure will be based on a review of existing ecological data and the findings of completed pre-construction surveys, to take into consideration the potential for direct encroachment onto protected species features, sensitive habitats or GWDTEs, or indirect alteration of hydrological flows supporting sensitive habitats or GWDTEs. Any micrositing will also take into consideration any buffer distances on protected features identified, as detailed within the SPP (**Technical Appendix 6.5** (EIAR Volume 4)).

6.3.32 There will be a contractual management requirement for the successful Contractor to develop and implement a comprehensive, site-specific and robust CEMP in consultation with the SEPA and the planning authority. This document will detail how the successful Contractor will manage the works in accordance with all commitments and mitigation detailed in the EIA Report, the SPP, statutory consents and authorisations, and good industry practice and guidance for environmental management, including implementation of appropriate pollution prevention (particularly in relation to watercourses).

6.3.33 The standard mitigation includes that construction work would comply with a CEMP developed by the Principal Contractor, which would be monitored by a suitably experienced ECoW. The ECoW will be appointed prior to the commencement of construction to advise the Applicant and the Contractor on all ecological matters. The ECoW will be required to be present on-Site during the construction phase and will carry out monitoring of works and briefings with regards to any ecological sensitivities on the Site to the relevant staff of the Contractor and sub-contractors.

6.3.34 Low-level security lighting at the substation, battery energy storage system (BESS) and solar array would also be required (see **Chapter 2: Development Description**, EIAR Volume 1).

6.3.35 A wildlife-friendly lighting scheme, to minimise the impacts of such infrastructure lighting on crepuscular species such as bats, otter and badger, and their navigation corridors will however be agreed in consultation with NatureScot and submitted to South Lanarkshire Council for approval.

OPERATION

6.3.36 The points discussed in paragraphs 6.3.34 and 6.3.35 will be implemented during the operational phase of the development.

6.3.37 In line with best practice guidance on bats (NatureScot *et al*., 2021[27]) the Proposed Development will utilise the method of reduced rotation speed whilst idling by feathering, at all wind turbines, to reduce collision risks to bats during the bat active period (April to October). The guidance notes that, "*The reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50 %*". Given the known presence of high collision risk bat species on-Site, this measure will be put in place from the start of the operational period of the Proposed Development, and it does not result in any loss of output.

6.3.38 Operational phase environmental management plans following relevant best practice and guidance will be in place during operation of the Proposed Development, these will for example include provisions for, but not limited to, ongoing pollution prevention control measures.

DECOMMISSIONING

6.3.39 Based on the time between construction and decommissioning, the mitigation required at decommissioning cannot be accurately identified at this stage. However, it would include pre-decommissioning surveys, adherence to the Decommissioning Environmental Management Plan (DEMP), presence of an ECOW and adherence to a SPP.

6.4 Baseline Conditions

Desk-Based Study

Designated Sites

6.4.1 Designated sites located within 5 km of the Site, and the relevant qualifying features relevant to this assessment are detailed in **Table 6.1** and illustrated in **Figure 6.1** (EIAR Volume 3a).

Table 6.1: Designated sites within 5 km of the Site				
Designated Site	**Distance from Site boundary**	**Distance from nearest proposed infrastructure**	**Qualifying Feature**	**Last Assessed Condition & Date**
Red Moss Special Area of Conservation (SAC)	Within Site boundary	125 m to turning head for Turbine 18	Active Raised Bog	Unfavourable Recovering 25/08/2015
Red Moss Site of Special Scientific Interest (SSSI)	Within Site boundary	125 m to turning head for Turbine 18	Raised Bog	Unfavourable Recovering 25/08/2015

Ancient Woodland

6.4.2 The definition of ancient woodland is land that is currently wooded and has been continually wooded at least since 1750. It is not related to the age of the trees that are currently growing there and they do not have to be ancient or elderly, as it is the historical continuity of the woodland habitat that makes a woodland ancient.

6.4.3 There is a single Ancient Woodland Inventory (AWI) site (as present on the Ancient Woodland Inventory[46]) partially within the Site, located northeast of Craighead Hill, known as Whitrae Wood. This is categorised as 2b (long-established woodlands of plantation origin);

- **Long-established woodlands of plantation origin (LEPO) (1b and 2b)** - Interpreted as plantation from maps of 1750 (1b) or 1860 (2b) and continuously wooded since. Many of these sites have developed semi-natural characteristics, especially the oldest stands, which may be as rich as ancient woodland.

6.4.4 Within 5 km of the Site there are several further areas of AWI, see **Figure 6.1** (Volume 3a).

Habitats

Terrestrial Habitats

6.4.5 The Carbon and Peatland Map 2016[47] was consulted to determine likely peatland classes present. The map is a predictive tool that provides an indication of the likely presence of peat at a high level. The map has been developed as *"a high-level planning tool to promote consistency and clarity in the preparation of spatial frameworks by planning authorities"[48].* It identifies areas of *"nationally important carbon-rich soils, deep peat and priority peatland habitat"[49]* as Class 1 and Class 2 peatlands. Class 1 peatlands are also *"likely to be of high conservation value"* and Class 2 *"of potentially high conservation value and restoration potential".*

6.4.6 **Figure 6.2** (EIAR Volume 3a) indicates that, according to this predictive tool and map, the Site contains a relatively small area of Class 1 peatland to the west by Red Moss. The majority of the remaining area is composed of Class 0[50] (mineral) soils (in the east), Class 3[51] soils (to

[46] NatureScot (2024). Ancient Woodland Inventory. Online. Available: https://opendata.nature.scot/datasets/ancient-woodland-inventory/explore.

[47] SNH. (2016) Carbon and Peatland 2016 map. Online. Available: https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/soils/carbon-and-peatland-2016-map.

[48] https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/soils/carbon-and-peatland-2016-map [Accessed June 2024].

[49] Priority peatland habitat is land covered by peat-forming vegetation or vegetation associated with peat formation.

[50] Class 0 - Mineral soil - Peatland habitats are not typically found on such soils. No peatland vegetation.

[51] Class 3 - Dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type. Occasional peatland habitats can be found. Most soils are carbon-rich soils, with some areas of deep peat. Indicative soil = Predominantly peaty soil with some peat soil. Indicative vegetation = Peatland with some heath.

the west, and north of the B7078 road), and Class 5[52] soils (to the west, and south of the B7078 road).

6.4.7 As the Carbon and Peatland Map is a high-level tool, detailed habitat and peat depth surveys have been carried out across the Site to inform siting, design and mitigation and the detailed assessment on peatland and associated habitats. The results of the habitat surveys are discussed in **Technical Appendix 6.1**, and the results of the peat depth surveys are presented and discussed in **Chapter 8: Hydrology, Hydrogeology and Geology** and associated Technical Appendices.

AQUATIC HABITATS

6.4.8 All watercourses within the Site flow south and southeast into the Duneaton Water, which then roughly flows southwest to northeast between the turbine array and solar arrays (see **Figure 6.1** (EIAR Volume 3a)). The Duneaton Water flows into the upper River Clyde to the east of the Site.

6.4.9 The Duneaton Water and River Clyde (Potrail to Mouse Water) was classified by SEPA as part of their Water Framework Directive (WFD) classification, and was assessed in 2022 as having an overall status of Moderate ecological potential (classified as potential as waterbody is classified as a heavily modified water body).

6.4.10 Barriers to fish migration are noted as a pressure on the condition of the upper River Clyde.

Protected Species

6.4.11 A search of the NBN Atlas Scotland (2023)[53] covering a 5 km buffer from the Site in the past 15 years (i.e., from 2008 onwards) identified records of the following protected or notable species:

- Eurasian badger;
- Eurasian red squirrel; and
- common lizard.

6.4.12 The NBN Atlas[54] search also identified records of the following bat species within 10 km of the Site between 2009 - 2024 inclusive:

- Daubenton’s bat (*Myotis daubentonii*);
- Natterer's bat (*Myotis nattereri*);
- *Myotis* spp.;
- Pipistrelle spp.;
- Common pipistrelle (Pipistrellus pipistrellus);
- Soprano pipistrelle (*Pipistrellus pygmaeus*); and
- Brown long-eared bat (*Plecotus auritus*).

6.4.13 No sightings of red or grey squirrels have been recorded on Saving Scotland’s Red Squirrels within 5 km of the Site in the past 13 years (i.e. since 2010).

[52] Class 5 - Soil information takes precedence over vegetation data. No peatland habitat recorded. May also include areas of bare soil. Soils are carbon-rich and deep peat. Indicative soil = Peat soil. Indicative vegetation = No peatland vegetation.
[53] Above licences referenced in Technical Appendix 6.2 (EIAR Volume 4).
[54] Above licences referenced in Technical Appendix 6.3 (EIAR Volume 4).

6.4.14 Surveys undertaken to inform the EIAR for Bodinglee Wind Farm[55] (adjacent to the Proposed Development) recorded evidence of:

- bats (foraging and commuting);
- otter (foraging and commuting);
- badger (foraging and commuting);
- brown hare (Lepus europaeus);
- trout; and
- reptile sp.

FISH

6.4.15 The Site is located in the upper River Clyde catchment. Based on the presence of natural fish barriers downstream on the River Clyde, migratory Atlantic salmon (*Salmo salar*) and European eel (*Anguilla anguilla*) are known not to be present in the upper River Clyde.

Other Species

INVASIVE NON-NATIVE SPECIES (INNS)

6.4.16 A search of the NBN Atlas Scotland (2023)[56] covering a 5 km buffer from the Site from 2008 onwards returned records of the following INNS:

- Grey squirrel (*Scirurus carolinensis*); and
- Signal crayfish (Pacifastacus leniusculus).

Field Surveys

Habitats

NATIONAL VEGETATION CLASSIFICATION (NVC) AND PHASE 1

6.4.17 **Technical Appendix 6.1** (EIAR Volume 4) sets out detailed descriptions of habitats identified, and vegetation recorded during the respective surveys. The NVC data collected were also cross-referenced to the Phase 1 Habitat Survey Classification (JNCC, 2010)[57] to allow a broader characterisation of habitats. The extent of Phase 1 habitat types within the Site was calculated using the correlation of NVC communities to their respective Phase 1 types specific to the Site and their extents mapped within ArcGIS software, including within mosaic areas.

6.4.18 Twenty-eight NVC communities and 16 non-NVC communities were recorded within the Site and wider survey area, and which corresponded to 29 Phase 1 habitat types. These communities and habitat types, and their respective Site-specific correlations are detailed in **Technical Appendix 6.1** (EIAR Volume 4), and their distributions illustrated in **Figure 6.3** (EIAR Volume 3a).

6.4.19 The extents of NVC communities and non-NVC types recorded within the Site are provided in **Annex A, Table 6.6** (included at the end of this chapter) and include proportions of particular habitat types that are found within the Site, including those within mosaic habitats.

6.4.20 The Site predominantly supports a mixture of unimproved acid grassland, marshy grassland, wet modified bog and improved grassland as summarised in **Diagram 6.1**.

55 https://publicaccess.southlanarkshire.gov.uk/online-applications/applicationDetails.do?activeTab=documents&keyVal=RYCKJ9OP07P00 [Accessed June 2024]

56 Above licences referenced in Technical Appendix 6.2 and Technical Appendix 6.3

57 JNCC (2010). Handbook for phase 1 habitat survey – a technique for environmental audit.

6.4.21 Interwoven throughout theses are patches and pockets of several other habitat types including broadleaf woodland plantation, wet dwarf shrub heath, blanket bog, acid/neutral flush, bare ground, semi-improved acid grassland and unimproved neutral grassland. It should be noted that non-native conifer plantation is present on the Site; this was created through a forestry grant scheme.

6.4.22 The only habitat types that have subsequently been scoped into the assessment of effects due to their extent and nature conservation value (as detailed in **Technical Appendix 6.1** (EIAR Volume 4)) are blanket bog and wet modified bog. Blanket bog here is mainly represented by the M17 and M19 NVC communities. The M2 community was also infrequently recorded. These habitats are associated with Scottish Biodiversity List (SBL) blanket bog habitat with some areas also corresponding to Annex 1 type 7130 blanket bog habitat. Wet modified bog communities recorded comprised M20, and M25 and M15 when on peat over 0.5 m in depth.

6.4.23 The blanket bog within the survey area is a degraded resource that has been impacted over time in several ways. Historical and ongoing impacts on blanket bog (and wet modified bog) at the Site include livestock grazing and agricultural improvement, extensive moor grip drainage, conifer plantation (direct planting on peatland and also indirect effects, such as drainage and ground disturbance), the presence of an active quarry and associated track and drainage network (e.g., direct removal of peat, and drainage and disturbance effects), and the presence of the M74 motorway and B7078 road (historically severing and fragmenting larger bog units). Some of the relatively larger patches of bog also exhibit some erosion features, such as haggs. The overall result is a highly fragmented, impacted, modified, and degraded peatland that would be classified, using NatureScot Peatland Action Condition Criteria[58], as predominantly 'Drained: Artificial' with any remaining areas falling within the 'Modified' or, less so, 'Drained: Hagg/Gully' categories.

58 https://www.nature.scot/doc/peatland-action-peat-depth-and-peat-condition-survey-guidance-and-recording-form-guidance

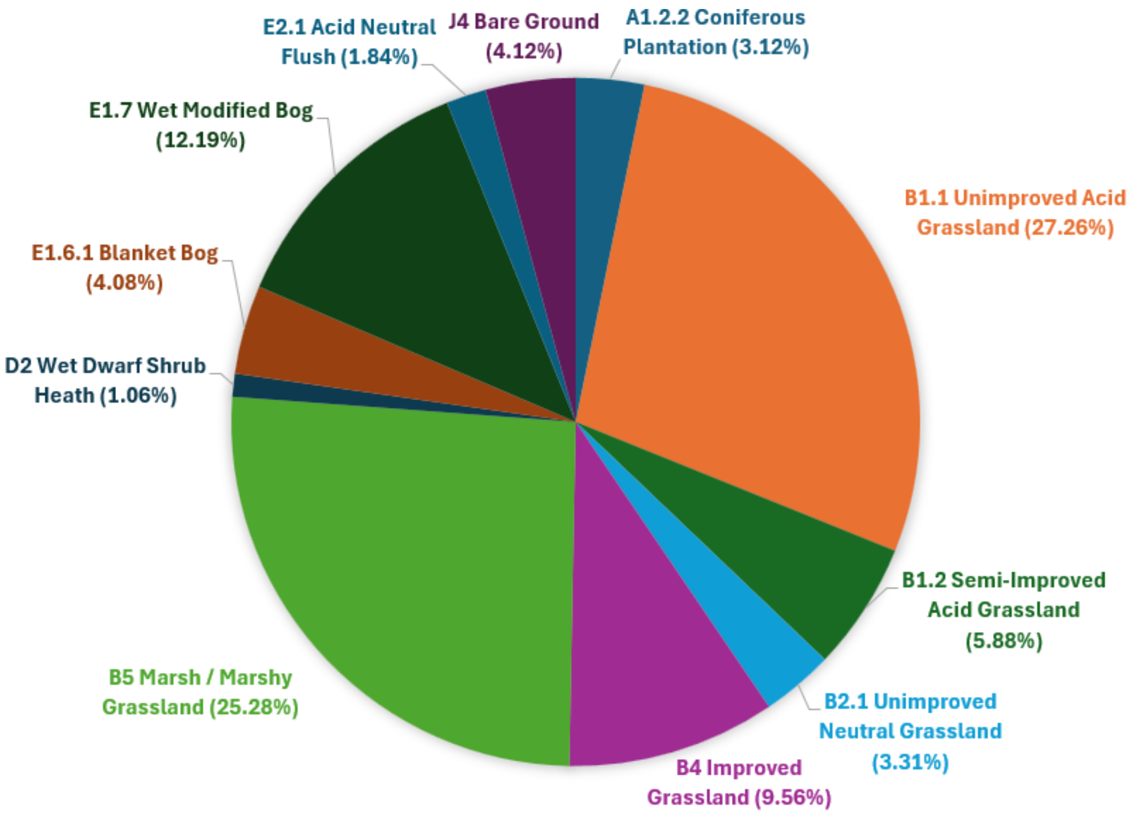

Diagram 6.1: Predominant Phase 1 Habitat Types Recorded within the Site (habitat types making up <1% of the Site are not included).

GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEMS (GWDTEs)

6.4.24 NVC communities recorded within the survey area were referenced against SEPA guidance[24] to identify those habitats which may be classified, depending on the hydrogeological setting, as being potentially groundwater dependent.

6.4.25 Potential GWDTE NVC communities recorded within the survey area are detailed in **Technical Appendix 6.1** (EIAR Volume 4) and their distribution shown on **Figure 6.4** (EIAR Volume 3a).

6.4.26 GWDTE sensitivity has been assigned solely on the SEPA listings. However, many of the NVC communities on the list are common habitat types across Scotland and generally of low Nature Conservation Value. Furthermore, depending on several factors such as geology, superficial geology, presence of peat and topography, many of the potential GWDTE communities recorded may in fact be only partially groundwater fed or not dependent on groundwater. Because designation as a potential GWDTE is related to groundwater dependency and not nature conservation value, GWDTE status has not been used as criteria to determine a habitat's nature conservation value and similarly does not factor in the identification of IEFs within ecological impact assessments. There is however a requirement to consider GWDTEs, and the data gathered during the NVC surveys has been used to inform this assessment in **Chapter 8: Hydrology, Hydrogeology and Geology**.

Annex I Habitats

6.4.27 A number of NVC communities can also correlate to various Annex I habitat types. However, the fact that an NVC community can be attributed to an Annex I type does not necessarily mean all instances of that NVC community constitute Annex I habitat. Its Annex I status can depend on various factors such as quality, extent, species assemblages, geographical setting and substrates.

6.4.28 Joint Nature Conservation Committee (JNCC) Annex I habitat listings and descriptions[16] have been compared with survey results and field observations. Those habitats within the Site which could be considered Annex I habitats are detailed in **Technical Appendix 6.1** (EIAR Volume 4).

Scottish Biodiversity List (SBL) Habitats

6.4.29 The SBL[59] is a list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland.

6.4.30 The SBL identifies habitats which are the highest priority for biodiversity conservation in Scotland; these are termed 'priority habitats'. Some of the priority habitats are quite broad and can be correlated to many NVC types.

6.4.31 Relevant SBL priority habitat types and corresponding associated NVC types recorded within the Site are detailed in **Technical Appendix 6.1** (EIAR Volume 4).

6.4.32 These SBL priority habitats correspond with the UKBAP Priority Habitats[60].

Protected Species (Non-avian)

6.4.33 This section outlines the results from the protected species surveys. Detailed methodologies, survey timings, and results, including the legal status of each species, are included within **Technical Appendices 6.2 - 6.4 inclusive** (EIAR Volume 4), and their associated annexes. Results are presented in **Figures 6.5 - 6.10 inclusive** (EIAR Volume 3a), with confidential information presented on **Figure 6.5.2** (EIAR Volume 3a).

Badger

6.4.34 In total, seven setts were recorded within the Site, including one main sett, one main or subsidiary sett, and five outlier badger setts (detailed in **Technical Appendix 6.2C** (EIAR Volume 4) and **Figure 6.5.2** (EIAR Volume 3a)).

6.4.35 Feeding signs, footprints, dung and a latrine were also recorded **Technical Appendix 6.2C** (EIAR Volume 4) and **Figure 6.5.2** (EIAR Volume 3a).

Bats

6.4.36 This section provides a summary of the field surveys and associated results for bats. Full details are contained within **Technical Appendix 6.3** (EIAR Volume 4).

Bat Roost Surveys

Preliminary Bat Roost Assessment

6.4.37 A total of 29 features were recorded within the study area (Site) and assessed from ground-level as providing negligible to high potential suitability for roosting bats, in accordance with the classifications provided in Collins[13].

[59] https://www.nature.scot/doc/scottish-biodiversity-list [Accessed May 2024]

6.4.38 Tree climbing and endoscope surveys of the three trees / tree groups were completed in January 2024; the surveys were used to allow a more detailed assessment of the features suitability for bats and to look for evidence of bat presence.

6.4.39 No evidence of bat presence was recorded (**Technical Appendix 6.3** (EIAR Volume 4)) and based on the Potential Roost Features (PRFs) present, the recorded features were considered to provide negligible to moderate roosting potential.

6.4.40 However, based on the low bat activity recorded during the automated surveys (see below and **Technical Appendix 6.3** (EIAR Volume 4)), the timing of those calls (not indicative of a nearby roost), the lack of continuous connectivity between the features and the wider environment, and the exposed nature of the Site, the potential moderate roosting features were reduced to low roosting potential.

6.4.41 A barn within the solar array near the M74 (**Figure 6.6** (EIAR Volume 3a)), was subject to a ground-based roost assessment undertaken in June 2024; it confirmed that the barn is of negligible value to roosting bats.

BAT ACTIVITY SURVEYS

AUTOMATED GROUND LEVEL ACTIVITY SURVEYS

6.4.42 Static bat activity surveys involved the deployment of 14 detectors onsite between May and September 2023 over a total period of 42 days, covering spring, summer and autumn and up to a maximum of 14 consecutive nights per season. This resulted in 588 associated data recording nights (significantly more than the 390 as required by NatureScot *et al*.[18] guidance for a development of this size; see **Technical Appendix 6.3** (EIAR Volume 4)). Anabat locations are detailed on **Figure 6.6** (EIAR Volume 3a).

6.4.43 Bats were detected on all 42 survey nights. A total of seven bat species and two bat genera were recorded during surveys, with 4,548 bat registrations in total. The total number of passes recorded for each species, and mean bat passes per hour (bpph), across all detectors is shown in **Table 6.2**.

6.4.44 Soprano and common pipistrelle combined accounted for 94.19% (n = 4,248) of registrations across all surveyed locations (**Table 6.2**).

Table 6.2 Total Number of Bat Passes for Each Species Across all Locations 2023.

Species/Species Group	No of Registrations	Percentage of total (%)	Mean Bat Passes Per Hour
Soprano pipistrelle	974	21.42	0.17
Common pipistrelle	3310	72.78	0.57
Noctule	51	1.12	0.01
Leisler’s	107	2.35	0.02
Daubenton’s	93	2.04	0.02
Natterer’s	6	0.13	0.001
Brown long-eared	7	0.15	0.001
Total	4548	100	1.56

QUANTIFYING ACTIVITY

6.4.45 At the time of preparing **Technical Appendix 6.3** (EIAR Volume 4) and undertaking the assessment within this chapter, the online tool Ecobat[61] was unavailable. Ecobat is the

[61] Mammal Society (2017).

guidance recommended tool to objectively quantify bat activity levels at a site, whereby Ecobat analyses activity levels during nights where bat activity is recorded and assigns a value to the activity levels (low, low/moderate, moderate, moderate/high or high) for each location on each night. In the absence of Ecobat, and on the advice of NatureScot, alternative quantitative methods may be used to assess bat activity levels. As such, the data obtained from the 2023 static bat survey was considered in accordance with NatureScot *et al*. guidance[18] as far as practicable to determine the overall Site risk level for each species of bat. This method is summarised below and involves the following modified steps:

- estimating bat activity levels by calculating bpph;
- categorising collision risk of the relevant species;
- identifying population relevant abundance (size of the populations);
- categorising the potential vulnerability of bat populations by combining collision risk with population abundance;
- categorising the Site risk level;
- completing the overall risk assessment; and
- an assessment of significance and mitigation.

6.4.46 To generate a bat activity index value and allow a comparison between locations, species and seasons, the number of bpph was calculated. This method refers to the number of bat passes as opposed to the number of individual bats recorded, as it is not possible to definitively identify individual bats and the total number of individual bats present. The bpph is used to provide a quantitative measure of bat activity across the Site.

6.4.47 Data on the activity levels for all species recorded across the Site and through the seasons is provided in **Technical Appendix 6.3** (EIAR Volume 4). However, the activity of high collision risk species (as per paragraph 6.4.53) is summarised in **Table 6.3**; see also **Figures 6.7 – 6.9** (EIAR Volume 3a).

Table 6.3 bpph for High Collision Risk Species Across all Locations and Seasons

Common pipistrelle			
	Spring[62] bpph	Summer[63] bpph	Autumn[64] bpph
Location 1	0.00	0.19	0.01
Location 2	0.01	0.07	0.02
Location 3	0.41	2.50	0.64
Location 4	3.57	0.04	0.04
Location 5	0.00	0.02	0.03
Location 6	0.00	0.03	0.01
Location 7	0.01	0.09	0.03
Location 8	0.01	0.02	0.03
Location 9	0.01	0.04	0.02
Location 10	0.00	0.04	0.02
Location 11	0.00	0.11	0.03

62 Survey dates = 24/04/2023 – 08/05/2023.
63 Survey dates = 25/07/2023 – 08/08/2023.
64 Survey dates = 12/09/2023 – 26/09/2023.

Table 6.3 bpph for High Collision Risk Species Across all Locations and Seasons

Location 12	0.02	0.02	0.02
Location 13	7.01	12.37	0.69
Location 14	0.07	0.22	0.15
Soprano pipistrelle			
Location 1	0.01	0.13	0.16
Location 2	0.01	0.02	0.05
Location 3	0.01	0.14	0.46
Location 4	0.00	0.06	0.05
Location 5	0.01	0.01	0.02
Location 6	3.33	0.06	0.04
Location 7	0.01	0.06	0.03
Location 8	0.00	0.03	0.01
Location 9	0.01	0.02	0.02
Location 10	0.00	0.02	0.05
Location 11	0.01	0.04	0.03
Location 12	0.01	0.01	0.01
Location 13	0.64	1.75	2.40
Location 14	0.01	0.06	0.10
Nyctalus spp.			
Location 1	0.00	0.13	0.00
Location 2	0.00	0.03	0.01
Location 3	0.00	0.07	0.01
Location 4	0.00	0.02	0.01
Location 5	0.00	0.02	0.01
Location 6	0.00	0.02	0.00
Location 7	0.00	0.02	0.01
Location 8	0.00	0.02	0.00
Location 9	0.00	0.01	0.01
Location 10	0.00	0.02	0.00
Location 11	0.00	0.01	0.03
Location 12	0.00	0.00	0.00
Location 13	0.04	0.37	0.28
Location 14	0.00	0.02	0.00

6.4.48 Throughout the survey period, for all species, the 28/04/2023, 05/08/2023 and 02/08/2023 recorded the highest total bat passes 722, 556 and 506 respectively.

6.4.49 Survey Location 13 had the highest total number of bat passes (n = 3,440; i.e., 75.6% of all passes) across the survey season, with Location 12 recording a total of 12. Location 13 was located along a plantation edge and within a short distance of Duneaton Water; the nearest proposed turbine is T16, located 330 m to the north in open moorland (**Figure 6.6** (EIAR Volume 3a)). Bats are known to use woodland edges as commuting corridors and the watercourse provides good foraging opportunities (Collins, 2023[13]). Location 12 was positioned just over 500 m from Location 13, on top of a hill, with little foraging opportunities and shelter for commuting bats.

CATEGORISING SITE RISK LEVEL

6.4.50 The Site risk level is determined by project size and habitat risk (**Technical Appendix 6.3** (EIAR Volume 4)). The Proposed Development consists of 22 turbines that are over 50 m in height, and so falls within the '**Medium**' project size.

6.4.51 In terms of habitat risk for bats, there are a small number of buildings and trees with low bat roosting potential within 200 m plus the rotor radius of turbines. Foraging habitat quality and connectivity within this buffer area is low with a largely treeless environment and small open upland burns and a fairly homogenous area of open grazed moorland and grassland habitat present, resulting in a habitat risk classification of '**Low**'.

6.4.52 According to **Technical Appendix 6.3** (EIAR Volume 4), the 'Medium' project size combined with a 'Low' habitat risk level results in an overall Site risk assessment of **'Low/Lowest'**.

CATEGORISING COLLISION RISK, POPULATION ABUNDANCE & POTENTIAL VULNERABILITY

6.4.53 The overall risk assessment is undertaken for high collision risk species only, which were identified at the Proposed Development. As per NatureScot *et al.* (2021) guidance[18], soprano pipistrelle, common pipistrelle, and *Nyctalus* spp. are species deemed to have a high collision risk.

6.4.54 As per NatureScot *et al.* (2021) guidance[18], common and soprano pipistrelle are also considered of common abundance and of medium population vulnerability. *Nyctalus* spp. are considered of rarest abundance and of high population vulnerability.

6.4.55 The remaining species recorded, Daubenton's bat, brown long-eared bat and Natterer's bat, are all considered to have a low collision risk and of low population vulnerability. These low-risk species have a low risk of collision with a turbine blade, so the impact of the Proposed Development on the local bat population would likely be negligible.

ASSESSING POTENTIAL RISK

6.4.56 In analysing bat activity levels, professional judgement has been used previously in the absence of any recognised standard measure to define levels as being high, medium or low. This took into consideration the geographical and Site location and habitats present as well as professional experience. NatureScot *et al*. (2021)[18] recommends the use Ecobat as a measure of activity levels; however, as noted above, at the time of preparation the Ecobat tool was still offline and unavailable.

6.4.57 Therefore, Site specific details, knowledge of bat species behaviour, professional judgement and experience from other and similar projects has been used to assess the bat activity levels at the Proposed Development as high, medium or low. While the appraisal of activity levels was ascertained using professional judgement, the risk assessment has taken due consideration of the NatureScot *et al*. (2021) guidance[18], as shown in the preceding sections above to provide an assessment of risk.

6.4.58 **Figures 6.7**, **6.8** and **6.9** (EIAR Volume 3a) illustrate further the results of the bpph analysis for high collision risk bat species recorded at the Site at each survey location, and per month, to provide an overview of how bat activity and risk levels vary across the Site through the year and by species. As seen in these figures many locations in many of the survey months recorded no activity by high collision risk bat species (in particular *Nyctalus* spp.). However, in locations and months where bat activity was recorded, the Site risk level for common pipistrelle, soprano pipistrelle and Nyctalus spp. per month at each location was considered Low.

6.4.59 As shown in **Figure 6.7** (EIAR Volume 3a), analysis of the risk to common pipistrelle, when considering the bpph, indicate a variation in activity across the majority of survey locations throughout the year, with highest numbers consistently recorded at a single survey location (Location 13) where the most valuable habitat for foraging and commuting bat was present - positioned along a plantation edge and within a short distance of Duneaton Water. The activity at Location 3 and 4 was lower and Location 13 throughout the year, and the remaining survey locations lower again, and remaining fairly consistent throughout the surveys. It should be noted that in general terms, activity is higher in spring and summer, and fall significantly in autumn

6.4.60 As shown in **Figure 6.8** (EIAR Volume 3a), analysis of the risk to soprano pipistrelle, when considering bpph, indicate an activity pattern very similar to that of common pipistrelle; higher activity is recorded as discussed above for common pipistrelle, with the remaining survey locations remaining consistent. As with common pipistrelle, in general terms, activity is higher in spring and summer, and falls in autumn.

6.4.61 As shown in **Figure 6.9** (EIAR Volume 3a), the majority of survey locations recorded no *Nyctalus* spp. activity in Spring, with very low numbers and bpph recorded across the Site in summer and autumn. The highest activity for Nyctalas was recorded at Location 13 in summer and autumn.

6.4.62 Overall, as can be seen from **Table 6-3** and **Figures 6.7 – 6.9** (EIAR Volume 3a) inclusive, the bpph for all high collision risk species across all locations and all seasons is deemed to be low, and therefore the collision risk to all bat species at the Proposed Development is also considered to be Low.

OTTER

6.4.63 Signs of otter were recorded along Duneaton Water, with one potential couch also recorded; these are discussed in **Technical Appendix 6.2C** (EIAR Volume 4) and **Figure 6.5.2** (EIAR Volume 3a).

6.4.64 Whilst the watercourses within the Site are largely small and of limited value to otter (limited / no connectivity upstream and limited food resource), the Duneaton Water and River Clyde have the potential to support otter, providing foraging and sheltering opportunities, and connectivity to the wider area.

PINE MARTEN

6.4.65 No field signs indicative of pine marten were recorded within the Site. There is very limited suitable habitat for pine marten within the Site, with areas of woodland small and scattered. The open farmland and moorland may provide some hunting suitability.

RED SQUIRREL

6.4.66 No signs of red squirrel were recorded during the surveys. Areas of woodland within the Site are small and scattered, offering limited suitability for red squirrel.

REPTILES

6.4.67 Although no reptiles were recorded during the surveys, seven features with the potential for use by hibernating reptiles were identified. These were stone piles, drystone walling and stone ruins.

WATER VOLE

6.4.68 No signs of water vole were recorded during the surveys. Several small watercourses are present on Site which could provide some suitability for water vole. Rush vegetation was noted as present along some watercourses, which could provide foraging opportunities for water vole. No field signs attributable to water vole were recorded within the survey area. Within the wider survey area most of the smaller watercourses were of low-moderate suitability for this species.

BROWN AND MOUNTAIN HARE

6.4.69 No evidence of brown or mountain hare was recorded during the desk-based survey or field surveys. However, suitable habitat is present within the Site.

FISH

6.4.70 Electrofishing surveys were undertaken by Clyde River Foundation (CRF) in June 2023, with full results detailed in **Technical Appendix 6.4** (EIAR Volume 4).

6.4.71 A total of ten survey points were sampled during the survey; fish were caught at eight of these (**Technical Appendix 6.4** (EIAR Volume 4)). A total of five species of fish were present within the Site; brown trout (*Salmo trutta*), brook lamprey (*Lampetra planeri*), stone loach (*Barbatula barbatula*), minnow (*Phoxinus phoxinus*), and three-spined stickleback (*Gasterosteus aculaeatus*).

6.4.72 Only 21 brown trout were caught in total, across seven of the ten sampling sites. No young-of-the-year (0+) fish were encountered, whilst numbers of older (1++) brown trout caught ranged between one and six fish (**Technical Appendix 6.4** (EIAR Volume 4).

6.4.73 Based on the presence of natural fish barriers downstream on the River Clyde, migratory Atlantic salmon (*Salmo salar*) and European eel (*Anguilla anguilla*) are known not to be present in the upper River Clyde, and no individuals were caught during the surveys.

OTHER SPECIES & INNS

6.4.74 Numerous mammal holes of various sizes were recorded across the Site (**Figure 6.5** (EIAR Volume 3a)). Some were of a size suitable for badger, but no definitive signs of use by badger were found. Others were likely to be in use by rabbits or foxes.

6.4.75 The fisheries report (**Technical Appendix 6.4** (EIAR Volume 4)) confirms that there is a large and increasing population of American signal crayfish in the upper Clyde and its tributaries. The records presented in **Technical Appendix 6.4** (EIAR Volume 4) are the first known from the Duneaton Water sub-catchment and increase the known range by approximately 7 km.

6.5 Future Baseline

6.5.1 In the absence of the Proposed Development, it is likely that the IEFs would generally remain as they are at present, although numbers and distribution of species may fluctuate naturally. The conifer plantation forestry will continue to mature but would be subject to a future felling plan, which may create temporary localised habitat changes until replanting and canopy closure. Vegetation and habitat composition and extents across the Application Boundary may fluctuate marginally in the long-term in line with increasing or decreasing livestock grazing and fluctuations in deer browsing.

6.5.2 As discussed, there is an operational quarry within the Site. It is understood that initial planning consent was granted for 23 years; this expired in February 2024 and was extended for a further two years and will terminate in February 2026; it will not be renewed. The lease requires all restoration works to be complete in line with the planning consent prior to the termination date. The future baseline is considered that the quarry be restored to the levels set out in the project assumptions (and so in line with the planning consent for the quarry operations). The indicative restoration plans indicate return to rough grazing.

6.6 Mitigation By Design

Mitigation by Design

6.6.1 As part of the iterative design process for the Proposed Development, ecological constraints identified through baseline survey results were considered to avoid or reduce negative effects on ecological features where possible (see **Chapter 2: Development Description** (EIAR Volume 4) and **Chapter 3: Design Evolution** (EIAR Volume 4)). This involves:

- A 50 m buffer for any infrastructure or construction activity around all watercourses where possible, except where a minimum number of watercourse crossings are required. This will minimise effects on associated habitats and species;
- Designing track length and alignment to reduce the extent of new track and number of watercourse crossings required, where feasible considering the topography of the Site;
- Designing track length and alignment to reduce the extent of new track crossing blanket bog and wet heath, where feasible considering the topography of the Site;
- Avoiding peat over 1m in depth, blanket bog and wet modified bog, and potential high GWDTEs for the location of wind turbines and other infrastructure as far as practicable;
- A minimum 30 m buffer for any infrastructure or construction activity (100 m for pile driving and blasting works) around the entrance to any badger sett;
- Positioning of turbines to ensure potential bat roosts (moderate or high potential) lie outwith the 275.5 m protection buffer; and
- Establishing a 50 m buffer from turbine blade tips to edge habitats (where present), across the Site to safeguard bats.

6.7 Summary of Sensitive Receptors

Scoped Out Receptors

6.7.1 Based on surveys findings combined with the iterative design and standard mitigation measures described in paragraphs 6.3.28 - 6.3.39, and project assumptions in paragraphs 6.3.27, several potential effects on IEFs can be scoped out of further assessment based on the professional judgement of the EIA Team and experience from other relevant projects and policy guidance or standards. This includes effects from the construction and operational phases of the Proposed Development, as well as cumulative effects. The following sections detail the ecological features and effects that have been scoped out following further desk-based assessment and Site surveys.

DESIGNATED SITES

6.7.2 There will be no direct impact upon any designated site with qualifying ecological features.

6.7.3 The potential for indirect impacts on the qualifying features of the Red Moss SAC and SSSI are also scoped out of detailed assessment on the basis of embedded good practice measures, to be implemented during the construction, operation and decommissioning of the Proposed Development through a CEMP which will include information of pollution prevention which is the main indirect risk to the SAC and SSSI.

6.7.4 The Site is considered to be sufficiently spatially separated from any other designated site with ecological features to preclude the potential for likely effects.

6.7.5 A summary of information to inform a Habitats Regulations Appraisal (HRA) of the Proposed Development in relation to the Red Moss SAC is provided in **Section 7.1**.

ANCIENT WOODLAND

6.7.6 There is a single area of ancient woodland partially within the Site, northeast of Craighead Hill, known as Whitrae Wood. This is categorised as 2b (long-established woodlands of plantation origin). Within 5 km of the Site there are a number of further ancient woodland stands, see **Figure 6.1** (EIAR Volume 3a).

6.7.7 No woodland removal or fragmentation will occur to any AWI site as a result of the Proposed Development. With standard mitigation in place, no pollution effects are anticipated. Effects on ancient woodland are therefore considered to be negligible and as such have been scoped out of further assessment.

TERRESTRIAL HABITATS

6.7.8 The following habitats (using Phase 1 Habitat terminology and codes[57]) are considered of less than 'Local' ecological value in the context of the Proposed Development as they are features which are relatively common and/or widespread locally and/or regionally (i.e. of low conservation value), which are, in some instances, present only in very small areas:

- Coniferous Plantation Woodland (A1.2.2);
- Scattered Coniferous Trees (A3.2);
- Unimproved Acid and Semi-Improved Acid Grassland (B1.1 and B1.2 respectively);
- Neutral Grassland and Unimproved Neutral Grassland (B2.1 and B2.2 respectively);
- Improved Grassland (B4);
- Marsh/Marshy Grassland (B5);
- Continuous Bracken (C1.1);
- Tall Ruderal (C3.1);
- Quarry (I2.1);
- Arable (J1.1);
- Amenity Grassland (J1.2);
- Building (J3.6); and,
- Bare Ground (J4).

6.7.9 A number of other habitats recorded within the Study Area are of local importance, some due to their listing as Annex I habitats or SBL Priority Habitats (**Technical Appendix 6.1** (EIAR, Volume 4)). However, as they occupy such small areas within the Study Area, they are species-poor examples, and/or any direct or indirect effects on the habitat will not occur or will be negligible in magnitude (**Annex A, Table 6.6**)), all effects on them are scoped out of the assessment. These habitats include:

- Broad-Leaved Semi-Natural Woodland (A1.1.1);
- Broad-Leaved Plantation Woodland (A1.1.2);
- Scattered Broad-Leaved Trees (A3.1);
- Acid Dry Dwarf Shrub Heath (D1.1);
- Wet Dwarf Shrub Heath (D2);

- Acid/Neutral Flush (E2.1);
- Swamp (F1);
- Standing Water (G1); and
- Running Water (G2).

AQUATIC HABITATS AND SPECIES

6.7.10 Effects on aquatic habitats including standing water, running water and fisheries interests are scoped out of the assessment, on the basis of sensitive scheme design and standard mitigation. Migratory salmonids are unable to access the Site as a result of natural barriers to migration identified downstream of the Proposed Development. Only 21 brown trout were caught in total, at seven of the ten sampling sites. No young-of-the-year (0+) fish were encountered, whilst numbers of older (1++) brown trout caught ranged between one and six fish (**Technical Appendix 6.4** (EIAR Volume 4)).

6.7.11 The Proposed Development has the potential to impact negatively on water quality and hydrogeomorphology in the absence of mitigation. However, to avoid direct or indirect impacts on these features, a minimum 50 m buffer distance between infrastructure and watercourses has been maintained where possible, except where an access track watercourse crossing and/or other design constraints cannot be avoided to maintain this buffer.

6.7.12 Three new watercourse crossings are required within the Site as part of the Proposed Development. Habitat suitability is limited here – this is reflected in the low numbers of fish caught during the baseline surveys. The design of permanent access track water crossings would comply with SEPA good practice guidance to minimise impacts on fish and their habitat.

6.7.13 In general, the standard mitigation includes that construction work would comply with a CEMP developed by the Principal Contractor, which would be monitored by a suitably experienced ECoW. The CEMP would include good practice mitigation for effective silt and pollution prevention and undertaking works in accordance with SEPA best practice guidance. With this standard mitigation in place, water pollution impacts and associated likely significant effects associated with the Proposed Development on watercourses and aquatic ecology are considered unlikely and therefore these pollution impacts are scoped out of further assessment. Further assessments of watercourses are provided in **Chapter 8: Hydrology, Hydrogeology and Geology** .

PROTECTED SPECIES

6.7.14 NatureScot guidance (NatureScot, 2023[38]) stipulates that there are some species, which with standard mitigation measures, are unlikely to experience a significant environmental effect to their populations as a result of the construction and/or operation of onshore wind farms. These species do not require surveys to inform the design and assessment of an onshore wind farm development, but may require appropriate mitigation to ensure legislative compliance.

6.7.15 Effects on water vole, pine marten, red squirrel, GCN, brown/mountain hare, wildcat, and beaver are scoped out of the assessment due to the absence of protected features, lack of suitable habitat, limited desk-based assessment or field evidence within the Site, and/or lack of potential effects from the Proposed Development.

6.7.16 No reptiles were recorded during the surveys but suitable hibernacula were recorded. Reptiles are mobile species capable of avoiding disturbance except during hibernation. The identified hibernacula lies outwith the turbine infrastructure. As the hibernacula within the solar array will be removed before construction of the solar array, the hibernacula will be dismantled by hand under ECoW supervision. Furthermore, reptile are included in the Species Protection

Plan (**Technical Appendix 6.5**, EIAR Volume 4). However, the risk is considered to be low and reptile are scoped out of the assessment.

6.7.17 Effects on otter are scoped out of the assessment. One otter couch (not a feature used for breeding) was recorded during the surveys. The closest infrastructure (solar array) is located approximately 98 m from the couch. As per NatureScot guidance[65], this is beyond the recommended 30 m buffer for an active couch. The number of water crossings will be minimised and sensitive design will allow free passage of otter. It is considered that with the application of standard mitigation during construction and operation, including pre-commencement surveys, good practice measures to prevent breaches of legislation, there is no likelihood for significant impacts to otter populations arising from disturbance, displacement or accidental mortality during the construction or operation of the Proposed Development. Otter is therefore scoped out of further assessment.

6.7.18 Effects on badger are scoped out of the assessment. Whilst the presence of badger has been established within the Site, the species is widespread across Scotland and is protected for welfare reasons rather than conservation concerns. There will be no mature or semi-mature woodland removal or fragmentation resulting from construction of the Proposed Development and suitable foraging habitats and sett creation opportunities will remain available and extensive within the Site and wider surrounding area. Mitigation through scheme design has also ensured that all setts recorded within the Site are located the recommended 30 m buffer for superficial works and 100 m for pile driving and blasting work, associated with the Proposed Development, in accordance with NatureScot guidance[66]. It is considered that with the application of standard mitigation during construction and operation, including pre-commencement surveys, good practice measures to prevent breaches of legislation including the outlining provisions for species licencing where this may be required, there is no likelihood for significant impacts to badger populations as a result of the Proposed Development. Badger is therefore scoped out of further assessment.

6.7.19 Effects on roosting bats are scoped out of the assessment. No potential maternity roosts and/or hibernation/swarming sites have been identified within at least 200 m plus blade tip (i.e., 275.5 m) of proposed turbine locations and there is no likelihood of impacts to such features. The roosting potential of those features 200 m plus blade tip (275.5 m) of proposed turbine locations were demonstrated to provide low / negligible value to roosting bat. Low levels of bat activity were recorded during automated surveys (**Technical Appendix 6.3** (EIAR Volume 4)), and the timing of calls did not indicate the presence of nearby roosts for any species. Disturbance to and displacement of roosting bats, and damage to roosts, removal of roosts is therefore scoped out of further assessment.

6.7.20 Construction would mainly take place during daylight hours during the season when bats are active (April to October, inclusive), therefore any disturbance for foraging and commuting bats of any species is unlikely to occur or would likely be negligible in magnitude, and is therefore scoped-out.

6.7.21 A SPP (outline provided in **Technical Appendix 6.5** (EIAR Volume 4)) will be implemented to enforce suitable mitigation measures to ensure compliance with protected species legislation during construction.

6.7.22 Effects on all IEFs during operation of the Proposed Development (with the exception of collision risk to high collision risk bat species) have been scoped out. Maintenance of the

[65] https://www.nature.scot/doc/standing-advice-planning-consultations-otters [Accessed May 2024]
[66] https://www.nature.scot/doc/standing-advice-planning-consultations-badgers [Accessed May 2024]

Proposed Development will involve vehicular access along the access tracks only, and any maintenance of turbines will be occasional, typically carried out by a small number of maintenance staff inside the turbines during normal working hours. This is unlikely to result in any operational effects on any species or habitats recorded at and around the Proposed Development.

OTHER SPECIES

DEER

6.7.23 Effects on deer are scoped out of the assessment. Red and roe deer may be present in the locality of the Site. There are only a relatively small number of small, isolated and fragmented woodland blocks within and in close proximity to the Site (**Figure 6.3** (EIAR Volume 3a)), which would only potentially support low numbers of deer. Operational effects are not anticipated as there is no deer fencing around the Site and therefore deer may use and pass through uninhibited. Due to the extensive amount of similar suitable habitat in the surrounding land, and its accessibility, the small loss of grazing habitat associated with the Proposed Development is expected to be negligible to the wide-ranging species. The size of the Proposed Development is not considered to pose a significant barrier to any local movements or migrations of deer.

6.7.24 Construction effects are expected to be minimal due to the timing of works (i.e., primarily during the day, with deer more active during evening/nights), and a short-term construction period (approximately 24 months). If individuals are displaced during construction, there are suitable routes around the Site which will not force deer into areas of risk, including M74 and B7078, or towards built-up areas. As a result of the size and location of the Proposed Development, temporary construction period, the retention of woodland, minimal habitat loss, and the extensive suitable habitat and commuting corridors locally within the Site and beyond, no negative effects on deer are predicted. Due to minimal displacement expected outwith the Site during construction and operation, no negative effects, through increased browsing/trampling on surrounding habitats are expected.

Scoped In Receptors

IMPORTANT ECOLOGICAL FEATURES

6.7.25 A summary of the nature conservation value (as detailed in **Technical Appendix 6.1** (EIAR Volume 4)) of the remaining IEFs identified within the Site and surrounding area (as confirmed through survey results and consultation outlined above) which have been scoped-in to the assessment is provided in **Table 6.4** below, together with the justification for inclusion. These comprise Blanket Bog and Wet Modified Bog (treated as a combined receptor). The nature conservation value and rationale is explained in Table 2.1 of **Technical Appendix 6.1** (EIAR Volume 4))

Table 6.4. Summary of IEF Sensitivity

IEF	Nature Conservation Value	Relevant Legislation / Guidance & Justification
Blanket Bog and Wet Modified Bog	Local	Blanket bog covers 52.2 ha (4.08%) of the study area whilst wet modified bog covers a further 155.56 ha (12.19%) (**Annex A**, **Table 6.6**). Both habitats are also present outwith the Application Boundary (**Figure 6.3** (EIAR Volume 3a)). The habitats present are not extensive but is present as generally relatively small and fragmented patches of habitat in the more elevated parts and watershed plateaus of the north and west of the Site, where it also commonly transitions and mosaics with wet

Table 6.4. Summary of IEF Sensitivity		
IEF	**Nature Conservation Value**	**Relevant Legislation / Guidance & Justification**
		modified bog. Blanket bog here is mainly represented by the M17 and M19 communities. The M2 community was also infrequently recorded. Wet modified bog communities recorded comprised M20, and M25 and M15 when on peat over 0.5 m in depth. These habitats are associated with SBL blanket bog habitat with some areas also corresponding to Annex 1 type 7130 blanket bog habitat. The SNH Carbon and Peatland Map (**Figure 6.2** (EIAR Volume 3a)) shows that the Site contains some relatively small areas of Class 1 peatland which suggests that potential nationally important peatlands could be present. The survey has confirmed the presence of peatland. It is recognised that this definition is not solely for nature conservation and so not directly applicable to evaluating the value of a peatland. Despite some of these communities being associated with Annex I and SBL blanket bog classifications, The habitat within the survey area is a degraded resource in relatively poor condition that has been impacted over time in several ways (as discussed in paragraph 6.4.23). Therefore, assigning a nature conservation value higher than Local is not deemed appropriate.
Bats (high-risk collision species/genus: common pipistrelle, soprano pipistrelle, Nyctalus spp.)	Site	All UK bat species are listed on Annex II of the Habitats Directive and are protected under the Habitats Regulations, the Wildlife and Countryside Act 1981 (as amended), the Habitats Regulations. Nine species/genus (including common pipistrelle, soprano pipistrelle, Nyctalus spp.) are also listed on the SBL. Common and soprano pipistrelle are considered to have a favourable conservation status in the UK and Scotland under Article 17 of the Habitats Directive and are listed as Least Concern (LC) under the IUCN Red List criteria (Matthews et al., 2018[67], JNCC, 2019[68 69]). Nyctalus spp. comprise Leisler's bat (*Nyctalus leisleri*) and noctule bat (*Nyctalus noctule*). Nyctalus spp. are considered to have a favourable conservation status in the UK (no Scotland specific categorisation), with noctule also listed as LC, and Leisler's as Near Threatened (NT), on the IUCN Red List (Matthews et al., 2018[67], JNCC, 2019[70 71]). The Proposed Development is outwith the core areas of predicted occurrence and predicted activity for both Nyctalus spp., being located on the northern edge of predicted Nyctalus spp. occurrence (see Matthews et al., 2018)[67]. Reliable population estimates for Nyctalus spp. in Scotland are currently not available with some currently used population estimates of only a few hundred bats (e.g., Harris et al., 1995[72]) outdated and based on expert opinion. Actual populations in Scotland, and their distribution range, are now thought to be much larger than previously reported with populations suggested to be in the region of many thousands (Newson et al., 2017[73]).

[67] Matthews, F., Kubasiewicz, L.M., Gurnell, J., Harrower, C.A., McDonald, R.A., Shore, R.F. (2018). A Review of the Population and Conservation Status of British Mammals: Technical Summary. A report by the Mammal Society under contract to Natural England, Natural Resources Wales and Scottish Natural Heritage. Natural England, Peterborough.

[68] JNCC (2019). Conservation status assessment for the species: S1309 - Common pipistrelle (Pipistrellus pipistrellus). United Kingdom.

[69] JNCC (2019). Conservation status assessment for the species: S5009 - Soprano pipistrelle (Pipistrellus pygmaeus). United Kingdom.

[70] JNCC (2019). Conservation status assessment for the species: S1331 - Leisler's bat (Nyctalus leisleri). United Kingdom

[71] JNCC (2019). Conservation status assessment for the species: S1312 - Noctule (Nyctalus noctula). United Kingdom.

[72] Harris S., Morris, P., Wray, S. & Yalden, D. (1995). A review of British mammals: population estimates and conservation status of British mammals other than cetaceans. JNCC, Peterborough.

[73] Newson, S.E., Evans, H.E., Gillings, S., Jarrett, D., Wilson, M.W. (2017). A survey of high risk bat species across southern Scotland. Scottish Natural Heritage Commissioned Report No. 1008.

Table 6.4. Summary of IEF Sensitivity		
IEF	**Nature Conservation Value**	**Relevant Legislation / Guidance & Justification**
		The majority of bat activity (94.2% of overall bat activity, 96.53% high collision risk bat species activity) was attributed to common or soprano pipistrelle bats, which are considered to have a 'common' population relative abundance and are considered of 'medium' potential vulnerability (NatureScot et al. 2021)[18]. Nyctalus spp. are considered to have 'rarest' population relative abundance and are considered of 'high' potential vulnerability (NatureScot et al. 2021)[18]; 158 Nyctalus spp. registrations were recorded during surveys (i.e., low number of bat passes). Activity levels of all the high-risk species/genus are deemed as low in the Site (**Technical Appendix 6.3** (EIAR Volume 4)). No bat roosts or potential bat roosts were recorded within the 275.5m (approved buffer of 200m + 75.5m turbine blade) of any turbines. Considering the above information, a nature conservation value of Site is considered suitable for all bat species.

6.8 Assessment of Likely Effects

Potential Construction Effects

6.8.1 This section provides an assessment of the likely effects of the construction of the Proposed Development upon the scoped in IEFs.

6.8.2 The most tangible effect during construction of the Proposed Development would be direct habitat loss due to the construction of infrastructure, such as new access tracks, turbines, hardstandings, substation, solar arrays and battery energy storage system (BESS). Much of this infrastructure would be permanent, however the temporary construction compound areas and borrow pits would be restored at the end of construction.

6.8.3 There may also be some indirect habitat losses to wetland habitats due to drainage effects. For the purposes of this assessment, it is assumed that wetland habitat losses due to indirect drainage effects may extend out to 10 m from the proposed infrastructure (i.e., in keeping with indirect drainage assumptions within the carbon calculator guidance (SEPA, undated[74])). It is expected that any indirect drainage effects would only impact wetland habitats such as blanket bog and wet modified bog. No indirect drainage effects are expected to impact or alter the quality or composition of non-wetland habitats such as woodland, acid grassland etc., as such only direct habitat loss applies to those habitats.

6.8.4 Temporary habitat losses due to the creation of a temporary construction compound areas and enabling works and up to six borrow pits have been calculated separately and are detailed in **Table 6.6 of Annex A**. These have been considered separately to permanent infrastructure as it is possible that not all borrow pit areas will be required or fully utilised, and although these areas would be restored at the end of the construction period (and therefore would not show a loss in habitat extent), the habitat type resulting after restoration may not be the same as the original due to changes in topographical or hydrological conditions. In particular, areas of land take for this temporary infrastructure may represent permanent losses for habitat types such as blanket bog and wet modified bog due to the effects on the structure and function of the habitat type, and the complexities and long timescales involved in restoring or re-creating these particular habitat types.

[74] Available at: https://informatics.sepa.org.uk/CarbonCalculator/assets/Carbon_calculator_User_Guidance.pdf. Accessed June 2024.

6.8.5 The following section assess the effect of these losses for each IEF scoped into the assessment.

Blanket Bog & Wet Modified Bog

6.8.6 **Effect:** Effects upon blanket bog and wet modified bog habitats during construction would be direct (through habitat loss occurring during construction of the Proposed Development) and indirect (through potential drying effects upon neighbouring blanket bog and wet modified bog habitats occurring from the construction phase into the operational phase). Direct loss would occur in areas where permanent infrastructure such as access tracks, turbines, hardstandings, substation, BESS etc. are sited on these habitat types. The excavation of blanket bog and wet modified bog for temporary infrastructure may also lead to losses due to the long-term effect on the ecological and hydrological structure and function of the habitat type. In addition, there may be indirect losses as a result of drainage around infrastructure (around 10 m from infrastructure is assumed) and disruption to hydrological flows.

6.8.7 **Nature conservation value:** Local (as detailed in **Table 6.4**).

6.8.8 **Conservation Status:** Conservation Status of this habitat as assessed in the JNCC report on blanket bog is 'Unfavourable Bad' and 'Stable' at the UK level[75].

6.8.9 **Magnitude of Effect:** The UK has an estimated 2,182,200 ha of blanket bog (JNCC, 2019[75]) of which around 1,759,000 to 1,800,000 ha is in Scotland (JNCC, 2019[76]) (approximately 23% of the land area)[77].

6.8.10 Blanket bog covers 52.02 ha (4.08%) of the Study Area and is indicated by NVC communities M17a, M19a, M17b, M19, M17 and M2 (**Annex A, Table 6.6**). The direct habitat loss for blanket bog is predicted to be 0.34 ha (0.65%) due to permanent infrastructure, with up to an additional 0.52 ha (1.01%) due to temporary works areas (**Annex A, Table 6.6**). This results in a potential total direct loss of 0.86 ha, equivalent to 1.66% of the blanket bog within the Site.

6.8.11 Wet modified bog covers 155.56 ha (12.19%) of the Study Area and is indicated by NVC communities M15d^[78], M25a^, M20, M20b and M20a (**Annex A, Table 6.6**). The direct habitat loss for wet modified bog is predicted to be 2.45 ha (1.58%) due to permanent infrastructure, with up to an additional 4.62 ha (2.97%) due to temporary works areas (**Annex A, Table 6.6**). This results in a potential total direct loss of 7.07 ha, equivalent to 4.55% of the blanket bog within the Site.

6.8.12 In addition, there may be some indirect losses because of the zone of drainage around infrastructure. The actual distance of the effects of drainage on a peatland is highly variable and depends on various factors such as the type of peatland and its characteristics and properties of the peat; the type, size distribution and frequency of drainage feature; and whether the drainage affects the acrotelm, penetrates the catotelm, or both. Consequently, drainage effects can be restricted to just a few metres around the feature or extend out to tens of metres, or further (e.g., see review within Landry & Rochefort (2012)[79]). The hydraulic conductivity of the peatland is one of the key variables which affect the extent of drainage. In

[75] /https://jncc.gov.uk/jncc-assets/Art17/H7130-UK-Habitats-Directive-Art17-2019.pdf [Accessed 20 June 2024]

[76] JNCC (2019). Article 17 Habitats Directive Report 2019: Species Conservation Status Assessments 2019. H7130 - Blanket bogs, United Kingdom https://jncc.gov.uk/jncc-assets/Art17/H7130-UK-Habitats-Directive-Art17-2019.pdf.

[77] https://www.nature.scot/landscapes-habitats-and-ecosystems/habitat-types/mountains-heaths-and-bogs/blanket-bog

[78] Where the respective community is denoted with a caret '^' this implies that during the vegetation surveys the community may be present on peat or peaty soils over 0.5 in depth.

[79] Landry, J. & Rochefort, L. (2012). The Drainage of Peatlands: Impacts and Rewetting Techniques. Peatland Ecology Research Group, Université Laval, Quebec.

general, less decomposed more fibric peatlands (which tend to be found commonly in fen type habitats) generally have a higher hydraulic conductivity and drainage effects can extend to around 50 m, whilst in more decomposed (less fibrous) peat drainage effects may only extend to around 2 m. Blanket bog habitats commonly are associated with more highly decomposed peats (Nayak *et al*. 2008[80]). For this assessment, indirect effects are assumed to extend out to 10 m from infrastructure.

6.8.13 If indirect drainage effects are fully realised out to 10 m in all blanket bog areas, then predicted losses increase to 0.37 ha for permanent infrastructure. This worst-case scenario of direct and indirect habitat loss for permanent and temporary works areas is a total of 1.23 ha or 2.36% of the Study Area for blanket bog.

6.8.14 If indirect drainage effects are fully realised out to 10 m in all wet modified bog areas, then predicted losses increase to 4.88 ha for permanent infrastructure. This worst-case scenario of direct and indirect habitat loss for permanent and temporary works areas is a total of 11.95 ha or 7.68% of the Study Area for wet modified bog.

6.8.15 It is considered unlikely that indirect drainage effects (i.e., out to 10 m either side of infrastructure) would have a significant effect on the degraded blanket bog / wet modified bog present in the Site or result in large-scale vegetation shifts to a lower conservation value habitat type (e.g., acid grassland). For instance, Stewart & Lance (1991)[81] found that a lowering of the water table next to drains was slight and confined to just a few metres either side of the drain, on sloping ground the uphill zone of drawdown was even narrower. Subtle variations in plant species abundance were noted, with species dependent on high water-tables having a lower cover-abundance near to drains, and species with drier heathland affinities having higher cover than at places farther away. However, there were no wholescale changes in vegetation or the species assemblage; for instance, declines in *Sphagna* moss cover were highly localised and took nearly 20 years to achieve statistical significance. Anecdotal observations from wind farms around Scotland also suggest that bog habitats readily persist around infrastructure and within this 10 m zone of possible influence.

6.8.16 It should also be noted that the predicted indirect losses due to drainage are calculated in GIS and based on the habitat survey mapping, there may be small-scale local specific factors such as those relating to natural breaks in hydrology, geology or topography, or the presence of non-wetland habitats that act as a break, barrier or buffer, that would prevent the full predicted indirect drainage effects from materialising.

6.8.17 Overall, evidence suggests that if some drainage effects materialise locally around infrastructure due to the Proposed Development, the most likely effect will not be a major change in overall bog habitat type, but rather a potential change in vegetation micro-topography, certain species cover, or abundance that may result in a subtle NVC community or sub-community shift, and which may only be apparent in the long term. If severe indirect drying effects are observed long-term then blanket bog communities may transition towards modified bog, or modified bog may transition towards wet heath vegetation on deeper peat. These are still habitats of conservation interest, being Annex I and SBL Priority Habitats.

6.8.18 When considering the scale of the above habitat losses, and accounting for the abundance, distribution, and quality of the habitat within the Site, as well as at the national level, an effect magnitude of Low Spatial and Long-term Temporal is appropriate.

[80] Nayak, R.A., Miller, D., Nolan, A., Smith, P., Smith, J. (2008). Calculating carbon savings from wind farms on Scottish peat lands - A New Approach.
[81] Stewart, A.J.A. & Lance, A.N. (1991). Effects of Moor Draining on the Hydrology and Vegetation of Northern Pennine Blanket Bog. Journal of Applied Ecology 28: 1105-1117.

6.8.19 **Significance of Effect:** Given the above consideration of nature conservation value, Conservation Status and Magnitude of Effect, the effect significance is considered to be **Minor Adverse** and **Not Significant** under the EIA Regulations.

Potential Operational Effects

6.8.20 This section provides an assessment of the likely effects of the operation of the Proposed Development upon scoped in IEFs.

Habitats

6.8.21 All likely direct and indirect effects on habitats have been considered in the Predicted Construction Effects section above.

6.8.22 Although most habitat loss is associated with infrastructure required for the operation of the Proposed Development (rather than temporary construction infrastructure), the physical loss of habitat would occur during the construction stage and is therefore considered above.

6.8.23 Any indirect effects on wetland habitats would largely occur during the operational phase as potential drying effects become established. However, for ease and clarity assessing effects on habitats, these are considered together within Predicted Construction Effects.

Bats

6.8.24 **Effect:** During the operational phase, there is potential for collision risk upon commuting and foraging bat species, together with the risk that bats may be affected by barotrauma when flying in close proximity to moving turbine blades. For the purposes of this assessment, the potential effects from barotrauma are assumed to be the same as for collision risk. This is due to the lack of published empirical evidence in causes of bat fatalities around wind farms and the difficulties in determining whether bat fatalities are due to strikes (collisions) with turbine blades or barotrauma.

6.8.25 Research undertaken by Exeter University on behalf of DEFRA (DEFRA, 2016[82]) found that most bat fatalities at UK wind farms have been common pipistrelle, soprano pipistrelle and noctule (e.g., Nyctalus spp.) bats. Further work (Richardson et al., 2021[83]) found that common pipistrelle activity was higher at turbine locations than at control locations in similar habitat, suggesting that this species may be at particular risk. In the same study, soprano pipistrelle activity was comparable between sites with no attraction or repulsion by wind turbines. It is suggested the observed higher levels of activity could be because there are more individual bats around wind turbines, or because bats spend more time in these locations relative to controls, even if the number of individual bats remains the same; however, it is not possible to distinguish between these possibilities using acoustic bat data (Richardson et al., 2021)[83].

6.8.26 As the turbines have a blade tip height of 200 m, there will be a requirement for an aviation lighting scheme (detailed in **Chapter 2 Development Description** (EIAR, Volume 2)) using visible red lights. A five-year study by Spoelstra et al. (2017[84]) concluded that foraging bats are not attracted to red lighting. The reason for this is that white and green spectrum lights attract foraging insects whilst red lights do not. Based on this, Spoelstra et al.[84] advised,

[82] DEFRA (2016). Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management. University of Exeter.
[83] Richardson, S.M., Lintott, P.R., Hosken, D.J., Economou, T and Mathews, F. (2021). Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats. Sci Rep. 11, 3636.
[84] Spoelstra, K., van Grunsven, R. H. A., Ramakers, J. J. C., Ferguson, K. B., Raap, T., Donners, M., Visser, M. E. (2017). Response of bats to light with different spectra: Light-shy and agile bat presence is affected by white and green, but not red light. Proceedings Royal Publishing B, 284, 20170075.

"Hence, in order to limit the negative impact of light at night on bats, white and green light should be avoided in or close to natural habitat, but red lights may be used if illumination is needed". A study by Voight et al. (2018[85]) found evidence of attraction of migratory soprano pipistrelle to red lighting. Soprano pipistrelles do not migrate in the UK as they do in continental Europe, so this finding is not relevant to the Proposed Development. However, the explanation for contrasting findings by Spoelstra et al. (2017)[84] is that "migratory bats may be more susceptible to light sources of specific wavelength spectra because vision may play a more dominant role than echolocation during migration. Non-migratory bats might use orientation cues that are more involved during general hunting behaviour, for example, echoes reflected from local landmarks, instead of cues from natural or artificial light sources".

6.8.27 Bats may also be displaced from their foraging grounds through avoidance of operational wind turbines (Scholz and Voigt, 2022). Barré et al. (2018) recorded a marked reduction in bat activity around operational wind turbines.

6.8.28 **Nature conservation value:** Site (as detailed in Table 6.4).

6.8.29 **Conservation Status:** Common pipistrelle are assessed in the 2019 JNCC report[68 69 70 71] as 'Favourable' and 'Improving' at the UK level, soprano pipistrelle are assessed as 'Favourable' and 'Stable' at the UK level; and noctule and Leisler's bat (i.e. Nyctalus spp.) populations are assessed as 'Favourable' and 'Stable' at the UK level . Mathews et al. (2018)[67] also consider common pipistrelle, soprano pipistrelle and Nyctalus spp. to have a 'Favourable' conservation status.

6.8.30 Further details on the Conservation Status of the high collision risk bat species recorded within the Site are provided below. Information on both noctule and Leisler's bats are presented as registrations for both species were present (**Technical Appendix 6.3** (EIAR Volume 4)).

6.8.31 Both common and soprano pipistrelle are widespread in Scotland. The low population estimates for Nyctalus spp. in Scotland are outdated and likely underestimated due to under-recording (Mathews et al. 2018)[67]. The survey data indicates that both noctule and Leisler's bats may be present at the Site. Studies by Newson et al (2017)[73] have shown a general east-west geographical divide between the species distribution in southern Scotland; with the Proposed Development located in the east of their research area and more within noctule distribution mapping.

6.8.32 The estimated population of common pipistrelle in 2019 ranged from 1,100,600 to 7,843,000 in the UK[86] , and from 285,000 to 2,160,000 in Scotland[87] , although best single value estimates are not provided due to the uncertainty around population estimates. Matthews et al. (2018)[67] provided a UK estimate of 3,040,000 (with a plausible range of 991,000 – 7,510,000); population estimates for Scotland were not provided in that review.

6.8.33 For soprano pipistrelle, the population was estimated to be from 2,024,000 to 8,563,000 in the UK[88], and from 512,000 to 2,180,000 in Scotland[89] , although best single value estimates are not provided due to the uncertainty around population estimates. Matthews et al. (2018)[67]

[85] Voigt, C.C., Rehnig, K., Lindecke, O., Pētersons, G. (2018). Migratory bats are attracted by red light but not by warm white light: Implications for the protection of nocturnal migrants. Ecology and Evolution. 2018;8:9353–9361.

[86] JNCC (2019). Conservation status assessment for the species: S1309 - Common pipistrelle (Pipistrellus pipistrellus). United Kingdom.

[87] JNCC (2019). Supporting documentation for the conservation status assessment for the species: S1309 - Common pipistrelle (Pipistrellus pipistrellus). Scotland.

[88] JNCC (2019). Supporting documentation for the conservation status assessment for the species: S5009 - Soprano pipistrelle (Pipistrellus pygmaeus). United Kingdom.

[89] JNCC (2019). Supporting documentation for the conservation status assessment for the species: S5009 - Soprano pipistrelle (Pipistrellus pygmaeus). Scotland.

provided a UK estimate of 4,670,000 (with a plausible range of 970,000 – 8,400,000); population estimates for Scotland were not provided in that review.

6.8.34 Population estimates of Leisler's bat in 2013 were 28,000 in the UK[90] and 250 in Scotland (JNCC, 2013[91]). There is no recent population estimate available for this species across the UK (Mathews et al., 2018[67], JNCC, 2019[70]) and there is limited accurate data on trends, and population changes, meaning that the detailed population status of this species in the UK and Scotland is currently unknown. However, Newson et al. (2017)[73] in their study stated that the previously used population estimates in Scotland of only a few hundred bats are outdated, with their research indicating actual populations of Nyctalus spp. in Scotland, and their distribution range, are much larger than previously reported, with populations suggested to be in the region of many thousands.

6.8.35 Population estimates of noctule bat in 2013 were 50,000 in the UK[90] and 25,086 in Scotland (JNCC, 2013[91]). The 2019 Article 17 of the UK Habitats Directive Reports estimates the population range to be from 20,600 to 2,176,000 in the UK (JNCC, 2019[71]) with no population value provided for Scotland (JNCC, 2019[71]). Matthews et al. (2018)[67] did not provide a UK population estimate; countrywide estimates were provided for England (565,000 with a plausible range of 17,700 - 1,872,000) and Wales (91,900 with a plausible range of 2,900 - 304,000); no estimate was provided for Scotland. As for Leisler's above, Newson et al. (2017)[73] in their study stated that the previously used population estimates in Scotland of only a few hundred bats are outdated, with their research indicating actual populations of Nyctalus spp. in Scotland, and their distribution range, are much larger than previously reported, with populations suggested to be in the region of many thousands.

6.8.36 **Magnitude of Effect:** Evaluating the vulnerability of a bat population to wind farms is based on three factors: activity level recorded, population vulnerability (determined by collision risk of species and population size), and site risk level. These factors are multiplied to generate an overall risk assessment score per species of either Low (0-4), Moderate (5-12) or High (15-25) in line with NatureScot et al. (2021)[18] guidance. **Technical Appendix 6.3** (EIAR Volume 4) sets out the results from this risk assessment for each high collision risk species and provides analysis of four reference sites to assess the overall site risk level. **Figures 6.6 – 6.9** inclusive (EIAR Volume 3a) also present the site-specific spatial and temporal activity levels for high-risk species, based on the results of the monitoring undertaking at locations across the Site in 2023. A summary is provided below to inform the assessment.

6.8.37 Average seasonal site activity levels (based on mean bpph) were recorded for the following high collision risk bat species:

- common pipistrelle: Low to High;
- soprano pipistrelle: Low to High ;
- Leislers: Low to High; and
- noctule: Low to High .

6.8.38 Due to having a 'high' collision risk and a 'common' population abundance rating, common pipistrelle and soprano pipistrelle are classified as having 'medium' population vulnerability. Nyctalus spp. are classified as having 'high' population vulnerability.

6.8.39 Evidence in the UK demonstrates that most bat activity is close to habitat features e.g., woodland or wetlands. Foraging habitat quality and connectivity in the Site is low, with a

[90] Estimate based on expert opinion with no or minimal sampling, expected to be an underestimate as per Newson, S.E., Evans, H.E., Gillings, S., Jarrett, D. & Wilson, M.W. (2017). A survey of high risk bat species across southern Scotland. Scottish Natural Heritage Commissioned Report No. 1008.

[91] JNCC (2013). Individual Species Reports – 3rd UK Habitats Directive Reporting 2013.

largely treeless environment, small, open upland burns and a largely homogenous area of open grazed marshy grassland and moorland habitat present. The Site risk level for the Proposed Development has been categorised as Low/Lowest, based on having a Medium project size and a Low habitat risk (**Technical Appendix 6.3** (EIAR Volume 4)).

6.8.40 The following overall collision risk assessment score for common pipistrelle, soprano pipistrelle, Leislers and noctule are Low/Lowest (2).

6.8.41 **Figures 6.6 – 6.9** (EIAR Volume 3a) display the activity levels (based on mean bpph) per season and Anabat. As can be seen in these figures, the activity level varied temporally and spatially between spring, summer and autumn for each species, with spring generally being the season with the greatest bat activity levels across the Site. Common and soprano pipistrelle were relatively active across the Site and in all seasons (although bpph overall was low with average 0.57 and 0.17 bpph respectively). Average bpph for Leislers was recorded as 0.02 and for noctule; 0.01.

6.8.42 The standard mitigation described in paragraph 6.3.36 with respect to bats, namely reduced rotor speed when idling by feathering, will be implemented throughout operation during the bat active period (April to October), reducing the risk of bat fatalities. The guidance by NatureScot et al. (2021)[18] notes that, "The reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50%". The presence of this mitigation measure has been considered when assigning the Significance of Effect.

6.8.43 All high collision risk species were calculated to have an overall collision risk assessment score of Low to Low-Moderate. While there may be an effect on individuals, the assessment determines that the effect would be unlikely to occur in sufficient numbers to affect the local populations.

6.8.44 Due to the levels of activity on site, and analysis of site risk, an effect magnitude of Low Spatial and Long Term temporal is considered appropriate for all species.

6.8.45 **Significance of Effect:** Given the above consideration of nature conservation value, Conservation Status and Magnitude of Effect, the effect significance of collision risk on all high collision risk bat species recorded at the Site is considered **Minor Adverse** and **Not Significant** under the EIA Regulations.

Potential Decommissioning Effects

6.8.46 Due to the distant time frame until their occurrence (40 years), decommissioning effects are difficult to predict with confidence. In general, decommissioning effects are usually considered for the purposes of assessment to be similar to (or likely less than) those of construction effects in nature and are likely to be of shorter duration. Prior to decommissioning, a Decommissioning Environmental Management Plan (DEMP) would be prepared and agreed with the relevant statutory consultees, which would include the need for pre-works surveys.

6.8.47 The decommissioning of the Proposed Development would involve the removal of most of the above ground elements and restoration of the associated ground (details provided in **Chapter 2 Development Description** (EIAR Volume 2)). Restoration would seek to return areas to their pre-construction habitat type, or as similar as feasible depending on local substrates, topography, hydrology etc. As a result, decommissioning will not lead to any further direct or indirect habitat losses above those already occurred during construction, rather, it is predicted that due to restoration of habitats in these areas, there would be a net positive effect.

Potential Cumulative Effects

6.8.48 The primary concern regarding the assessment of cumulative effects is to identify situations where effects on habitats or species populations that may be non-significant from individual developments, are judged to be significant when combined with nearby existing or proposed projects. In the interests of focusing on the potential for similar significant effects, this assessment considers the potential for cumulative effects with other wind farm developments at application stage (as those sites that are operational or under construction are considered part of the baseline) within 5 km of the Site; namely Bodinglee Wind Farm and Little Gala Wind Farm. Wind farm projects at scoping stage have been scoped out of the cumulative assessment because they generally do not have sufficient information on potential effects to be included, as the baseline survey period is ongoing, or results have not been published. Projects that have been refused or withdrawn have also been scoped out.

6.8.49 Small projects with three or fewer turbines have also been excluded from the cumulative assessment as often these projects are not subject to the same level of detail of assessment, and so there are no directly comparable data. Because of the small scale of such projects, effects are likely to be negligible on the IEFs assessed.

Construction

6.8.50 Blanket bog and wet modified bog, i.e., the habitat IEF considered in relation to the Proposed Development (as per above), have been scoped-out of the cumulative assessment. It is considered unlikely that any significant ecological cumulative effects will arise as a consequence of the Proposed Development adding to habitat loss associated with other projects (this applies to both the construction phase and also any limited drainage effects which may continue into the operational phase).

6.8.51 In general for wind farm developments, mitigation and/or additional management/ restoration/ enhancement/ creation of habitats is usually proposed to compensate and offset any effects on IEFs. These mitigation and enhancement areas also tend to be larger or many orders of magnitude greater than the area of predicted loss. The requirement for each development project to provide significant biodiversity enhancement is also now imperative through NPF4 Policy 3. The Proposed Development proposes significant biodiversity enhancement via the OBEMP, including peatland restoration of an area over approximately 143.10 ha, split over two sub-units; this equates to approximately 12 times larger than the area of potential direct and indirect loss; this is discussed in the Outline Biodiversity and Environment Habitat Management Plan (OBEMP) submitted as **Technical Appendix 6.6** (EIAR Volume 4).

6.8.52 The section has assessed two wind farms at the Application stage, within 5 km of the Site; Bodinglee and Little Gala. An Outline Habitat Management Plan has been submitted as part of the consent application for both Bodinglee and Little Gala.

6.8.53 Therefore, it is considered unlikely that any significant residual cumulative effects at a local or regional level will arise as a consequence of the Proposed Development adding to habitat loss associated with other projects. This is due to the small nature and not significant levels of habitat losses associated with the Proposed Development (with Bodinglee and Littlegala wind farms both resulting in similar type of habitat loss) and the Applicant's commitment to the delivery of a BEMP for the Proposed Development which would include provisions for the maintenance, creation, restoration and/or enhancement of various habitats and would be used to provide significant biodiversity enhancements in line with NPF4. As such, no adverse cumulative effects are predicted. Based on the above commitments, the effect significance is considered to be **Minor Beneficial** and **Not Significant** under the EIA Regulations.

Operation

6.8.54 No potential cumulative operational phase effects are considered likely. Based on the commitment of the Applicant to implement the BEMP over the operational phase of the Proposed Development, the effect significance is considered to be **Minor Beneficial** and **Not Significant** under the EIA Regulations.

6.9 Mitigation, Compensation and Enhancement

Construction Phase

6.9.1 General and standard mitigation measures for habitats and species, such as complying with best practice, micrositing, presence of an ECoW and adherence with a detailed CEMP and SPP are included in paragraphs 6.3.27 - 6.3.39.

6.9.2 No significant construction effects were identified, and no non-standard mitigation is proposed for the construction phase. However, a number of additional mitigation, compensation and significant enhancement measures are proposed as part of the Proposed Developments Outline Biodiversity Management Plan (OBEMP), as detailed in **Technical Appendix 6.6** (EIAR Volume 4) and outlined below.

6.9.3 Enhancement and restoration of habitats through the delivery of a BEMP would reduce effects on habitats further. Overall, the BEMP would aim to achieve significant biodiversity enhancement at the Proposed Development, in line with objectives outlined in NPF4 Policy 3[9], the Onshore Wind Policy Statement[7] and the Scottish Biodiversity Strategy to 2045[8]. The BEMP would include provisions for the protection, maintenance, restoration and/or enhancement of bog habitats locally. Furthermore, the BEMP would deliver peatland restoration of an area over approximately 143.10 ha, split over two sub-units; this equates to approximately 12 times larger than the area of potential direct and indirect loss..

6.9.4 The OBEMP is provided in **Technical Appendix 6.6** (EIAR Volume 4), also see **Figure 6.11** (EIAR, Volume 3a). The OBEMP is based on a number of identified habitat management areas for each respective habitat management and biodiversity enhancement proposal. These habitat management areas will likely be refined following further specialist surveys and feedback from relevant consultees, and all search areas may not be taken forward for the final BEMP, and other search areas and/or proposals may also be considered; however, the Applicant remains committed to delivering significant biodiversity enhancement at the Proposed Development.

6.9.5 In summary the OBEMP includes the following proposals (full details are provided in **Technical Appendix 6.6** (EIAR Volume 4):

- Aim 1: Peatland Restoration / Enhancement (Habitat Management Area A)
- Aim 2: Native Woodland Creation (Habitat Management Area B)
- Aim 3: Riparian and Riverine Enhancement (Habitat Management Area C)
- Aim 4: Woodland Planting (Habitat Management Area D)
- Aim 5: Grassland / Scrub Planting (Habitat Management Area E)
- Aim 6: Species-Rich Meadow/Grassland Creation (Habitat Management Area F)
- Aim 7: Species Rich Hedgerow Creation (Habitat Management Area G)
- Aim 8: Enhance and Conserve Breeding Wader Productivity (Habitat Management Areas X and Y)

6.9.6 The detailed BEMP will be submitted to and approved by South Lanarkshire Council and NatureScot in advance of construction, and would ensure the Proposed Development secures significant biodiversity enhancements through restoring degraded habitats and strengthening nature networks.

6.10 Assessment of Residual Effects

6.10.1 No significant effects (either standalone, or cumulative) identified with all scoped in IEFs remaining as Minor adverse, or Minor beneficial[92], and Not Significant.

6.11 Monitoring

Construction Phase Monitoring

6.11.1 Construction Phase Monitoring would comply with a CEMP developed by the Principal Contractor, and would be monitored by a suitably experienced ECoW. General environmental monitoring of the Site to be undertaken by an ECoW. Such monitoring would also consider the SPP (**Technical Appendix 6.5** (EIAR Volume 4).

Operation Phase Monitoring

6.11.2 Operational Phase Monitoring would comply with the BEMP, once finalised (OBEMP provided a **Technical Appendix 6.6** (EIAR Volume 4).

Decommissioning Phase Monitoring

6.11.3 None identified at this stage.

6.12 Summary

6.12.1 For all IEFs assessed above, the predicted residual levels of significance of effects during the construction, operational and decommissioning phases of the Proposed Development, alone or cumulatively with other projects, are considered to be no more than Minor adverse and therefore Not Significant. The summary of potential significant effects of the Proposed Development is discussed in **Table 6.5** below.

Table 6.5. Summary of Potential Significant Effects of the Proposed Development

IEF	Potential Effect	Significance	Mitigation Proposed	Outcome/ Residual Effect
Construction				
Red Moss SAC	Indirect	Minor adverse	In addition to standard mitigation, the implementation of a BEMP (OBEMP provided in **Technical Appendix 6.6** (EIAR Volume 4) which includes bog restoration (measures implemented near SAC (removal of plantation and no peat dams).	Not significant
Red Moss SSSI	Indirect	Minor adverse	In addition to standard mitigation, the implementation of a BEMP (OBEMP provided in **Technical Appendix 6.6** (EIAR Volume 4) which includes bog restoration	Not significant

[92] Based on design and implementation of the Biodiversity and Environmental Management Plan (BEMP); OBEMP provided in **Technical Appendix 6.6** (EIAR Volume 4).77

Table 6.5. Summary of Potential Significant Effects of the Proposed Development				
IEF	**Potential Effect**	**Significance**	**Mitigation Proposed**	**Outcome/ Residual Effect**
			(measures implemented near SSSI (removal of plantation and no peat dams).	
Blanket Bog & Wet Modified Bog	Direct and indirect habitat loss	Minor adverse	In addition to standard mitigation, the implementation of a BEMP (OBEMP provided in **Technical Appendix 6.6** (EIAR Volume 4) which includes bog and upland habitat restoration.	Not significant
Operation				
Red Moss SAC	Indirect	Minor beneficial	Implementation of a BEMP (OBEMP provided in **Technical Appendix 6.6** (EIAR Volume 4) which includes bog restoration (measures implemented near SAC (removal of plantation and no peat dams) will be beneficial to the SAC.	Not significant
Red Moss SSSI	Indirect	Minor beneficial	Implementation of a BEMP (OBEMP provided in **Technical Appendix 6.6** (EIAR Volume 4) which includes bog restoration (measures implemented near SSSI (removal of plantation and no peat dams) will be beneficial to the SSSI.	Not significant
Blanket Bog & Wet Modified Bog	Habitat improvement	Minor beneficial	Implementation of a BEMP (OBEMP provided in **Technical Appendix 6.6** (EIAR Volume 4) which includes bog and upland habitat restoration.	Not significant
Bats (high-risk collision species/genus: common pipistrelle, soprano pipistrelle, Nyctalus spp.)	Injury / mortality	Minor adverse	The standard mitigation described in paragraph 6.3.34 with respect to bats, namely reduced rotor speed when idling by feathering, will be implemented throughout operation during the bat active period (April to October), reducing the risk of bat fatalities.	Not significant
Decommissioning				
None identified. Generally, as for Construction (or less). No further direct or indirect losses; potential net positive effect on habitats after Site restoration.				
Cumulative Construction				
None identified.				
Cumulative Operation				
None identified.				

6.13 Information to Inform Habitats Regulations Appraisal – Red Moss SAC

Screening for Likely Significant Effects

6.13.1 Under the Habitats Regulations, any development that is likely to have a significant effect (LSE) on a SAC, either alone or in combination with other plans or projects, requires an Appropriate Assessment (AA) to be carried out by the relevant competent authority, to determine whether the proposal would have an adverse effect on the integrity of the SAC. Although the HRA considers the SAC only, the same assessment applies to the SSSI (similar qualifying/ notified features subject to the same risks) in terms of LSE.

6.13.2 A screening process has been undertaken to determine whether any of the predicted impacts of the Proposed Development would result in an LSE. This screening assessment is presented here to provide information to the competent authority to allow them to reach a decision on whether or not the Proposed Development would have an LSE on the Red Moss SAC and therefore whether an AA is required.

6.13.3 The Red Moss SAC is designated for the presence of active raised bog. The SAC is located within the western edge of the Site. There is hydrological connectivity between the Site and the SAC via drainage through peat identified to the east of the SAC (which is present within the Site) and in the absence of mitigation, there is a risk of impact on the SAC, resulting from the Proposed Development.

Information to Inform Appropriate Assessment

6.13.4 Full details of standard construction phase mitigation measures for the Proposed Development would be contained within a CEMP. The CEMP will include all good practice construction measures, pollution prevention controls and monitoring to be implemented during construction of the Proposed Development in line with current industry and statutory guidance. Good practice measures in relation to pollution risk, sediment management, watercourse crossings and sensitive techniques with regards construction in peatlands and near watercourses, to be adopted during the construction, operation and decommissioning phases and serving to protect the aquatic environment, are detailed in **Chapter 8: Hydrology, Hydrogeology and Geology**.

6.13.5 With the application of standard mitigation and good practice, which have demonstrable extensive success in preventing impacts and adverse effects associated with wind farm development, it can be concluded that the Proposed Development would not result in any Adverse Effects on Site Integrity (AESI), either alone or in combination with other developments.

6.13.6 Furthermore, an OBEMP has been submitted as a Technical Appendix of the EIAR (**Technical Appendix 6.6 (EIAR Volume 4)**). The SAC is, in part, fed through water run-off from the surrounding environments (catchment), including the Site. There is coniferous plantation within this catchment that will be removed as part of the Proposed Development. Coniferous plantation will intercept water flowing down gradient, preventing it from reaching the SAC, potentially having an adverse impact on the integrity of the SAC. As part of the OBEMP, the monoculture Sitka spruce and mixed conifer plantation will be removed at construction, together with associated fencing and drainage as practicable. This will be restocked with native broadleaf planting. Replanting in situ with 24.09 ha of native broadleaved trees is proposed. This could potentially result in a beneficial impact on the SAC. Furthermore, although peat restoration has been proposed within the Site to the immediate east of the SAC, this will focus on reprofiling haggs and reducing the extent of exposed haggs. Peat damming will not be undertaken and this should not adversely interfere with the water available to the SAC; therefore, peat restoration will contribute to potential beneficial impacts on the SAC.

Potential Impacts

RED MOSS SAC

6.13.7 **Effect:** There will be no direct effects upon the SAC as no development will be undertaken within the SAC. Effects upon Red Moss SAC during construction would be indirect through changes in Site drainage, up gradient of the SAC (potential drying effects upon neighbouring bog habitats occurring from the construction phase into the operational phase). In addition, there may be indirect losses as a result of drainage around infrastructure (around 10 m from infrastructure is assumed) and disruption to hydrological flows. Furthermore, there is potential for run-off during the construction phase carrying polluted water (sediment and chemical) to the SAC.

6.13.8 **Nature conservation value:** International.

6.13.9 **Magnitude of Effect:** The SAC is designated for active raised bogs for which this is considered to be one of the best areas in the United Kingdom. However, with the implementation of standard mitigation, including the CEMP, PPG and work being supervised by an ECoW, it is considered unlikely that there will be a significant impact on Red Moss SAC.

6.13.10 As discussed in **Technical Appendix 6.6 (EIAR Volume 4)**, as part of the design, the coniferous plantation located upgradient and to the east of the SAC will be removed, and localised areas of broadleaf planting will be undertaken to extend existing areas of broadleaf woodland. Although not quantifiable, it is considered that overall, this would reduce water retention by trees up gradient of the SAC, increasing the volume of water flowing into the SAC. For this reason, and as discussed on the OBEMP (**Technical Appendix 6.6 (EIAR Volume 4)**), although peat enhancement will be undertaken in this area (currently coniferous plantation) peat damming will not be included in this area.

6.13.11 When considering the above potential effects, and accounting for the qualifying features of the SAC, as well as at the national level, an effect magnitude of Low Spatial and Long-term Temporal is appropriate.

6.13.12 **Significance of Effect:** Given the above consideration of nature conservation value, Conservation Status and Magnitude of Effect, it is considered unlikely that there will be an adverse effect on the integrity of the qualifying features of Red Moss SAC.

Summary of Information to Inform HRA

6.13.13 To summarise, in the absence of standard mitigation, there is the potential for indirect LSE to the integrity of the SAC; this would be through indirect effects of pollution incidents, such as accidental spills or mobilisation of sediments, during the construction and operation phases of the Proposed Development.

6.13.14 With the successful implementation of the proposed standard mitigation, it is concluded that the potential for effects on qualifying features of the Red Moss SAC would be negligible and there would be no adverse effect as a result of the Proposed Development. With the implementation of the OBEMP, it is possible that the Proposed Development will benefit the integrity of the SAC.

6.14 Annex A

6.14.1 **Table 6.6** below details the estimated relative losses expected to occur for IEF habitats, for all new temporary and permanent infrastructure.

Table 6.6: Summary of Receptor Sensitivity

Phase 1 Habitat Type	Phase 1 Extent in Study Area (ha)	NVC Community Code or Habitat Type[93]	Direct Habitat Loss (ha)	Direct Habitat Loss as a % of Phase 1 Type	Direct & Indirect Habitat Loss (ha) in Study Area	Direct & Indirect Habitat Loss as a % of Phase 1 Type in Site
Permanent						
Blanket Bog	52.02	M17a, M19a, M17b, M17, M2	0.34	0.65	0.71	1.36
Wet Modified Bog	155.56	M20, M25^, M20b, M20a.	2.45	1.58	6.46	4.15
Temporary						
Blanket Bog	52.02	M17a, M19a, M17b, M19, M17, M2	0.52	1.01	0.52	1.01
Wet Modified Bog	155.56	M20, M25, M20b, M20a.	4.62	2.97	4.62	2.97

[93] Only specific IEF habitats, communities or features subject to habitat losses are presented within this table. Any IEF communities not listed here are not subject to any predicted direct or indirect habitat losses.

7 Ornithology

7.1 Executive Summary

7.1.1 Chapter 7: Ornithology of the EIA Report considers the potential for significant effects upon important ornithological features (IOFs) associated with the construction, operation and decommissioning of the Proposed Development.

7.1.2 Baseline conditions to inform the design and assessment of the Proposed Development have been established through a desk study and ornithological field surveys in accordance with industry standard guidance and in consultation with nature conservation bodies and specialist species recording groups.

7.1.3 The Site does not form part of any statutory designated site for nature conservation with qualifying ornithological interests or lie within potential connectivity distances for any Special Protection Area (SPA).

7.1.4 Baseline studies have established that the Site and adjacent habitats are used by foraging, breeding and roosting raptors and owls including barn owl, hen harrier, peregrine, red kite and short-eared owl. An assemblage of breeding ground nesting waders has also been recorded, typical of the locale and habitats present. The Site and immediate surrounding area are not identified as being important for migratory waterfowl.

7.1.5 Collision mortality risks to the turbine array have been estimated for curlew, herring gull, lapwing and red kite using the NatureScot Collision Risk Model (CRM). Collision mortality risks are predicted as being low or negligible for all species.

7.1.6 Standard mitigation, including the appointment of a suitably qualified Ecological Clerk of Works (ECoW) during construction works and implementation of a Bird Disturbance Management Plan, will enable the protection of breeding birds during construction and operational maintenance works associated with the Proposed Development.

7.1.7 In addition to habitat reinstatement following the cessation of construction works, the Proposed Development will also provide for the delivery of long-term beneficial habitat enhancement measures for bird species and wider biodiversity. This will include in areas away from operational infrastructure where specific management for breeding waders and black grouse will be undertaken.

7.1.8 Residual effects upon all IOFs are predicted to be not significant as a result of the Proposed Development alone, or in combination, with other wind farm developments.

7.2 Introduction

7.2.1 This chapter of the Environmental Impact Assessment (EIA) Report (EIAR) assesses the potential for significant effects on Important Ornithological Features (IOFs) associated with the construction, operation and decommissioning of the Proposed Development.

7.2.2 The specific objectives of the chapter are to:

- describe the ornithological baseline conditions and identify IOFs;
- describe the assessment methodology and significance criteria used in completing the assessment;
- describe the potential impacts, including direct, indirect and cumulative impacts;

- describe any additional mitigation measures proposed to address potentially significant effects; and
- assess the residual effects remaining following the implementation of any additional mitigation.

7.2.3 The assessment has been carried out by MacArthur Green. All staff contributing to this chapter have undergraduate and/or postgraduate degrees in relevant subjects, have extensive professional ornithological impact assessment experience, hold professional membership of the and/or abide by the Chartered Institute of Ecology and Environmental (CIEEM) Code of Professional Conduct.

7.2.4 This chapter is supported by the following figures and technical appendices:

- **EIAR Volume 3a: Figures**
  - Figure 7.1 Site and Ornithological Study Areas.
  - Figure 7.2 Vantage Point (VP) and Viewshed Coverage: 2022/2023 Non-breeding season (September 2022 to February 2023).
  - Figure 7.3 Vantage Point (VP) and Viewshed Coverage: 2023 breeding season (March to August 2023).
  - Figure 7.4 Ornithological Designated Sites within 20 km.
  - Figure 7.5 Flight Activity: Goshawk, Merlin, Osprey and Peregrine Falcon.
  - Figure 7.6 Flight Activity: Red kite and Short-eared Owl.
  - Figure 7.7 Flight Activity: Curlew, Golden Plover and Lapwing.
  - Figure 7.8 Flight Activity: Greylag Goose, Herring Gull and Pink-Footed Goose.
  - Figure 7.9 Raptor and Short-eared Owl Activity (September 2022 to August 2023).
  - Figure 7.10 Breeding Wader Registrations (2023).
  - Figure 7.11 Goose Activity (September 2022 to August 2023).
- **EIAR Volume 4: Technical Appendices**
  - Technical Appendix 7.1: Ornithology (with Annexes A to E).
  - Technical Appendix 7.3: Assessment Methodology.
- **EIAR Volume 5: Confidential Volume**
  - Technical Appendix 7.2: Confidential Ornithology.
  - **Confidential Figure 7**.2.1 South Strathclyde Raptor Study Group Existing Ornithological Records – Sensitive.
  - **Confidential Figure 7**.2.2 Breeding Raptor and Short-eared Owl Activity – Sensitive.

7.2.5 All other Chapters, Figures and Technical Appendices are referenced in the text where referred to.

7.3 Assessment Methodology

Scope of Assessment

7.3.1 The assessment presented within this chapter considers the following main potential impacts upon ornithological features associated with onshore renewable energy developments:

- Direct habitat loss – temporary and permanent habitat loss, due to land take and activities during the construction, operational maintenance and decommissioning of development infrastructure;

- Disturbance/displacement – the avoidance of birds from the area occupied by development infrastructure and working areas and therefore the further indirect loss of habitats during construction, operation and decommissioning; and
- Collision mortality – the risk of mortality resulting from collision or interaction with turbine arrays during operation.

7.3.2 The potential for significant effects is considered as a result of the construction and operation of the Proposed Development alone and where appropriate and sufficient information is available, cumulatively with other wind farm developments subject to a valid planning application.

7.3.3 The scope of the assessment has been informed by consultation responses detailed in **Technical Appendix 1.1: Consultation Register (EIAR Volume 4)** and the following key legislation, industry standard guidelines, national and local policies of relevance to ornithology:

- Legislation:
  - The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (the EIA Regulations);
  - Environmental Impact Assessment Directive 2014/52/EU (the EIA Directive);
  - Directive 2009/147/EC on the Conservation of Wild Birds (the EU Birds Directive);
  - The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) and the Conservation of Habitats and Species Regulations 2017 (hereafter the 'Habitat Regulations');
  - The Wildlife & Countryside Act 1981 (as amended);
  - The Wildlife and Natural Environment (Scotland) Act 2011; and
  - The Nature Conservation (Scotland) Act 2004.
- Guidance:
  - Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018[1]);
  - Developing Field and Analytical Methods to Assess Avian Collision Risk at Wind Farms (Band *et al*., 2007[2]);
  - Bird Monitoring Methods (Gilbert *et al*., 1998[3]);
  - Disturbance Distances Review: An Updated Literature Review of Disturbance Distances of Selected Bird Species (Goodship and Furness, 2022[4]);
  - Raptors: A Field Guide to Survey and Monitoring (Hardey *et al*., 2013[5]);
  - Standing Advice for Planning Consultations – Birds (NatureScot, 2022a[6]);

[1] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. Chartered Institute of Ecology and Environmental Management (CIEEM), Winchester.

[2] Band, W., Madders, M., & Whitfield, D. P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In G. Janss, M. de Lucas, & M. Ferrer (Eds.), Birds and Wind Farms. (Quercus, Madrid., pp. 259-275.

[3] Gilbert, G., Gibbons, D. W., & Evans, J. (1998). Bird Monitoring Methods. Royal Society for the Protection of Birds (RSPB), Sandy.

[4] Goodship, N. M., & Furness, R. W. (2022). Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species. NatureScot Research Report 1283 [Online]. Available at: https://www.nature.scot/doc/naturescot-research-report-1283-disturbance-distances-review-updated-literature-review-disturbance [Accessed 14 August 2024].

[5] Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B., & Thompson, D. (2013). Raptors: a field guide for surveys and monitoring (3rd edition). The Stationery Office, Edinburgh.

[6] NatureScot (2022a). Standing advice for planning consultations – Birds [Online]. Available at: https://www.nature.scot/doc/standing-advice-planning-consultations-birds#:~:text=A%20bird%20survey%20should%20be,to%20a%20protected%20area%20for [Accessed 14 August 2024].

- General Pre-application and Scoping Advice for Solar Farms (NatureScot, 2022b[7])
- General Pre-application and Scoping Advice for Onshore Wind Farms. (NatureScot, 2024a[8]);
- Calculating a Theoretical Collision Risk Assuming No Avoiding Action (SNH, 2000[9]);
- Assessing Connectivity with Special Protection Areas (SNH, 2016a[10]);
- Environmental Statements and Annexes of Environmentally Sensitive Bird Information: Guidance for Developers, Consultants and Consultees (SNH, 2016b[11]);
- Dealing with Construction and Birds (SNH, 2016c[12]);
- Recommended Bird Survey Methods to iInform Impact Assessment of Onshore Wind Farms (SNH, 2017[13]);
- Assessing Significance of Impacts from Onshore Wind Farms outwith Designated Areas (SNH, 2018a[14]);
- Avoidance Rates for the Onshore SNH Wind Farm Collision Risk Model (SNH, 2018b[15]);
- Assessing the Cumulative Impacts of Onshore Wind Farms on Birds. Scottish Natural Heritage (SNH, 2018c[16]);
- Good Practice During Wind Farm Construction. 4th Edition (NatureScot, 2024b[17]);
- Birds of Conservation Concern 5 (Stanbury *et al*., 2021[18]); and
- Natural Heritage Zone Bird Population Estimates (Wilson *et al*., 2015[19]).

• Policy:

7 NatureScot (2022b). General pre-application and scoping advice for solar farms [Online]. Available at: https://www.nature.scot/doc/general-pre-application-and-scoping-advice-solar-farms#Birds [Accessed 28 August 2024].

8 NatureScot (2024a). General pre-application and scoping advice for onshore wind farms [Online]. Available at: https://www.nature.scot/doc/naturescot-pre-application-guidance-onshore-wind-farms [Accessed 14 August 2024].

9 SNH (2000). Windfarms and Birds: Calculating a theoretical collision risk assuming no avoiding action [Online]. Available at: https://www.nature.scot/doc/wind-farm-impacts-birds-calculating-theoretical-collision-risk-assuming-no-avoiding-action [Accessed 14 August 2024].

10 SNH (2016a). Assessing connectivity with Special Protection Areas [Online]. Available at: https://www.nature.scot/doc/assessing-connectivity-special-protection-areas [Accessed 14 August 2024].

11 SNH (2016b). Environmental Statements and Annexes of environmentally sensitive bird information: Guidance for developers, consultants and consultees [Online]. Available at: https://www.nature.scot/doc/environmental-statements-and-annexes-environmentally-sensitive-bird-information [Accessed 14 August 2024].

12 SNH (2016c). Dealing with construction and birds [Online]. Available at: https://www.nature.scot/doc/dealing-construction-and-birds [Accessed 14 August 2024].

13 SNH (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms [Online]. Available at: https://www.nature.scot/doc/recommended-bird-survey-methods-inform-impact-assessment-onshore-windfarms [Accessed 14 August 2024].

14 SNH (2018a). Assessing significance of impacts from onshore wind farms outwith designated areas [Online]. Available at: https://www.nature.scot/doc/guidance-assessing-significance-impacts-bird-populations-onshore-wind-farms-do-not-affect-protected [Accessed 14 August 2024].

15 SNH (2018b). Avoidance rates for the onshore SNH wind farm Collision Risk Model [Online]. Available at: https://www.nature.scot/doc/wind-farm-impacts-birds-use-avoidance-rates-naturescot-wind-farm-collision-risk-model [Accesses 14 August 2024].

16 SNH (2018c). Assessing the cumulative impacts of onshore wind farms on birds [Online]. Available at: https://www.nature.scot/doc/guidance-assessing-cumulative-impacts-onshore-wind-farms-birds [Accessed 14 August 2024].

17 NatureScot (2024b) Good Practice During Wind Farm Construction [Online]. Available at: https://www.nature.scot/doc/good-practice-during-wind-farm-construction [Accessed 14 August 2024].

18 Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., & Win I. (2021). The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. *British Birds* **114**, p.723-747.

19 Wilson, M. W., Austin, G. E., Gillings S., & Wernham, C. (2015). Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned report number SWBSG_1504. pp72.

- National Planning Framework 4 (NPF4) (February 2023);
- Draft Planning Guidance: Biodiversity (November 2023);
- Scottish Biodiversity Strategy to 2045: Tackling the Nature Emergency in Scotland (September 2023);
- Planning Advice Note 60: Planning for Natural Heritage (January 2000);
- Planning Advice Note 1/2013-Environmental Impact Assessment (August 2013);
- Onshore Wind Turbines: Planning Advice (May 2014);
- South Lanarkshire Council (2024) South Lanarkshire Biodiversity Strategy 2024-2030[20]; and
- The Scottish Biodiversity List (2020).

Assumptions

7.3.4 The assessment is based on the Proposed Development as described in **Chapter 2: Development Description (EIAR Volume 1).** In relation to describing impacts on ornithological features, the following specific development specifications are used to determine the 'worst-case' (or otherwise precautionary) scenario for assessment:

- Up to 22 turbines with a maximum tip height of 200 m and rotor diameter of 155 m and requirement for visible aviation lighting;
- A ground-mounted solar array covering approximately 160 ha;
- Associated on-site substation compound, BESS and connecting access tracks;
- Up to four temporary construction compounds and six borrow pits;
- A construction period of approximately 18 months. The number of bird breeding (or non-breeding) seasons potentially disrupted would therefore depend on the month in which construction commences and the breeding season of the potentially affected species. The main breeding season of most ornithological species recorded within proximity to the Site from baseline studies, extends from March to August. For the purposes of a worst-case assessment, it is assumed that, for any given species of bird, construction activities may commence during the breeding (or non-breeding) season and may therefore potentially affect up to two consecutive breeding (or non-breeding) seasons i.e. short-term in accordance with temporal magnitude criteria presented within **Technical Appendix 7.3 (EIAR Volume 4)**;
- An operational lifetime of 40 years and after which point a decision to refurbish, remove, or replace the turbine and/or solar array would be made; and
- Both the solar and turbine arrays are designed to operate largely unattended, with minimal requirement for operational maintenance works.

Mitigation by Design

7.3.5 Breeding locations of target species identified from baseline studies have been considered during the design of the Proposed Development, in order to avoid or where otherwise minimise the potential for significant effects.

7.3.6 The following specific ornithological constraints buffers, identified with reference to Goodship and Furness (2022[4]), have been adopted in so far as has been possible during scheme design to avoid the potential for disturbance (and therefore displacement) of sensitive ornithological features, whilst retaining a viable scheme and meaningful contribution to renewable energy targets:

[20] Available at: https://www.southlanarkshire.gov.uk/downloads/file/16574/biodiversity_strategy_2024_-_2030 [Accessed 14 August 2024].

- Avoidance of infrastructure within 500 m of Schedule 1 species' breeding sites; and
- Avoidance of infrastructure within 500 m of Schedule 1A species' roosting sites.

Standard Mitigation Measures

7.3.7 This Chapter has been prepared on the basis that the following standard, industry good practice, mitigation measures will form part of the Proposed Development:

- To ensure all reasonable precautions are taken to avoid disturbance to birds and comply with environmental legislation, prior to construction, decommissioning and where relevant during the operation of the Proposed Development, the Applicant (or subsequent operator of the Proposed Development) will appoint a suitably qualified Ecological Clerk of Works (ECoW) who will advise its appointed contractors on all ornithological (and ecological) matters (with the assistance of a suitably qualified/licenced ornithologist if required). The ECoW will be present on Site during the construction and decommissioning periods as required, and will carry out monitoring of works and briefings with regards to any ornithological sensitivities on the Site to the appointed contractors;
- All electrical cabling between associated with the Proposed Development will be underground in shallow trenches which would be reinstated post-construction and, in most cases, follow proposed access tracks;
- Any disturbance areas around permanent infrastructure and/or construction compounds during construction will be temporary and land will be reinstated or restored before the construction period ends in accordance with the Proposed Development's Construction Environmental Management Plan (CEMP), based on the Outline CEMP (OCEMP) presented as **Technical Appendix 2.1 (EIAR Volume 4)**;
- Borrow pits will be excavated as required during the construction period and will be reprofiled at the end of the construction period in accordance with the CEMP; and
- A Bird Disturbance Management Plan (BDMP) will be prepared and implemented for the Proposed Development, which will detail good practice and species-specific measures to be implemented during construction, decommissioning and where relevant during operational maintenance activities, to enable legislative compliance and safeguard sensitive bird species including those listed on Schedule A1, 1 and 1A of the Wildlife and Countryside Act 1981 (as amended). The BDMP shall be informed by information obtained during baseline studies, pre-commencement surveys, consultation with third-party recording groups and industry good practice.

Biodiversity Enhancement Management Plan (BEMP)

7.3.8 The Chapter has also been prepared in view of the requirements of NPF4 Policy 3 and the finalisation and implementation of a Biodiversity Enhancement Management Plan (BEMP) as part of the Proposed Development, based on the OBEMP submitted as **Technical Appendix 6.6 (EIAR Volume 4).**

7.3.9 The BEMP will be finalised on the basis of the OBEMP in consultation with relevant landowners and stakeholders prior to the commissioning of the Proposed Development.

7.3.10 Specifically in relation to ornithological features, Aim 8 of the OBEMP will include for measures aimed at conserving and enhancing of breeding wader productivity within the Site, including in areas away from operational infrastructure.

7.3.11 Aims 1-7 of the OBEMP also set out habitat enhancement will provide benefit for local bird populations, including black grouse.

Ornithological Features Scoped Out

7.3.12 As stipulated within the Chartered Institute for Ecology and Environmental Management (CIEEM, 2018[1]) and NatureScot impact assessment guidance (2017[13] and 2018a[14]), it is not necessary to carry out a detailed assessment of impacts upon ornithological (or ecological) features that are sufficiently widespread, unthreatened and resilient to potential project impacts. As such, the assessment within this chapter considers in detail the potential for significant effects on ornithological features which are considered 'important' (i.e. IOFs), identified on the basis of baseline information, relevant guidance, literature, professional judgement, opinions of statutory nature conservation bodies (provided through consultations in relation to the Proposed Development) and, where relevant, other renewable energy developments.

7.3.13 Where ornithological features are not considered so important as to warrant a detailed assessment, or where they are unlikely to be significantly affected on the basis of baseline information, these are 'scoped out' of the assessment. Mitigation measures for such features have, however, been outlined as appropriate and in line with standard industry good practice to reduce and/or avoid any potentially adverse effects or to enable compliance with national legislation and protection afforded to breeding and (where relevant) roosting birds.

7.3.14 The following ornithological features have therefore been 'scoped out' from consideration within this Chapter on the basis of their lower conservation priority and/or generally accepted low sensitivity to renewable energy developments e.g. as recognised in NatureScot guidance for onshore wind energy developments in Scotland (SNH, 2017[13] and 2018a[14]):

- Common and/or low conservation species, not recognised in statute as requiring special conservation measures (i.e., not listed as Annex 1[21]/ Schedule A1/1/1A[22] species);
- Common and/or low conservation species. not included in non-statutory lists (i.e., not listed as a Red-listed Birds of Conservation Concern (BoCC) species (as per Stanbury *et al*., 2021[18]); and,
- Passerine species, given they are not generally considered to be at risk from wind farm developments (SNH, 2017[13]), unless being particularly rare or vulnerable at a national level.

7.3.15 Those additional ornithological features scoped-out of detailed assessment following a review of baseline information and professional judgement are presented in **Section 7.4.**

Potential Effects Scoped Out

7.3.16 The potential for significant effects upon all ornithological features arising from the following are scoped out of assessment:

- Habitat loss during construction;
- Infrastructure lighting; and
- Decommissioning.

Potential Construction Impacts (Habitat Loss)

7.3.17 The direct temporary and permanent habitat losses to the footprint of the Proposed Development are detailed within **Chapter 6: Ecology (EIAR Volume 2)**. These have been minimised in so far as has been possible, through sensitive scheme design.

[21] Listed on Annex 1 of the Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds (the 'Birds Directive).

[22] Listed on Schedule A1/1/1A of the Wildlife and Countryside Act 1981 (as amended), see **Technical Appendix 7.1, Annex A (EIAR Volume 4).**

7.3.18 Unavoidable habitat losses would result in the direct loss of potential nesting and foraging opportunities for ornithological features identified from baseline studies. The Proposed Development will also include the reinstatement of habitats within temporary construction working areas before the construction period ends in accordance with the Proposed Development's CEMP, based on the OCEMP presented as **Technical Appendix 2.1 (EIAR Volume 4)**.

7.3.19 Retained habitats on Site and all off-site habitats will be unimpacted with the implementation of industry standard good practice runoff control and pollution prevention measures that will also form part of the Proposed Developments CEMP (see **Technical Appendix 2.1, EIAR Volume 4**).

7.3.20 Habitat losses for the turbine array will therefore be very small relative to the remaining extent of similar habitats available within the Site and wider surrounding area, including across the regional Natural Heritage Zone (NHZ) NHZ 19 (Western Southern Uplands and Inner Solway) within which the Proposed Development is located (see **Figure 7.1, EIAR Volume 3a**).

7.3.21 Direct habitat losses for the solar array will also be relatively small. Solar farm construction generally required very low levels of direct and permanent land take. BRE guidance (2014[23]) states that as panels are raised above the ground, over 95% of a solar farm development remains accessible for plant growth and habitat management.

7.3.22 The Proposed Development, in accordance with NPF4 Policy 3, will include for a commitment to contribute to the enhancement of biodiversity through the finalisation and implementation of a BEMP for the Proposed Development. Once finalised and implemented, the Proposed Development will provide for the retention and enhancement of existing breeding and roosting bird habitats both within the Site and away from operational infrastructure, over the operational lifetime of the Proposed Development.

7.3.23 Overall direct and permanent habitat loss effects would not result in potentially significant effects upon any ornithological feature and are therefore not considered further, as part of this assessment.

Potential Operational Impacts (Turbine/Infrastructure Lighting)

7.3.24 Once installed on-site, the Proposed Development turbines would be lit with medium intensity (2000 candela) steady red aviation warning lights, mounted on the nacelle of the turbines and a low-intensity light (32 candela) on the turbine tower at an intermediate level of half the hub height (see **Technical Appendix 4.7: Aviation Lighting Assessment, EIAR Volume 4**).

7.3.25 In addition to lighting on the turbines themselves, low-level security lighting at the substation, battery energy storage system (BESS) and solar array would also be required (see **Chapter 2: Development Description, EIAR Volume 1**). A wildlife-friendly lighting scheme, to minimise the impacts of such infrastructure lighting on crepuscular species will however be agreed in consultation with South Lanarkshire Council and NatureScot (see **Chapter 6**).

7.3.26 It is acknowledged that lighting can have various effects on birds e.g. they may be attracted to lights and thereby placed at higher risk of collisions, have migration patterns disrupted, show avoidance of lights with a consequent displacement impact, or be subject to increased

[23] BRE (2014) Biodiversity Guidance for Solar Developments. Eds G E Parker and L Greene.

predation threat. NatureScot has identified attraction (phototaxis) as posing the principal threat to birds, in relation to wind turbine developments (2020b[24]).

7.3.27 In NatureScot's advice on the scope of assessment for turbine lighting (2020a), an assessment of the possible effects of lighting on birds may be required in the following three situations, where risk is greater:

- wind turbines on or adjacent to a seabird colony that hosts burrow nesting species;
- wind turbines that are on or adjacent to protected areas that host large concentrations of wintering waterbirds, where such sites are located within open country away from other sources of artificial light; and
- where wind farms are located on migratory corridors or bottlenecks for nocturnally migrating passerines.

7.3.28 The location of the Proposed Development does not fall into any of the above greater risk scenarios. The Proposed Development, particularly the substation, BESS and solar array components, is also located in close proximity to major road networks including the M74 and B7078. Therefore, existing sources of existing artificial light spill occur within the Site, and some level of species' tolerance towards this occurs.

7.3.29 In view of NatureScot guidance (2020a[24]), the low-level wildlife-friendly nature of lighting proposed and existing baseline conditions at the Site, it is highly unlikely that any species would be significantly impacted by lighting requirements of the Proposed Development. Such impacts are therefore scoped-out of assessment.

Decommissioning

7.3.30 As noted in **Chapter 2: Development Description (EIAR Volume 2)**, a decision to refurbish, remove, or replace the turbine and/or solar array would be made at the end of the Proposed Development operational lifetime. Whilst future ornithological baseline conditions cannot be accurately known at this stage, given the nature of decommissioning works, potential effects on ornithological features associated with the decommissioning the Proposed Development can be reasonably concluded as being of equal or lesser significance to construction disturbance/displacement effects, over a reduced timeframe.

7.3.31 Decommissioning phase impacts for any ornithological feature are therefore not considered exclusively in detail within this Chapter.

Method of Baseline Characterisation

Extent of the Study Area

7.3.32 The study area within which baseline information relating to the presence and distribution of ornithological features has been collected, has included the footprint of the Proposed Development, together with the following appropriate buffers, defined with reference to NatureScot guidance (SNH, 2016a[10] and 2017[13]) and illustrated in **Figure 7.1 (EIAR Volume 3a)**:

- Breeding and wintering birds (waders and wildfowl) - 500 m from all Proposed Development infrastructure;

[24] NatureScot (2020a) The Effect of Aviation Obstruction Lighting on Birds at Wind Turbines, Communication Towers and Other Structures [Online]. Available at: https://www.nature.scot/doc/information-note-effect-aviation-obstruction-lighting-birds-wind-turbines-communication-towers-and [Accessed 14 August 2024].

- Black grouse – 1.5 km from the turbine array / 750 m from access tracks and solar array; and
- Scarce breeding and roosting birds – 2 km from the turbine array / 800 m from all access tracks and solar array;

7.3.33 Statutory designated sites for nature conservation with ornithological qualifying features have been identified–within 20 km of the Site.

Desk Study

7.3.34 The following key sources have been consulted for existing ornithological information within proximity to the Proposed Development:

- NatureScot Sitelink website[25];
- RSPB Scotland; and
- The South Strathclyde Raptor Study Group (SSRSG).

7.3.35 Publicly available EIA documentation for the adjacent Bodinglee Wind Farm[26] and Kennoxhead Extension II Wind Farm[27] has also been reviewed for existing information on Schedule 1 breeding raptors, short-eared owl and lekking black grouse within proximity to the Proposed Development.

7.3.36 Agri-Environment Climate Scheme (AECS) documentation for the Site has also been reviewed to identify existing habitat management measures for ground-nesting waders within the Site (within the Blackburn Farm landholding).

7.3.37 Peer-reviewed literature has also been referred to and is referenced where relevant.

7.3.38 The Southern Upland Partnership (SUP) were also consulted for existing black grouse records, but confirmed it held no records for the search area and that RSPB Scotland hold existing records for South Lanarkshire.

Field Surveys

7.3.39 Baseline ornithological field surveys to inform the design and assessment of the Proposed Development commenced in September 2022 and were completed in August 2023.

7.3.40 All field surveys were undertaken in line with appropriate industry standard guidance and species-specific methodologies (Gilbert *et al*., 1998[3], Hardey *et al*., 2013[5] and SNH, 2017[13]), with the following surveys completed:

- Flight activity surveys – September 2022 to August 2023;
- Winter walkover surveys – autumn/winter 2022/2023;
- Black grouse surveys – spring 2023;
- Scarce breeding bird surveys – spring/summer 2023; and
- Moorland breeding bird survey – spring/summer 2023.

[25] Available at: https://sitelink.nature.scot/

[26] Energy Consents Unit (ECU) Reference: ECU00004839.

[27] Which summarises baseline information collected to inform the design and assessment of the consented Kennoxhead Wind Farm (ECU Reference ECU00002101), Extension I (ECU Reference ECU00002038) and Extension II (ECU Reference ECU00003263) developments and referred to as the Kennoxhead Wind Farm Cluster herein.

7.3.41 Field survey areas were defined with reference to NatureScot guidance (SNH, 2017[13]) and on the basis of the maximum developable turbine and solar array areas available at the time of survey commencement and completion.

7.3.42 A total of 10 Vantage Point (VP) locations were adopted over the course of flight activity surveys; seven (VPs 1-7) between September 2022 and February 2023 (2022/2023 non-breeding season) and four (VPs 2 and 8-10) between March and August 2023 (2023 breeding season).

7.3.43 VP locations and viewshed coverage of the turbine array at 20 m above the ground from each VP are shown in **Figures 7.2** and **7.3 (EIAR Volume 3a)**.

7.3.44 Following changes in scheme design, the viewsheds of VPs 6 and 7 do not provide any coverage of the turbine array or Collision Risk Analysis Area (CRAA) used in the estimation of collision mortality risks for the Proposed Development. Flight activity data observed from these VPs has therefore been excluded from collision risk analysis as it is not considered 'at-collision risk', but is discussed within this Chapter and presented within **Technical Appendix 7.1 (EIAR Volume 4)** for completeness.

7.3.45 Full details of baseline surveys including methodologies, survey conditions and survey areas are presented in **Technical Appendix 7.1 (EIAR Volume 4)**.

7.3.46 In conjunction with the extensive existing ornithological information pertaining to the Site and immediately surrounding area from sources set out above, a single year of baseline ornithological field surveys is considered to be adequate in informing the robust design and assessment of the Proposed Development.

Method of Assessment

7.3.47 The assessment of potentially significant effects upon ornithological features has been undertaken following the principles of CIEEM guidance (2018[1]).

7.3.48 The assessment methodology, including criteria for assessing sensitivity of ornithological features, magnitude of change and cumulative effects, as well as overall significance criteria, is detailed in **Technical Appendix 7.3: Assessment Methodology (EIAR Volume 4)**.

Limitations

7.3.49 No substantial limitations to baseline studies or assessment presented within this chapter have been identified.

7.3.50 Baseline field survey effort has met minimum requirements stipulated in NatureScot guidance (SNH, 2017[13]). In general, weather conditions were appropriate for the surveys, but where not, surveys were suspended and rescheduled (or additional surveys were undertaken) (refer to **Technical Appendix 7.1, EIAR Volume 4**).

7.3.51 Some limitations do exist with regard to the knowledge base on how some species, and the populations to which they belong, react to impacts associated with onshore wind farms and associated construction activities. A precautionary approach is therefore taken in these circumstances, and as such it is considered that these limitations do not affect the robustness of this assessment.

7.3.52 It is also acknowledged that the visibility of turbine T22, at heights below the rotor sweep area of the preferred candidate turbine specification for the Proposed Development[28] i.e.

[28] i.e. based on a maximum tip height of 200 m and rotor diameter of 155 m.

<30 m above the ground, has not been captured during baseline flight activity surveys. The turbine location is however visible from VP10 at heights within the rotor sweep i.e. >30 m above the ground.

7.3.53 Whether this would substantially affect the robustness of the collision risk modelling depends on how similar the flight activity rates in the un-surveyed areas around the turbine location is to flight activity rates recorded in the viewshed areas surveyed. In this case it is considered that the recorded flight activity rates of target species would be sufficiently representative. The turbine is located in similar habitat and on similar gradients to the remaining 21 turbines covered by other VP viewsheds. It is therefore likely that flight activity, particularly from large raptors and owls (e.g. red kite and short-eared), would be similar around the turbine location as recorded across the Site. Therefore, the mean flight activity rates per unit area (hectare) used in the NatureScot Collision Risk Model (CRM) inputs are considered to be appropriate, and unlikely to result in un-representative collision risk estimates for the Proposed Development.

7.4 Baseline Conditions

Current Baseline

Designated Sites for Nature Conservation

7.4.1 The Site does not form part of any statutory designated site with qualifying ornithological features. Within 20 km of the Site, there is one Special Protection Area (SPA) and three Sites of Special Scientific Interest (SSSIs) with ornithological qualifying features. These designations are illustrated in **Figure 7.4 (EIAR Volume 3a)** and summarised in **Table 7.1**.

7.4.2 Distances within **Table 7.1** are from the nearest points of the designation boundary to Site.

7.4.3 In review of NatureScot guidance (SNH, 2016a[10]) regarding connectivity with SPAs and the core foraging ranges of hen harrier (2 km), merlin (5 km), peregrine falcon (2 km), short-eared owl (2 km) and golden plover (3 km), there is considered to be no potential for connectivity between the Muirkirk and North Lowther Uplands SPA, its underpinning North Lowther Uplands and Muirkirk Uplands SSSIs, and the Site.

7.4.4 The Proposed Development is also considered to be sufficiently distant from the Tweedsmuir Hills SSSI to preclude the potential for effects upon its qualifying features.

7.4.5 The potential for adverse effects on the qualifying features of any designated sites for ornithological interests is therefore scoped out of the assessment and further consideration within this chapter.

7.4.6 The potential for adverse effects upon the species listed as qualifying interests of those designations (as summarised in **Table 7.1**) is however considered against those species' relevant wider countryside populations as relevant.

Table 7.1: Ornithological Designated Sites (20 km).

Designation	Distance	Qualifying Features
Muirkirk and North Lowther Uplands SPA	5.29 km	▪ Golden plover (breeding) ▪ Hen harrier (breeding) ▪ Hen harrier (non-breeding) ▪ Merlin (breeding) ▪ Peregrine (breeding) ▪ Short-eared owl (breeding)

Table 7.1: Ornithological Designated Sites (20 km).		
Designation	**Distance**	**Qualifying Features**
North Lowther Uplands SSSI	5.29 km	▪ Hen harrier (breeding) ▪ Breeding bird assemblage[29]
Muirkirk Uplands SSSI	10.02 km	▪ Hen harrier (breeding) ▪ Hen harrier (non-breeding) ▪ Short-eared owl (breeding) ▪ Breeding bird assemblage[30]
Tweedsmuir Hills SSSI	17.89 km	▪ Breeding bird assemblage[31]

Flight Activity

7.4.7 Flight activity surveys have determined the level of flight activity within the turbine array for target species, following the survey methods described in **Technical Appendix 7.1 (EIAR Volume 4)**.

7.4.8 Flight activity of the following target species was recorded over the course of surveys, with those for which collision mortality risks for the Proposed Development have been estimated using the NatureScot CRM, highlighted in bold:

- **Curlew**;
- Golden plover;
- Goshawk;
- **Greylag goose**;
- **Herring gull**;
- **Lapwing**;
- Merlin;
- Osprey;
- Peregrine falcon;
- **Pink-footed goose**;
- **Red kite**; and,
- Short-eared owl.

7.4.9 Due to the absence of 'at risk' flight activity recorded during flight activity surveys, the potential for significant operational collision mortality risks to golden plover, goshawk, merlin, osprey, peregrine falcon and short-eared owl is concluded as highly unlikely and scoped out of the assessment.

7.4.10 Similarly, collision risks to those species for which less than one collision over the operational lifetime of the Proposed Development (40 years) is predicted (i.e. herring gull and greylag goose) are scoped out of the assessment, given significant adverse effects are also highly unlikely to result.

7.4.11 Collision mortality risk estimates for scoped in target species are summarised in **Table 7.2**, with details of calculations presented in **Technical Appendix 7.1, Annex E (EIAR Volume**

[29] Cited to include hen harrier, short-eared owl, merlin, peregrine, golden plover, red grouse, raven, dunlin, snipe, teal, curlew, redshank, whinchat and wheatear.

[30] Cited to include teal, hen harrier, buzzard, merlin, peregrine, short-eared owl, red grouse, golden plover, dunlin, snipe, curlew, redshank, whinchat, stonechat, wheatear, and ring ouzel.

[31] Cited to include red grouse, black grouse, golden plover, curlew, dunlin, common snipe, ring ouzel, whinchat, stonechat and wheatear.

4). Full details of recorded target species flight activity are presented in **Technical Appendix 7.1,Annex D (EIAR Volume 4)**, and illustrated in **Figures 7.5** to **7.8 (EIAR Volume 3a)**.

7.4.12 Avoidance rates specified in **Table 7.2** and which have been used in calculations are in accordance with those recommended in current NatureScot guidance (SNH, 2018b[15]).

Table 7.2: Collision Mortality Risks.

Species	Avoidance Rate	2022/2023 Non-breeding Season	2023 Breeding season	Annual Collision Risk	Years per Collision
Curlew	98%	0.000	0.139	0.139	7.179
Greylag goose	99.8%	0.006	0.000	0.006	175.564
Herring gull	98%	0.000	0.016	0.016	64.358
Lapwing	98%	0.021	3.537	3.559	0.281
Pink-footed goose	99.8%	0.108	0.000	0.108	9.220
Red kite	99.8%	0.047	0.058	0.105	9.543

Black Grouse

7.4.13 No observations of black grouse were made over the course of targeted survey visits in 2023, or incidentally during other ornithology survey visits undertaken between September 2022 and August 2023.

7.4.14 No existing lek records were returned by RSPB Scotland, but a single sighting record was returned from an area to the far south of the Site.

7.4.15 In review of AECS documentation for Blackburn Farm it is understood that black grouse have previously been recorded within the Site, associated with alder-willow carr habitat that borders the Black Burn within the Red Moss SAC/SSSI.

7.4.16 The presence and distribution of lekking black grouse in the immediate and surrounding area has also been extensively established in baseline studies for the Kennoxhead Wind Farm Cluster (located to the west and southwest of the Proposed Development) and Bodinglee Wind Farm (located immediately to the east and west of the Proposed Development).

7.4.17 In summary:

- In review of EIA documentation for Kennoxhead Wind Farm Extension II, which presents black grouse survey information from the period 2017-2019 (and more historically for 2011 and 2012), black grouse activity locally is known to be concentrated locally in two main areas: the area of open ground between Auchendaff Hill and Kennox Hill (c. 8 km southwest of the Site) and the area around Flow Moss (c. 3 km northwest of the Site). Baseline studies also identified a single lek site to the south of Mid Rig (the access track for the Kennoxhead Wind Farm Cluster). This is just over 1 km from the Site of the Proposed Development and over 1.5 km from Proposed Development turbine array.
- In review of EIA documentation for Bodinglee Wind Farm, which presents black grouse survey information from 2021 and 2022 in moorland habitats immediately adjacent to the north of the Site, surveys occasionally recorded single males, with a single lekking male recorded at different locations within the Bodinglee Wind Farm site. No observations of lekking birds were recorded at any historical lek locations identified within 1.5 km of the Bodinglee Wind Farm development, and which is assumed to include that known to

occur south of Mid Rig (see above). Surveys indicated that the current local black grouse population is likely to be very small with irregular use of lek sites.

7.4.18 Whilst black grouse is present in the wider local area, its distribution has been demonstrated as being more readily associated with habitats in closer proximity to larger continuous areas of woodland, and which provide the species preferred habitat mosaics of woodland, moorland areas and edges. Such woodland habitats occur >750 m to the north and south-west of the Site and which is beyond the upper disturbance distance buffer currently recommended to avoid the potential for disturbance to lekking black grouse (Goodship and Furness, 2022[4]).

7.4.19 Whilst the open moorland habitats and marginal farmland habitat within the Site do present some foraging, nesting and lekking opportunities for black grouse, they are considered poorly connected to larger areas of woodland and edge habitats (which provide shelter and nesting opportunities), including through separation by the M74. Whilst occasional foraging use of habitats within the Site may occur (e.g. as documented within AECS documentation for Blackburn Farm), surveys and existing ornithological information do not identify the Site or immediately adjacent areas as supporting any regularly used lek sites. Overall use and importance of the Site for black grouse, on the basis of habitats present and connectivity with preferred habitat mosaics can therefore reasonably be considered low.

7.4.20 It is proposed that the BDMP will include for additional industry standard species-specific measures, as appropriate and informed by pre-commencement surveys, to be implemented over the construction, decommissioning and operational phases of the Proposed Development, and which would further reduce the risk of disturbance to lekking black grouse (see **Section 7.6**).

7.4.21 Positive habitat management measures for black grouse will also be delivered as part of the Proposed Development, as set out in the OBEMP (see **Technical Appendix 6.6, EIAR Volume 4**).

7.4.22 Aim 1: Peatland Habitat Enhancements, Aim: 2: Native Woodland Creation and Aim 3 of the OBEMP: Riparian and Riverine Enhancement will serve to provide habitat enhancement and connectivity for black grouse over the lifetime of the Proposed Development.

7.4.23 Impacts upon black grouse during the construction and operation of the Proposed Development have therefore been scoped out of the assessment on the basis of standard and additional mitigation and positive habitat management measures, with potentially significant adverse effects upon the species highly unlikely to occur.

Raptors and Owls

BARN OWL

7.4.24 No observations of barn owl were recorded over the course of baseline surveys, although the species is known to breed outside the Site, over 800 m from the Proposed Development at its nearest point (see **Confidential Technical Appendix 7.2** and **Confidential Figure 7.2.1, EIAR Volume 5**).

7.4.25 This is beyond the upper 100 m disturbance distance buffer currently recommended to avoid the potential for disturbance to breeding barn owl (Goodship and Furness, 2022[4]).

7.4.26 Considering this species' low risk of collisions with onshore wind turbines due to their low-level hunting flights (Barn Owl Trust, 2023[32]), and breeding sites being located sufficiently distant from the Proposed Development to preclude the potential for disturbance during construction and operational maintenance works, significant adverse effects upon the species are highly unlikely to occur and are scoped-out of the assessment.

GOSHAWK

7.4.27 No evidence of breeding attempts by goshawk were recorded during baseline surveys, and no existing breeding records within 2 km of the Site were identified in consultation with the SSRSG. No goshawk breeding sites were identified within suitable woodland habitats within 500 m of the Bodinglee Wind Farm site during baseline surveys for the development in 2021 or 2022, although low levels of flight activity were reported.

7.4.28 In review of EIA documentation for the Kennoxhead Wind Farm Extension II, goshawk are known to breed within the commercial forestry complex to the west of the Site (outside the study area) and within which the Kennoxhead Wind Farm Cluster is located.

7.4.29 Only a single goshawk flight was recorded during flight activity surveys (see **Figure 7.5, EIAR Volume 3a**), which was not identified to be 'at collision risk' from the Proposed Development. No collision risk for the species is therefore predicted.

7.4.30 Considering the very low levels of species activity recorded, and the absence of breeding evidence within the study area, significant adverse effects upon goshawk are highly unlikely to occur and are scoped-out of the assessment.

HEN HARRIER

7.4.31 No observations of hen harrier were made over the course of baseline surveys, and no breeding records were identified from within 2 km of the Site in consultation with the SSRSG.

7.4.32 No hen harrier breeding sites were recorded during baseline surveys undertaken for the adjacent Bodinglee Wind Farm, in 2021 and 2022.

7.4.33 In review of EIA documentation for the Kennoxhead Wind Farm Extension II, hen harriers have been known to breed in areas over 2 km from the Site; being recorded during baseline surveys in 2014 within the Muirkirk and North Lowther Uplands SPA and identified in historical data provided by the SSRSG within proximity to the developments Mid Rig Access Track (2014 and prior).

7.4.34 These locations are all greater than 750 m from the Site, the upper disturbance distance buffer currently recommended to avoid the potential for disturbance to breeding hen harrier (Goodship and Furness, 2022[4]).

7.4.35 Impacts upon breeding birds are therefore not predicted to occur and as no flight activity of hen harrier was recorded, no collision risk is predicted for the Proposed Development. The species is generally accepted as being of low sensitivity to collision with onshore wind turbines due to their low-level hunting flights (Whitfield and Madders, 2006)[33].

7.4.36 In consultation with the SSRSG a hen harrier winter roost location was identified within 750 m of the Proposed Development, and which is monitored annually by the SSRSG. It is understood

[32] Barn Owl Trust (2013) Wind turbines and barn owls. [Online] Available at: https://www.barnowltrust.org.uk/hazards-solutions/barn-owls-wind-turbines/#:~:text=Barn%20Owls%20can%20be%20at,such%20as%20'humming%20lines' [Accessed 14 August 2024].

[33] Whitfield, D.P and Madders, M. (2006). A review of the impacts of wind farms on hen harriers *Circus cyaneus* and an estimation of collision avoidance rates. A report prepared by Natural Research Ltd.

that the number of birds using the roost location has declined in the past ten years from 7-8 birds, to 2-3 birds in 2023 (see **Confidential Technical Appendix 7.2** and **Confidential Figure 7.2.1, EIAR Volume 5**).

7.4.37 Due to the proximity of the winter roost to the Proposed Development, the potential for significant disturbance/displacement effects upon hen harrier, during the construction and operation is scoped-in to the assessment.

MARSH HARRIER

7.4.38 No observations of marsh harrier were recorded over the course of baseline surveys, although in review of existing information provided by the SSRSG, the species is known to have made an unsuccessful breeding attempt within 2 km of the Site in 2020 (see **Confidential Technical Appendix 7.2** and **Confidential Figure 7.2.1, EIAR Volume 5**). No additional breeding records have been identified for the study area.

7.4.39 Considering the absence of predicted collision risk for the Proposed Development and that the Site and wider study area is not identified as being of any regular importance for breeding pairs, potentially significant adverse effects upon marsh harrier are highly unlikely to occur and are scoped-out of the assessment.

7.4.40 The BDMP will include for pre-commencement surveys and where required species-specific measures (as appropriate) to be implemented over the construction, decommissioning and operational phases of the Proposed Development should breeding attempts for the species be made within proximity to the Proposed Development in future years.

MERLIN

7.4.41 No evidence of breeding attempts by merlin was recorded during baseline surveys, and no existing breeding records within 2 km were identified in consultation with the SSRSG.

7.4.42 No merlin breeding sites were recorded during baseline surveys undertaken for the adjacent Bodinglee Wind Farm, during survey in 2021 and 2022. In review of EIA documentation for the Kennoxhead Wind Farm Extension II, merlin has additionally not been known to breed locally since 2014.

7.4.43 All observations of merlin recorded during baseline surveys were made during the 2022/2023 non-breeding season. This included two flights during flight activity surveys (**Technical Appendix 7.1, EIAR Volume 4**, and **Figure 7.5, EIAR Volume 3a**). No flights were identified to be 'at collision risk' to the Proposed Development and therefore no collision risk for the species is predicted.

7.4.44 A further observation of a single bird was also recorded during a winter walkover in November 2022 (**Technical Appendix 7.1, EIAR Volume 4,** and **Figure 7.9, EIAR Volume 3a**).

7.4.45 Considering the very low levels of species activity recorded at the site and restricted to non-breeding birds (and which is broadly consistent with the findings of baseline studies undertaken for the Bodinglee and Kennoxhead Wind Farm Extension II),the absence of any recent known breeding evidence within the study area, significant adverse effects upon merlin are considered highly unlikely to occur and scoped-out of the assessment.

OSPREY

7.4.46 A small number of osprey observations were made over the course of surveys during the 2022/2023 non-breeding and 2023 breeding season however, no evidence of breeding attempts was recorded within 2 km of the Proposed Development. No existing breeding records within 2 km of the Proposed Development were identified in consultation with the SSRSG and no breeding records of osprey were reported within EIA documentation for the Kennoxhead Wind Farm Extension II or Bodinglee Wind Farm.

7.4.47 Two osprey flights were recorded during flight activity surveys, both of which were recorded in September 2022 (**Technical Appendix 7.1, EIAR Volume 4,** and **Figure 7.5, EIAR Volume 3a**) and are presumed to have been birds on migration to wintering grounds. No flights were identified to be 'at collision risk' to the Proposed Development and therefore no collision risk is predicted. Additional observations were also made of single birds during the 2023 breeding season over the course of scarce breeding bird and moorland breeding bird survey visits in July 2023, all birds in flight to the east of the Site (**Technical Appendix 7.1, EIAR Volume 4** and **Figure 7.9**, **EIAR Volume 3a**).

7.4.48 Considering the very low levels of species activity recorded, and the absence of breeding evidence within the study area, significant adverse effects upon osprey are highly unlikely to occur and scoped-out of the assessment.

PEREGRINE FALCON

7.4.49 A single peregrine falcon breeding site was recorded over the course of baseline surveys and in consultation with the SSRSG (see **Confidential Technical Appendix 7.2** and **Confidential Figures 7.2.1** and **7.2.2, EIAR Volume 5**). The breeding site is located within 750 m of the Proposed Development at its nearest point but is separated from the Site by an existing road.

7.4.50 It is understood that breeding attempts in the most recent monitoring period (2020-2023) have all failed.

7.4.51 No additional peregrine breeding sites potentially within proximity to the Proposed Development are identified from EIA documentation for the Bodinglee Wind Farm or Kennoxhead Wind Farm Extension II.

7.4.52 Flight activity surveys recorded a single peregrine flight (**Technical Appendix 7.1, EIAR Volume 4,** and **Figure 7.5, EIAR Volume 3a**) that was not identified to be 'at collision risk' to the Proposed Development. No collision risk is therefore predicted.

7.4.53 Additional (non-sensitive) observations of the species made over the course of breeding bird and winter walkover survey visits is presented in **Figure 7.9** (**EIAR Volume 3a**) and detailed in **Technical Appendix 7.1** (**EIAR Volume 4**).

7.4.54 As Goodship and Furness (2022[4]) recommend a buffer zone of 500-750 m for avoiding disturbance to breeding peregrine, pre-construction surveys as part of the BDMP will be undertaken and species-specific restrictions as necessary put in place to allow any breeding attempt at the identified breeding site to continue and enable legislative compliance.

7.4.55 In view of the species very low level of activity recorded, spatial separation of the identified breeding site from the Proposed Development and standard mitigation, significant adverse effects upon peregrine falcon are highly unlikely to occur and scoped-out of the assessment.

RED KITE

7.4.56 Two red kite breeding locations were recorded during baseline surveys within 2 km of the Site, with both locations known to the SSRSG, with one location is within 500 m of the Proposed Development at its nearest point (see **Confidential Technical Appendix 7.2** and **Confidential Figure 7.2.2, EIAR Volume 5**).

7.4.57 In consultation with the SSRSG three further red kite breeding locations were identified within the surrounding area; all at distances >2 km from the Site. Recent breeding attempts at all locations are understood to have been successful (see **Confidential Technical Appendix 7.2** and **Confidential Figure 7.2.1, EIAR Volume 5**).

7.4.58 No additional red kite breeding sites potentially within proximity to the Proposed Development are identified from EIA documentation for the Bodinglee Wind Farm or Kennoxhead Wind Farm Extension II.

7.4.59 No communal roosting locations were identified over the course of surveys or in review of existing ornithological information obtained from the SSRSG and RSPB Scotland.

7.4.60 Flight activity surveys recorded a total of 45 red kite flights (**Technical Appendix 7.1, EIAR Volume 4** and **Figure 7.6, EIAR Volume 3a**); with a total of 13 flights identified to be 'at collision risk' and predicting a worst-case collision risk of one bird every 9.54 years (**Table 7.2** and **Technical Appendix 7.1, Annex E, EIAR Volume 4**).

7.4.61 Additional (non-sensitive) observations of the species made over the course of breeding bird and winter walkover survey visits is presented in **Figure 7.9** (**EIAR Volume 3a**) and detailed in **Technical Appendix 7.1** (**EIAR Volume 4**).

7.4.62 Due to the proximity of an identified breeding site to the Proposed Development and estimated collision mortality risks, the potential for significant effects upon red kite, during the construction and operational phase is scoped-in to the assessment.

SHORT-EARED OWL

7.4.63 Up to three short-eared owl breeding territories were recorded during baseline surveys in 2023 within 2 km of the Site; no nest site locations were confirmed but on the basis of activity recorded, it was thought all locations were within 500 m of the Proposed Development (see **Confidential Technical Appendix 7.2**and **Confidential Figure 7.2.2, EIAR Volume 5**).

7.4.64 In review of existing information obtained from the SSRSG, between one and three short-eared owl territories are typically present within the study area each year, with higher numbers of breeding attempts likely to coincide with 'good vole years', when prey abundance is higher, and which was considered the case in 2023 (see **Confidential Technical Appendix 7.2**and **Confidential Figure 7.2.1, EIAR Volume 5**).

7.4.65 No additional short-eared owl breeding locations potentially in proximity to the Proposed Development were recorded during baseline surveys undertaken for the adjacent Bodinglee Wind Farm in 2021 or 2022.

7.4.66 Flight activity surveys recorded a total of four short-eared owl flights (**Technical Appendix 7.1, EIAR Volume 4,** and **Figure 7.6, EIAR Volume 3a**); however, no flights were identified to be 'at collision risk' to the Proposed Development and therefore no collision risk is predicted.

7.4.67 Additional (non-sensitive) observations of the species made over the course of breeding bird and winter walkover survey visits is presented in **Figure 7.9** (**EIAR Volume 3a**) and detailed in **Technical Appendix 7.1** (**EIAR Volume 4**).

7.4.68 Due to the proximity of regularly used breeding areas to the Proposed Development, the potential for significant disturbance/displacement effects upon short-eared owl, during the construction, operational and decommissioning phase is scoped-in to the assessment.

Breeding Waders

7.4.69 In review of RSPB Scotland's response to the EIA Scoping Request (see **Technical Appendix 1.1: Consultation Register, EIAR Volume 4**), it is understood that the Proposed Development is located within the monitoring area for the Clyde Valley Breeding Wader Initiative (CVWI).

7.4.70 Existing ornithological data obtained from RSPB Scotland for the Site and immediate surrounding area, including that gathered by the CVWI for the most recent five-year period available (2017-2022), shows that the vast majority of wader monitoring records reported within the study area are from outside of the Site, to the south along the Duneaton Water. Results of the monitoring also indicate a high incidence of failed breeding attempts annually for species including curlew, lapwing and oystercatcher.

7.4.71 The moorland breeding bird survey undertaken in 2023 recorded an assemblage of breeding waders representative of the open moorland and agricultural grassland habitats present within the Site.

7.4.72 The number of estimated breeding territories for all species recorded during survey both within and overlapping the study area, is summarised in **Table 7.3**, with breeding registrations illustrated on **Figure 7.10** (**EIAR Volume 3a**). A small number of ringed plover observations were also made over the course of survey visits during the 2023 breeding season; however, no confirmed breeding evidence was recorded.

Table 7.3: Breeding Wader Assemblage within the study area (500 m)

Species	**No. of Territories**
Common sandpiper	0-1
Curlew	13-22
Lapwing	6-12
Oystercatcher	9-15
Redshank	5
Snipe	3-8

7.4.73 The breeding wader assemblage recorded within the study area includes some species of lower conservation priority and which are not listed on Annex 1 of NatureScot guidance (2018a[14]) and therefore not generally considered sensitive to onshore renewable energy developments. These are common sandpiper, oystercatcher, redshank and snipe, for which a relatively small number of territories were recorded within the study area. Significant adverse effects upon these species are therefore considered highly unlikely and scoped-out of the assessment.

7.4.74 AECS options for breeding waders are currently under agreement within the Blackburn Farm component of the Site (see **Technical Appendix 6.6, EIAR Volume 4**). These are in place for the 2024 round, until 2028 i.e. the next four years. No Proposed Development infrastructure is located within areas covered by these AECS options.

7.4.75 Breeding waders have been also identified as species to benefit from the implementation of the Proposed Development's BEMP (**Technical Appendix 6.6, EIAR Volume 4**).

7.4.76 Aim 1: Peatland Habitat Enhancement, Aim 2: Native Woodland Creation and more specifically Aim 8 of the OBEMP: Enhance and Conserve Breeding Wader Productivity will provide for habitat management measures both within the Site and away from operational infrastructure, that will improve breeding opportunities and positively affect the productivity of local breeding wader populations over the lifetime of the Proposed Development.

7.4.77 It is proposed that Aim 8 of the OBEMP will be prescribed and finalised in consultation with relevant landowners and the CVWI.

CURLEW

7.4.78 The moorland breeding bird survey completed in 2023 recorded breeding curlew within the 500 m study area (**Figure 7.10, EIAR Volume 3a**) with an estimated minimum of 13 and maximum of 22 territories recorded to be present within and/or overlapping the study area (**Table 7.3**). It is likely that some species registrations recorded during the 2023 breeding season were of birds which did not go on to breed within the study area (i.e. non-breeding birds), with the maximum territory estimate based on these registrations considered precautionary.

7.4.79 No aggregations of non-breeding birds were recorded within the study area during the 2022/2023 non-breeding season.

7.4.80 Flight activity surveys recorded a total of 58 curlew flights (**Technical Appendix 7.1, EIAR Volume 4,** and **Figure 7.7, EIAR Volume 3a**); with a total of seven flights identified to be 'at collision risk' and predicting a worst-case collision risk of one bird every 6.59 years (**Table 7.2** and **Technical Appendix 7.1, Annex E, EIAR Volume 4**).

7.4.81 Considering this species' breeding activity within the Site and predicted collision mortality risk, curlew is scoped-in to the assessment.

GOLDEN PLOVER

7.4.82 Observations of golden plover during baseline surveys were made almost exclusively during between September 2022 and early April 2023 (one record was of a flock of 50 birds passing through in early May 2023). Golden plover activity recorded during the baseline survey period is therefore attributed to that of non-breeding birds (birds on passage), which is consistent with baseline survey findings reported within EIA documentation for the Bodinglee Wind Farm and Kennoxhead Wind Farm II Extension.

7.4.83 Flight activity surveys recorded a total of six flights (**Technical Appendix 7.1, EIAR Volume 4,** and **Figure 7.7, EIAR Volume 3a**); however, no flights were identified to be 'at-risk' and therefore no collision risk is predicted.

7.4.84 Considering the absence of breeding activity and absence of predicted collision risk, significant adverse effects upon golden plover are highly unlikely and scoped-out of the assessment.

LAPWING

7.4.85 The moorland breeding bird survey completed in 2023 recorded breeding lapwing within the 500 m study area (**Figure 7.10**) with an estimated minimum of six and maximum of 12 territories recorded to be present within and/or overlapping the study area (**Table 7.3**).

7.4.86 Flight activity surveys recorded a total of 35 lapwing flights (**Technical Appendix 7.1, EIAR Volume 4,** and **Figure 7.7, EIAR Volume 3a**), which in the main were of single or small numbers of birds (up to four individuals). Observations of post-breeding flocks were however made in flight in late July (flocks of 60 and 140 birds), with non-breeding flocks also recorded in January and February 2023 (flocks of 32 and 25 birds). A total of five flights identified to be 'at collision risk' predicting an annual risk of 3.559 birds (**Table 7.2** and **Technical Appendix 7.1, Annex E, EIAR Volume 4**).

7.4.87 This collision risk estimate is however a substantial over-estimate, as breeding season calculations have included the passage of post-breeding flock flights recorded in late July 2023. Such flights would not be considered a regular pattern of species flight activity at the

Site during the breeding season and their inclusion has the effect of overinflating seasonal risks predicted by the NatureScot CRM.

7.4.88 No regular aggregations of foraging non-breeding birds were recorded within the Site during the 2023/2022 non-breeding season.

7.4.89 Considering this species' breeding activity within the Site and collision mortality risk predicted, lapwing is scoped-in to the assessment.

NON-BREEDING WILDFOWL

7.4.90 Baseline surveys undertaken over the 2022/2023 non-breeding season, together with existing ornithological information for the Site and surrounding area do not identify the Site as being important for foraging migratory wildfowl and which is consistent with Mitchell (2012[34]). The open moorland habitats within the Site are largely unsuitable for foraging wildfowl.

GREYLAG GOOSE

7.4.91 Observations of greylag geese recorded over the baseline survey period are considered to be of birds forming part of the British greylag population and which comprises a large component of the naturalised feral population.

7.4.92 A total of 15 flights were recorded over the 2022/2023 non-breeding and 2023 breeding seasons during flight activity surveys, with a total of three flights identified to be 'at collision risk'. This estimates an annual collision rate of one bird every 175 years (**Table 7.2** and **Technical Appendix 7.1, Annex E, EIAR Volume 4**).

7.4.93 A single flock of 14 birds were also recorded within the study area over the 2022/2023 non-breeding season (November 2022), outside of the Site south of Netherton Farm. Additional observations of family groups were also made during the 2023 breeding season (see **Technical Appendix 7.1**, **EIAR Volume 4** and **Figure 7.11, EIAR Volume 3a**).

7.4.94 Given the low conservation status assigned to the feral population, the very high avoidance rate assigned to greylag goose for use with the NatureScot CRM (SNH, 2018b[15]) and the absence of potential connectivity with a designated site for which greylag goose is a qualifying feature, significant effects upon the species, at any population level would not occur and are scoped out of the assessment.

PINK-FOOTED GOOSE

7.4.95 A total of seven flights were recorded over the 2022/2023 non-breeding and 2023 breeding seasons during flight activity surveys, with two flights identified to be 'at collision risk', predicting a mean annual collision rate of one bird every 9.22 years (**Table 7.2** and **Technical Appendix 7.1, Annex E, EIAR Volume 4**).

7.4.96 No foraging flocks were recorded within the study area. Additional flight activity, likely of late passage birds (during the early 2023 breeding season), recorded during scarce breeding bird survey and moorland breeding bird survey visits are detailed in **Technical Appendix 7.1** (**EIAR Volume 4**) and illustrated in **Figure 7.11** (**EIAR Volume 3a**).

7.4.97 Given the high avoidance rate assigned to the species (SNH, 2018b[15]) and absence of connectivity with a designated site for which the species is a qualifying feature, significant

[34] Mitchell, C. (2012). Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland. Wildfowl & Wetlands Trust / Scottish Natural Heritage Report, Slimbridge.

effects upon pink-footed goose are scoped out of the assessment and which is in accordance with current NatureScot advice (2023[35]).

ADDITIONAL SPECIES

7.4.98 Existing ornithological information has not identified the Site and immediate surrounding area as being important for any additional breeding bird species or species-groups, and which are identified as being potentially sensitive to onshore renewable energy developments in Scotland.

7.4.99 Observations of commoner raptor and owl species including buzzard, kestrel, long-eared owl and sparrowhawk were also made over the course baseline surveys; however, the potential for significant effects upon these species is scoped out of the assessment due to their lower conservation status (Stanbury *et al*., 2021[18]) and lower priority for consideration in the assessment of renewable energy developments (SNH, 2018a[14]).

7.4.100 A small number of woodcock observations were made during survey visits over the 2022/2023 non-breeding season (see **Technical Appendix 7.1, Annex D, EIAR Volume 4**). Considering this species' lack of breeding activity, infrequency within the study area and no predicted risk of collision, woodcock is scoped-out of the assessment.

7.4.101 Observations of black-headed gull, common gull and lesser black-backed gull were also recorded over the 2022/2023 non-breeding season (see **Technical Appendix 7.1, Annex D, EIAR Volume 4**) however, the potential for significant effects upon these species is scoped out of the assessment due to their lower conservation status (Stanbury *et al*., 2021[18]), lower priority for consideration in the assessment of renewable energy developments (SNH, 2018a[14]) and absence of potential connectivity to nearby statutory designated sites.

7.4.102 Herring gull flight activity was also low with no regular aggregations of foraging birds recorded within proximity to the Proposed Development. Collision mortality risks to the species are predicted to be less than one bird over the operational lifetime of the Proposed Development, which would not be measurable at a population level (see **Table 7.2** and **Technical Appendix 7.1, Annex E, EIAR Volume 4**). In the absence of potential connectivity with any nearby statutory designated sites, significant adverse effects are scoped out of the assessment.

7.4.103 Incidental observations of common crossbill, a Schedule 1 listed passerine, were made over the course of the surveys and it is possible the species breeds within suitable woodland habitat within and in proximity to the Proposed Development. The BDMP will include for pre-commencement surveys and where required species-specific measures (as appropriate) to be implemented and enable legislative compliance with regards to common crossbill (and all other S1 species) over the construction, decommissioning and operational phases of the Proposed Development. Significant adverse effects upon common crossbill are therefore scoped-out of the assessment.

Future Baseline

7.4.104 In the absence of the Proposed Development, or assuming a gap between baseline surveys and the commencement of the Proposed Development, any noticeable changes in baseline conditions (for example, in the distribution and population of breeding and non-breeding

[35] "*In light of the robust population and its high avoidance rate of 99.8%, collision risk modelling for pink-footed geese is only required if a proposal has connectivity with a protected area where this species is a qualifying interest.*" Available at: https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/renewable-energy/onshore-wind-energy/wind-farm-impacts-birds [Accessed 01st July 2024].

ornithological features) are most likely to result from habitat modifications within or surrounding the Site, or due to widespread land management practices.

7.4.105 Such changes are not predicted to happen at least in the short and medium term.

7.4.106 The Site is not subject to any other development pressures, which may have the potential to affect habitats and species in such a way as to substantially alter the baseline reported here. In the absence of the Proposed Development, the habitats within the Site are therefore considered most likely to remain under the existing management regime, largely comprising grazing for livestock including cattle and sheep.

7.4.107 In relation to breeding waders, it is unknown if current AECS options will remain in place within the Blackburn Farm area of the Site in the medium to long term, but for the purposes of assessment it is assumed that these would be renewed in the 2029 round of the scheme under identical management prescriptions.

7.4.108 It is also expected that coniferous plantation woodland within the Site and planted under the Forestry Grant Scheme in 2017, would continue to mature and which may provide opportunities for the establishment of ground-nesting bird predators such as foxes and corvids. It is unknown if this woodland would be felled and restocked at the end of the grant's obligation period, but for the purposes of assessment it is assumed it would remain as coniferous plantation woodland for the foreseeable future in the absence of the Proposed Development.

7.4.109 Breeding bird densities would therefore reasonably be expected to remain at comparable levels with those recorded during field surveys and identified through desk study, although remaining subject to minor inter-annual variation and existing local population pressures.

7.4.110 The UKCP18 climate change projections do show a general trend towards warmer, wetter winters and hotter, drier summers. These factors may result in extensions to breeding bird seasons, with the potential for increases in some species breeding productivity.

7.4.111 Conversely it may also result in unfavourable habitat changes, changes to prey availability and species survival rates. This makes predicting future outcomes very difficult.

7.4.112 Breeding productivity for some species sensitive to precipitation rates e.g. ground nesting species including breeding waders, may reduce, given the predicted higher rates of average precipitation across the lifespan of the Proposed Development (according to the UKCP18 climate change projections). This would most likely occur in line with national trends for such and there is no reason to anticipate that the baseline bird assemblage established to be using the Site would change substantially over the lifespan of the Proposed Development due to climate change.

7.4.113 Whilst short-term and small-scale variability in ornithological populations and distributions may occur, and revisions to conservation statuses and statutory designation sites for nature conservation are possible, such changes would be unlikely to qualitatively alter the conclusions of the assessment and have been accounted for through the adoption of a precautionary approach and appropriate industry standard mitigation and good practice.

Summary of Ornithological Features

Scoped Out Features

7.4.114 Following a review of baseline information and the exercise of professional judgment in the undertaking of impact assessment for onshore renewable energy developments, the following ornithological features have been scoped out of the assessment due to a lack of potential for significant effects:

- Designated sites for nature conservation with ornithological qualifying features;
- Black grouse;
- Schedule 1 raptors and owls - barn owl, goshawk, marsh harrier, merlin, osprey and peregrine falcon;
- Commoner raptors and owls - buzzard, kestrel, long-eared owl and sparrowhawk;
- Waders - common sandpiper, golden plover, oystercatcher, redshank, ringed plover, snipe and woodcock;
- All gulls; and
- Migratory waterfowl including greylag goose and pink-footed goose.

7.4.115 This is on the basis of:

- Standard measures within a BDMP for the Proposed Development to enable the protection of all wild breeding birds and legislative compliance during the construction, operation and decommissioning phase;
- Species being common and/or of low conservation priority;
- Low levels of activity recorded and absence of potentially significant collision mortality risks; and/or
- Implementation of positive habitat management measures within the Proposed Development's finalised BEMP.

Scoped In Features

7.4.116 The assessment considers the potential for significant effects upon those scoped-in IOFs and which are considered to be of 'medium' or 'high' Nature Conservation Interest (NCI) (in accordance with the criteria set out in **Technical Appendix 7.3, EIA Volume 4**), and as confirmed though baseline studies.

7.4.117 These IOFs are summarised in **Table 7.4**.

Table 7.4: Summary of IOFs Scoped-in to the Assessment.

Feature	Sensitivity	Justification
Hen harrier	Medium	Schedule 1/1A and Annex I listed. Red-listed BoCC (Stanbury *et al*., 2021[18]). Priority bird species for assessment in Scotland (SNH, 2018a[14]).
Red kite	Medium	Schedule 1/1A and Annex I listed. Priority bird species for assessment in Scotland (SNH, 2018a[14]).
Short-eared owl	Medium	Annex I Listed. Priority bird species for assessment in Scotland (SNH, 2018a[14]).
Curlew	Medium	Red-listed BoCC (Stanbury *et al*., 2021[18]). Priority bird species for assessment in Scotland (SNH, 2018a[14]).
Lapwing	Medium	Red-listed BoCC (Stanbury *et al*., 2021[18]). Priority bird species for assessment in Scotland (SNH, 2018a[14]).

7.4.118 The conservation status of these IOFs is detailed in **Table 7.5**.

Table 7.5: Conservation Status of IOFs Scoped-in to the Assessment.

Feature	Conservation Status	Information
Curlew	BoCC Red listed	The national breeding curlew population estimate was 59,000 pairs in 2016 (Woodward *et al*., 2020[36]), with long-term declines documented across Scotland. The NHZ 19 population was most recently estimated by Wilson *et al*. (2015[19]) as 4,284 breeding pairs (range 3,851-4,717). NatureScot in consultation advised that 3,843 pairs, based on a 10.3% decline in Scotland between 2017 and 2021, may still likely be an overestimate of the NHZ 19 population based on continued annual declines (see **Technical Appendix 1.1: Consultation Register**, **EIAR Volume 4**) The continued inclusion of the species on the BoCC Red list (Stanbury *et al*., 2021[18]) and population declines suggests that the national and NHZ/regional populations are in **unfavourable conservation status**.
Hen harrier	Annex 1, Schedule 1 /1A and BoCC Red listed	Hen harrier is a Red-listed BoCC due to a historical decline in the UK breeding population without substantial recent recovery (Stanbury *et al*., 2021[18]). From the species' most recent census in 2023, the UK plus the Isle of Man population was estimated to be 691 territorial pairs, of which 653 are found in the UK. This is a 20% increase since the last census in 2016 (RSPB, 2023[37]). Scotland holds the bulk of the population with an estimated 529 breeding pairs in 2023 (RSPB, 2023[37]). An estimated 1,050-1,540 birds are thought to be present in the winter, with the population thought to be supplemented to some degree by wintering birds from Scandinavia (Forrester *et al*., 2012[38]). The regional NHZ 19 breeding population is most recently cited by Wilson *et al*. (2015[19]) as 18 pairs (range 15-20) in 2011, although it was recognised that this was likely an underestimate. In the most recent assessment of regional and national conservation status, Fielding *et al* (2011[39]) considered that although the regional NHZ 19 population passed the 'Level 1' and 'Level 2' tests of habitat occupancy and density, the NHZ 19 population was in unfavourable conservation status due to its low productivity rates (1.03 young fledged/pair). The regional/NHZ breeding population is assigned an **unfavourable conservation status** for the purposes of assessment.
Lapwing	BoCC Red listed	The national breeding lapwing population has been most recently estimated as 98,000 pairs (in 2016 by Woodward *et al*. 2020), with the Scottish population is estimated to be between 71,500 and 105,600 pairs (Forrester *et al*., 2012[38]). Woodward *et al*. (2020[40]) reported a national breeding decline of 59 % across the UK, with Scottish densities highest in Orkney, Shetland and the Outer Hebrides.

36 Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D.A. & Noble, D. (2020). Population estimates of birds in Great Britain and the United Kingdom. *British Birds,* **113**: 69–104.

37 RSPB (2023). Hen Harrier Survey Results 2023: Numbers improve, but much more to be done. [Online] Available at: https://www.rspb.org.uk/whats-happening/news/hen-harrier-survey-results [Accessed 01st July 2024].

38 Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. and Grundy, D.S. eds (2012). The digital birds of Scotland. The Scottish Ornithologists' Club, Aberlady.

39 Fielding, A., Haworth, P., Whitfield, P., McLeod, D. & Riley, H. (2011) A Conservation Framework for Hen Harriers in the United Kingdom. JNCC Report 441. Joint Nature Conservation Committee, Peterborough.

40 Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D.A. & Noble, D. (2020). Population estimates of birds in Great Britain and the United Kingdom. *British Birds*,113, pp. 69–104.

Table 7.5: Conservation Status of IOFs Scoped-in to the Assessment.		
Feature	**Conservation Status**	**Information**
		The NHZ 19 population estimate and trend is unknown but for the purposes of assessment, the regional and national populations are on balance taken as being in **unfavourable conservation status**.
Red kite	Annex I, Schedule 1, BoCC Green list	Woodward *et al*. (2020[40]) most recently estimated the red kite UK breeding population to be 4,400 pairs (based on 2017 data), with the species included on the BoCC Green list (Stanbury *et al*., 2021[18]) indicating that the national population is considered to be in favourable conservation status. Following reintroduction efforts between 1989 and 2009, the Scottish red kite breeding population was estimated by the Scottish Raptor Monitoring Scheme (SRMS) to be at least 273 pairs in 2021 (Challis *et al*., 2023[41]), with the most recently cited NHZ 19 population estimate being 83 breeding pairs (Wilson *et al*., 2015[19]) based on 2013 monitoring data. The national and regional populations of red kite in Scotland are considered to still remain in their expansion phase. Annual productivity rates remain high (1.3 young fledged/pair laying eggs in 2022, Challis *et al*., 2023[41]), with the species populations continuing to grow in size and distribution. The most recently cited NHZ 19 population estimate is therefore likely to be conservative. Based on an average annual 3.8% change in the number of pairs reported by the SRMS for NHZ 19 for the period 2008-2018 (Wilson *et al*., 2022[42]), an estimate of the 2024 NHZ 19 breeding population might be 125 pairs. The regional/NHZ breeding population is consequently assumed to be stable but growing and is assigned a **favourable conservation** status for the purposes of assessment.
Short-eared owl	Annex I, BoCC Amber list	The most recent UK breeding short-eared owl population estimate published by the SRMS is 620-2,200 pairs (based on 2007-2011 data published by Woodward *et al*., 2020[40]), with the most recently published NHZ 19 population cited as 35 pairs (7-67 pairs) by Wilson *et al*. (2015[19]) and based on a population estimate from 1990. Short-eared owl populations are however acknowledged to be difficult to monitor, due to their nomadic nature, which is linked to cyclic populations of field voles. Breeding short-eared Owls are quick to move away from areas where voles are scarce and to colonise areas where voles are more abundant (Chalis *et al*., 2023[41]). The national and regional population trends are therefore not accurately known.

7.5 Assessment of Effects

7.5.1 This section presents the assessment of potentially significant effects upon IOFs, in the absence of non-standard (additional) mitigation both as a result of the Proposed Development alone and cumulatively in combination with other wind farm developments.

[41] Challis, A., Beckmann, B.C., Wilson, M.W., Eaton, M.A., Stevenson, A., Stirling-Aird, P., Thornton, M. & Wilkinson, N.I. (2023). Scottish Raptor Monitoring Scheme Report 2021 & 2022. BTO Scotland, Stirling.

[42] Wilson, M., Challis, A. and Wernham, C.V. (2022). Scottish Raptor Monitoring Scheme Trends for 2009-2018: Methods and Analysis of Gaps. A report to the SRMG. [Online] Available at: https://raptormonitoring.org/wp-content/uploads/2022/11/SRMS-Trends-2009-2018_methods-and-gap-analysis_WORKING-VERSION_Nov-2022.pdf

7.5.2 The following potential impacts are assessed, as relevant, for ornithological features scoped-in to detailed assessment:

- Construction and decommissioning phase impacts;
  - Disturbance/displacement to birds during construction due to vehicular traffic, operating plant and the presence of construction workers;
- Operational phase impacts;
  - Disturbance/displacement to birds during the operation of the turbines, vehicular traffic and the presence of people during operations; and/or
  - The risk of death or injury through collision with wind turbine blades or other types of infrastructure associated with the Proposed Development.

7.5.3 The assessment is based on the assumptions, standard mitigation measures and implementation and finalisation of a BEMP as set out in **Section 7.3**.

Curlew

Potential Construction Effects (Disturbance/Displacement)

7.5.4 **Effect:** breeding curlew may be displaced from the Site temporarily during construction by disturbance.

7.5.5 **Sensitivity:** medium NCI (**Table 7.4**), Red-listed BoCC, with NHZ 19 and national populations considered to be in an unfavourable conservation status (**Table 7.5**). Consequently, curlew sensitivity in the context of the Site and for the purposes of assessment is considered to be **medium-high**.

7.5.6 **Magnitude of Effect:** an estimated 13-22 curlew territories recorded in 2023 would be located within or overlapping a 500 m buffer from Proposed Development infrastructure, primarily in proximity to the turbine array (**Table 7.3 and Figure 7.10**, **EIAR Volume 3a**). This represents up to 0.6% of a possible NHZ 19 breeding population estimate of 3,843 pairs (see **Table 7.5**).

7.5.7 It is very unlikely that all breeding curlew pairs within 500 m of the turbine array would be displaced from the regional NHZ population in any year due to construction activities associated with the Proposed Development. A disturbance buffer of up to 300 m is currently recommended as being appropriate to avoid the potential for disturbance to breeding curlew (Goodship and Furness, 2022[4]) and so the study area adopted for assessment is precautionary.

7.5.8 Construction activity would also not take place simultaneously across the whole Site during the breeding season and some pairs, where affected by construction disturbance, may move to adjacent suitable habitats within and surrounding the Site, unaffected by construction activities.

7.5.9 It is also noted that many breeding season registrations of curlew in 2023 were in close proximity (<500 m) to major transport routes that intersect the Site, including the M74 and B7078 (see **Figure 7.10, EIAR Volume 3a**). Curlew pairs choosing to breed within or in proximity to the Site are therefore likely to have some existing level of tolerance during the breeding season to vehicular and pedestrian traffic.

7.5.10 As a worst-case, assuming some breeding pairs would be temporarily displaced during the construction phase, (and considered temporarily lost to the NHZ population for the purposes of assessment) an effect of no more than **negligible** and **short-term** magnitude is predicted.

7.5.11 **Significance of effect:** the unmitigated effect on the NHZ 19 curlew population as a result of construction disturbance is therefore considered to be no more than **minor adverse** and **not significant** in the context of the EIA regulations.

Potential Operational Effects (Disturbance/Displacement)

7.5.12 **Effect:** nesting or foraging curlew may be displaced from habitat around operational infrastructure, thereby affecting productivity and/or survival rates.

7.5.13 **Sensitivity: medium-high**.

7.5.14 **Magnitude of effect:** It is similarly considered unlikely that all breeding curlew recorded within 500 m of infrastructure would be lost from the regional NHZ (or national) population permanently i.e. over the Proposed Developments operational lifetime. Some pairs may be affected, but where affected would most likely be displaced into suitable breeding habitat within the Site or surrounding area.

7.5.15 The Proposed Developments BEMP will include for positive habitat enhancement measures for breeding waders, including curlew, as set out in the OBEMP (**Technical Appendix 6.6, EIAR Volume 4**). These measures will seek to improve peatland habitats within the Site and the breeding productivity of breeding wader species locally over the lifetime of the Proposed Development. Aim 8 of the OBEMP, proposed to be finalised in consultation with the CVWI will be achieved through livestock management, the creation of scrapes and predator control measures within the Site and away from operational infrastructure.

7.5.16 Whilst some curlew pairs may therefore be displaced (up to 0.6% of the regional NHZ population) from existing habitats as a result of the operational if the Proposed Development, increases in the productivity of remaining pairs locally to be achieved through the implementation of measures within the Proposed Developments BEMP would serve to sufficiently offset such effects upon the local curlew population.

7.5.17 An effect of no more than **negligible** but **permanent** magnitude is therefore predicted.

7.5.18 **Significance of effect:** the unmitigated effect on the regional curlew population as a result of operational displacement is concluded to be **negligible** and **not significant** in the context of the EIA regulations.

Potential Operational Effects (Collision Mortality Risk)

7.5.19 **Effect**: birds that utilise the airspace within the Proposed Development at potential collision heights may be at risk of collision with turbines, thereby increasing the annual mortality rate of the population above background levels.

7.5.20 **Sensitivity**: **medium-high**.

7.5.21 **Magnitude of effect**: curlew flight activity was recorded during the 2023 breeding season, with the NatureScot collision risk model predicting an annual mortality risk of 0.15 birds, or one bird every 6.59 years (see **Table 7.2**).

7.5.22 Flight activity was considered largely associated with breeding territories within proximity to the Proposed Development in 2023. Predicted collision risks for the purposes of assessment are therefore attributed to regional breeding population, conservatively at 3,843 pairs (or 7,686 adult breeding birds).

7.5.23 The additional predicted annual mortality due to collision with operational turbines would result in an increase of 0.019% over the calculated annual baseline mortality rate (0.101, BTO BirdFact[43]s) and which would be unmeasurable at the regional population level.

7.5.24 The increase in annual baseline mortality for curlew is considered to be an effect of **negligible** but **permanent** magnitude.

7.5.25 **Significance of effect**: the unmitigated effect on the breeding NHZ 19 curlew population from collision risk is therefore concluded to be no more than **minor** and **not significant** in the context of the EIA regulations.

Hen Harrier

Potential Construction Effects (Disturbance/Displacement)

7.5.26 **Effect**: roosting hen harrier may be displaced from roosting habitats within proximity to the Proposed Development during construction by disturbance, thereby impacting on fitness and survival rates within the non-breeding season population.

7.5.27 **Sensitivity**: medium NCI (**Table 7.4**) based on presence as a non-breeding (wintering) species and unfavourable conservation status (**Table 7.5**); overall **medium-high** sensitivity.

7.5.28 **Magnitude of Effect**: baseline studies identified a wintering hen harrier roost location (SSRG_HH1, **Figure 7.2.1, EIAR Volume 5**), located within 750 m of the Proposed Development (turbine array), the upper recommended disturbance buffer for non-breeding hen harriers (Goodship and Furness, 2022[4]). The roost location comprises a linear habitat feature, with roosting birds thought to favour certain parts (see **Technical Appendix 7.2, EIAR Volume 5**). There will be no direct habitat loss from the roost feature as a result of the Proposed Development.

7.5.29 From consultation with the SSRSG the roost is known to be used annually (i.e. is considered a 'traditional' roost site) however, the number of birds recorded using the roost has declined in recent years to two or three birds in 2023 (see **Technical Appendix 7.2, EIAR Volume 5**). The cause of the decline is unknown, but in review of monitoring data obtained for the roost location between the 2019/2019 and 2022/2023 non-breeding seasons, the number of birds present over each wintering period is highly variable between nights (see **Technical Appendix 7.2, EIAR Volume 5**).

7.5.30 As hen harriers are dispersive over the non-breeding season, with roost sites and wintering foraging areas often well away from breeding sites, individual birds using the roost location will be transient, likely occupying multiple roost sites over the course of the non-breeding season. Alternative roost sites may therefore have become more favourable and/or there is a degree of flexibility in roost site choice in the surrounding wider area. Hen harriers are therefore assumed to be able to seek alternative roost sites, or an alternative position within a roosting feature, away from a perceived disturbance source if required.

7.5.31 No hen harrier flight activity was recorded over the course of baseline surveys which suggests that during the non-breeding (and breeding season) the Site does not comprise a regularly used or important foraging area for the species.

7.5.32 Hen harrier is listed on Schedule 1 and 1A of the Wildlife and Countryside Act 1981 (as amended). The Proposed Development's BDMP will therefore include for standard species-specific restrictions during the construction works to enable legislative compliance and avoid

[43] Adult survival and mortality rates available at: https://www.bto.org/understanding-birds/birdfacts/curlew [Accessed 14 August 2024].

(or otherwise minimise) the disturbance to roosting hen harrier. This would specifically include for the avoidance of activity within the 750 m buffer of roosting hen harrier overnight and within two hours of dusk (two hours before official sunset time) and dawn (two hours after official sunrise time) during the non-breeding season in accordance with current NatureScot guidance (SNH, 2014[44]).

7.5.33 An effect of **negligible** and **short-term** magnitude is therefore predicted. **Significance of Effect**: the unmitigated effect on the non-breeding hen harrier population (taken as the national dispersive population estimate, see **Table 7.5**) is therefore concluded as **negligible** and therefore **not significant** in the context of the EIA Regulations.

Potential Operational Effects (Disturbance/Displacement)

7.5.34 **Effect**: roosting hen harrier may at risk of displacement from roosting habitats during the operation of the Proposed Development (and operational maintenance works), thereby impacting on fitness and survival rates.

7.5.35 **Sensitivity**: **medium-high**.

7.5.36 **Magnitude of Effect**: possible effects on wintering hen harriers from operational wind farms are not well understood however, evidence broadly suggests that hen harriers are not very sensitive to displacement around operational infrastructure.

7.5.37 Studies conducted at Irish and Scottish wind farms (Madden and Porter, 2007[45]; Robson, 2012[46]; Haworth and Fielding, 2012[47]) have all recorded harrier flights close to operational turbines. Haworth and Fielding (2012[47]) have also presented several examples, from within the UK, where harriers have been recorded nesting close to operating turbines. In their review they found no clear evidence of hen harrier foraging displacement at distances beyond 100 m from turbines at wind farms in Scotland, and no evidence that turbines restrict hen harrier nesting attempts, except at perhaps a distance of 200 – 250 m. It was their conclusion that "*even if the effects of wind farms are much larger than the available evidence suggests it is highly unlikely that these effects would result in significant population level effects*" (Haworth and Fielding, 2012[47]).

7.5.38 Based on published evidence, a 100 m displacement distance is likely to be a reasonable extent within which possible effects on hen harrier activity around turbine locations of the Proposed Development could occur. Even if displacement effects to roosting hen harriers were of greater spatial extent, based on information obtained from baseline studies it appears that there is very likely to be a degree of flexibility in roost site choice by individual hen harriers over the non-breeding season.

7.5.39 The Proposed Development's BDMP will inherently include for species-specific restrictions during the operational maintenance works to enable legislative compliance and avoid (or otherwise minimise) the disturbance to roosting hen harrier. As for construction works, this

[44] SNH (2014) Implications of Additional Protection for Hen Harrier, Red Kite and Golden Eagle under Schedule A1 & 1A of the Wildlife and Countryside Act (1981) [Online]. Available at: https://www.nature.scot/doc/implications-additional-protection-hen-harrier-red-kite-and-golden-eagle-under-schedules-a1-1a [Accessed 14 August 2024].

[45] Madden, B. & Porter, B. (2007). Do wind turbines displace Hen Harriers *Circus cyaneus* from foraging habitat? Preliminary results of a case study at the Derrybrien wind farm, county Galway. *Irish Birds*, 8, pp. 231–236.

[46] Robson, P. (2012). Hen Harrier activity at Cruach Mhor windfarm. Review of monitoring data 2001-2011. SNH Sharing Good Practice Workshop - Assessing the impact of windfarms on birds, 3 April 2012.

[47] Haworth, P. and Fielding, A. (2012). A review of the impacts of terrestrial wind farms on breeding and wintering hen harriers. Haworth Conservation.

would similarly include for the avoidance of activity within a 750 m buffer of roosting hen harrier overnight and within two hours of dusk (two hours before official sunset time) and dawn (two hours after official sunrise time) during the non-breeding season, which is in accordance with current NatureScot guidance (SNH, 2014[44]).

7.5.40 Adopting a worst-case for the purposes of assessment, and assuming that some of the roosting feature may become unattractive to up to eight hen harriers (0.76% of an assumed national population of 1,050 birds, see **Table 7.5**) due to the presence of operational infrastructure, the unmitigated impact on non-breeding hen harrier may result in an effect of **negligible** but **permanent** magnitude on the population.

7.5.41 **Significance of Effect**: the unmitigated effect on the non-breeding hen harrier population (national dispersive) from operational displacement is concluded to be no more than **minor adverse** and therefore **not significant** in the context of the EIA Regulations.

7.5.42 To further minimise the magnitude of potential operational effects upon roosting hen harrier, proposed positive habitat management measures are outlined in **Section 7.6** for inclusion within the Proposed Developments BEMP .

Lapwing

Potential Construction Effects (Disturbance/Displacement)

7.5.43 **Effect**: breeding or foraging lapwing may be displaced from the Site during construction by disturbance.

7.5.44 **Sensitivity**: medium NCI (**Table 7.4**) and unfavourable conservation status (**Table 7.5**); overall **medium-high** sensitivity.

7.5.45 **Magnitude of effect**: up to 12 breeding lapwing territories were recorded to be within or overlapping a 500 m buffer from Proposed Development infrastructure (**Table 7.3 and Figure 7.10**, **EIAR Volume 3a**). The regional NHZ 19 lapwing population is unknown but for the purposes of an assessment, a conservative population estimate might be up to 2,000 pairs based on population estimates presented for the Lothians and Borders in Forrester *et al.* (2012[38]); 12 breeding pairs comprises 0.6% of this notional population estimate.

7.5.46 It is considered very unlikely that all breeding lapwing activity recorded within the study area would be lost to the population over the course of construction works. In review of existing records obtained in consultation with RSPB, breeding lapwing are known to occur extensively within habitats adjacent to the Site, at distances greater than 500 m from the Proposed Development. It is considered more likely that any lapwing that may choose to breed within proximity to working areas would be displaced to adjacent suitable habitats.

7.5.47 Similarly to curlew, it is also noted that many breeding season registrations recorded in 2023 were in close proximity (<500 m) to major transport routes (see **Figure 7.10, EIAR Volume 3a**). It is therefore very likely that lapwing pairs within the Site have some level of tolerance to vehicular and pedestrian traffic within and in proximity to current nesting areas.

7.5.48 As a worst-case (where breeding lapwing would be lost from the population rather than displaced), an impact of **negligible** and **short-term** magnitude is predicted.

7.5.49 **Significance of Effect**: the unmitigated effect on the notional regional lapwing population as a result of construction is considered to be **negligible** and therefore **not significant** in the context of the EIA Regulations.

Potential Operational Effects (Disturbance/Displacement)

7.5.50 **Effect**: nesting or foraging lapwing may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

7.5.51 **Sensitivity**: **medium-high**.

7.5.52 **Magnitude of impact**: it is similarly considered unlikely that all breeding lapwing recorded within the study area would be permanently lost to regional population as a result of the Proposed Development. Some pairs where affected would most likely be displaced into suitable breeding habitat within the Site or surrounding area.

7.5.53 The Proposed Developments BEMP will include for positive habitat enhancement measures for breeding waders, including curlew, as set out in the OBEMP (**Technical Appendix 6.6, EIAR Volume 4**).. These measures will seek to improve peatland habitats within the Site and the breeding productivity of breeding wader species locally over the lifetime of the Proposed Development.

7.5.54 Whilst some lapwing pairs may therefore be displaced (up to 0.6% of a notional population estimate) from existing habitats as a result of the operational if the Proposed Development, increases in the productivity of remaining pairs locally to be achieved through the implementation of measures within the Proposed Development's finalised BEMP would serve to sufficiently offset such effects upon the local lapwing population.

7.5.55 An effect of no more than **negligible** but **permanent** magnitude is therefore predicted.

7.5.56 **Significance of effect**: the unmitigated effect on the regional lapwing population as a result of operational displacement is therefore concluded as **negligible** and **not significant** in the context of the EIA regulations.

Potential Operational Effects (Collision Mortality Risk)

7.5.57 **Effect**: birds that utilise the airspace within the Proposed Development at potential collision heights may be at risk of collision with turbines, thereby increasing the annual mortality rate of the population above background levels.

7.5.58 **Sensitivity**: **medium-high**.

7.5.59 **Magnitude of effect**: lapwing flight activity was recorded across the survey period, attributable to both breeding and post-breeding birds. The NatureScot collision risk model predicts an annual mortality risk of 3.559 birds, and which included for pre- and post-breeding flocking behaviour prior to and at the end of the 2023 breeding season; including flocks of 32-35 birds on a single date in February 2023 and 140 and 60 birds recorded in late July 2023 (see **Technical Appendix 7.1, Annex D, EIAR Volume 4**).

7.5.60 For context and conservative assessment, assuming all risks are associated with a notional regional breeding population (i.e. 2,000 pairs or 4,000 adult breeding birds), the additional predicted mortality due to collision with operational turbines would result in an increase of 0.302% over the baseline mortality rate (0.295, BTO BirdFacts [48]).

7.5.61 The increase in annual baseline mortality for lapwing is considered to be of **negligible** and **permanent** magnitude, and is unlikely to be measurable at the regional population level.

[48] Adult survival and mortality rates available at: https://www.bto.org/understanding-birds/birdfacts/lapwing [Accessed 08 July 2024].

7.5.62 **Significance of effect**: the unmitigated effect on the regional breeding lapwing population from collision risk is considered to **negligible** and is therefore **not significant** in the context of the EIA regulations.

Red kite

Potential Construction Effects (Disturbance/Displacement)

7.5.63 **Effect:** breeding or foraging red kite may be displaced from the Site by construction disturbance.

7.5.64 **Sensitivity:** medium NCI (**Table 7.4**) and favourable conservation status (**Table 7.4**), therefore considered to have an overall **medium sensitivity**.

7.5.65 **Magnitude of effect**: baseline studies identified two red kite breeding sites within 2 km of the Proposed Development, with a single breeding site located within 300 m of the Proposed Development at its nearest point (see **Figure 7.2.1** and **Figure 7.2.2** and **Technical Appendix 7.2, EIAR Volume 5**), and therefore within the upper recommended disturbance buffer for breeding red kite (Goodship and Furness, 2022[4])..

7.5.66 No communal red kite roost locations were identified during baseline studies and which may be impacted by the Proposed Development.

7.5.67 Red kite is listed on Schedule 1 and 1A of the Wildlife and Countryside Act 1981 (as amended). The Proposed Development's BDMP will therefore inherently include for species-specific restrictions during the construction works to enable legislative compliance and avoid (or otherwise minimise) the disturbance to nesting (and/or roosting) red kite. This would include for the avoidance of activity within a 300 m buffer of nesting red kite during the species breeding season (April to July) and within a 300 m of any identified roost locations overnight and within two hours of dusk (two hours before official sunset time) and dawn (two hours after official sunrise time) during the non-breeding season, which is in accordance with current NatureScot guidance (SNH, 2014[44]).

7.5.68 Red kites usually forage within 3 km of their nest sites but can forage up to 6 km (Hardey *et al*., 2013[5]). Much of the red kite activity recorded within the Site is therefore most likely related to birds that breed locally, including at those nest sites identified during baseline studies. Some activity is however attributable to juvenile or non-breeding adults which may range across much wider area.

7.5.69 Red kites are generally accepted as being opportunistic foragers and scavengers and can often be found nesting close to human habitation (see **Confidential Technical Appendix 7.2** for nesting locations). Any displacement of breeding or non-breeding foraging birds from within proximity to construction works is therefore unlikely to result in a measurable adverse impact.

7.5.70 Overall, construction impacts to red kite therefore be of **negligible** and **short-term** magnitude.

7.5.71 **Significance of effect:** the unmitigated construction effect on the regional red kite population is considered to be **negligible** adverse and **not significant** in the context of the EIA regulations.

Potential Operational Effects (Disturbance/Displacement)

7.5.72 **Effect:** red kite may be at risk of displacement from foraging and nesting habitat due to the presence of operational infrastructure, thereby impacting on productivity, fitness and survival rates.

7.5.73 **Sensitivity: medium sensitivity**.

7.5.74 **Magnitude of effect**: Current evidence suggests that red kites do not exhibit a strong degree of displacement from operational wind farms in Scotland (Duffy and Urquhart, 2014[49] and SNH, 2018b[15]). The occurrence and/or extent of displacement effects upon red kite from operational solar arrays within the UK is unknown. However, in this case, given the relatively low-level of operational maintenance works associated with solar arrays and likely levels of habituation of pairs within proximity to the Proposed Development to existing sources of disturbance including major roadways, agricultural practices and quarry activities, any measurable displacement effects to breeding birds would very unlikely result in nest site abandonment.

7.5.75 The Proposed Developments BDMP will also include for species-specific restrictions during the operational maintenance works to enable legislative compliance and avoid (or otherwise minimise) the disturbance to nesting (and where relevant) roosting red kite. As for construction works, this would similarly include for the avoidance of activity within 300 m of identified active nest sites and 300 m buffer of any identified roost sites overnight and within two hours of dusk (two hours before official sunset time) and dawn (two hours after official sunrise time) during the non-breeding season, which is in accordance with current NatureScot guidance (SNH, 2014[44]).

7.5.76 Assuming a worst-case scenario whereby a single red kite breeding pair is displaced from its current nesting site due to the presence of operational infrastructure, this represents up to 0.8% of a likely NHZ population estimate (125 pairs, see **Table 7.5**).

7.5.77 Whilst suitable woodland nesting habitats for red kite (primarily deciduous woodland copses) within 300 m of the Proposed Development is relatively limited, suitable nesting habitats are however present within the wider area, including along the Duneaton Valley and to which existing pairs may be displaced and/or establish.

7.5.78 Overall operational impacts to red kite are concluded as being of no more than **negligible** and **permanent** magnitude, as there will continue to be sufficient available foraging habitat and nesting opportunities surrounding the Proposed Development.

7.5.79 **Significance of effect:** the unmitigated operational displacement effect on the regional NHZ red kite population is considered to be **negligible adverse** and **not significant** in the context of the EIA regulations.

Potential Operational Effects (Collision Mortality Risk)

7.5.80 **Effect**: birds that utilise the airspace within the Proposed Development at potential collision heights may be at risk of collision with turbines, thereby increasing the annual mortality rate of the population above background levels.

7.5.81 **Sensitivity**: **medium**.

7.5.82 **Magnitude of Effect**: the NatureScot CRM predicts an annual collision mortality risk of 0.08, or one bird every 9.54 years.

7.5.83 Based on a likely regional NHZ population of 250 adult breeding birds (see **Table 7.5**), the additional mortality due to collisions represents an increase in baseline mortality of 0.02 %

[49] Duffy, K. & Urquhart, B. (2014) Braes of Doune Windfarm Report on Red Kite Studies 2004-2012. A report prepared by Natural Research Projects on behalf of the Braes of Doune Ornithology Steering Group.

(using an annual adult mortality rate of 0.14, as per Sansom *et al*., 2016[50]). Given the continued relatively high productivity of breeding pairs reported for the expanding Scottish population (1.3 young fledged per pair laying eggs in 2022, Challis *et al*., 2023[41]), previous population modelling elsewhere in Scotland has demonstrated that the growth of regional red kite populations (even where constrained by other significant anthropogenic sources e.g. persecution events) is not necessarily further constrained by additional predicted baseline mortality from onshore wind farms i.e. growth is slowed, but the population remains stable and growing (Samson *et al*., 2016[50]).

7.5.84 Given the very small, predicted increase in annual baseline mortality for red kite, which would unlikely be measurable at the regional population level, an effect of **negligible** and **permanent** magnitude is predicted.

7.5.85 **Significance of effect**: the unmitigated collision risk effect on the regional NHZ red kite breeding population is concluded as **negligible** and **not significant** in the context of the EIA regulations.

7.5.86 To further minimise the magnitude of potential operational effects upon red kite, it is proposed that an operational livestock carcass monitoring and removal strategy will be implemented for the Proposed Development. This will include for the regular searching of livestock carcasses within the turbine array, and removal of such off Site to an agreed location (see **Section 7.6**).

Short-eared Owl

Potential Construction Effects (Disturbance/Displacement)

7.5.87 **Effect**: breeding or foraging short-eared owl may be displaced from the Site due to construction disturbance.

7.5.88 **Sensitivity**: medium NCI (**Table 7.4**) with the NHZ 19 and national populations of unknown (but potentially unfavourable) conservation status (**Table 7.5**). Consequently, short-eared owl sensitivity in the context of the Site is considered to be **medium-high**.

7.5.89 **Magnitude of effect**: Short-eared owls are generally nomadic breeders, with breeding densities and productivity strongly linked to cyclic populations of field voles. Activity and breeding locations identified during baseline studies were in large associated with the Red Moss area and which extends south of the Proposed Development and outwith the Site. In some years, depending on the availability of prey, between one and three short-eared owl breeding attempts are known to occur within 500 m of the Proposed Development, representing between 2.86% and 8.57% of the most recently estimated regional NHZ 19 population. It is however unlikely that birds would return to the exact same nest site or area for future breeding attempts and there is natural variability in the number of breeding attempts made between years within proximity to the Proposed Development.

7.5.90 Goodship and Furness (2022[4]) recommend a disturbance-free buffer of up to 500 m from short-eared owl nests. However, it is considered very unlikely that all breeding short-eared owl activity within 500 m of infrastructure would be displaced, given the variability in number and locations of breeding attempts and that construction activity would not take place simultaneously across the whole Site during the breeding season.

[50] Sansom, A., Etheridge, B., Smart, J. & Roos, S. (2016). Population modelling of North Scotland red kites in relation to the cumulative impacts of wildlife crime and wind farm mortality. Scottish Natural Heritage Commissioned Report No. 904.

7.5.91 Pairs that are affected by construction disturbance would most likely move to adjacent suitable habitats within and surrounding the Site, unaffected by construction activities.

7.5.92 Of relevance locally, short-eared owls are known to breed within close proximity to wind farm construction traffic, having nested within 800 m of the Kennoxhead Cluster Mid Rig access track, to the north of the Site. As such the species may have an existing level of tolerance to such activities during the breeding season and alternative nesting habitats are known to be available beyond the Site.

7.5.93 As a worst-case, assuming some breeding pairs in some years (up to 8.57% of the most recently cited regional NHZ 19 population) may be temporarily displaced during the construction phase, (and considered temporarily lost to the NHZ population for the purposes of assessment) an effect of up to **low** and **short-term** magnitude is predicted.

7.5.94 **Significance of effect:** the unmitigated effect on the NHZ 19 short-eared owl population as a result of construction disturbance is considered to be no more than **minor** and **not significant** in the context of the EIA regulations.

7.5.95 To avoid or otherwise minimise the magnitude of potential construction effects upon breeding short-eared owl, additional mitigation measures are set out in **Section 7.6**.

Potential Operational Effects (Disturbance/Displacement)

7.5.96 **Effect:** breeding or foraging short-eared owl may be at risk of displacement from around turbines or other infrastructure as a result of habitat loss.

7.5.97 **Sensitivity**: **medium**.

7.5.98 **Magnitude of Effect**: It is similarly considered unlikely that all breeding short-eared owl activity recorded within 500 m of infrastructure would be displaced over the Proposed Development's operational lifetime. Some pairs affected would most likely be displaced into suitable breeding habitat within the Site or surrounding area and the number of pairs choosing to nest within proximity to the Proposed Development, would vary between years on account of the natural variability in breeding attempts by the species.

7.5.99 As a worst-case, assuming some breeding pairs in some years (up to 8.57% of the most recently cited NHZ 19 population) may be displaced (and assumed lost to the NHZ population for the purposes of assessment) a potential effect of **low** but **permanent** magnitude is predicted.

7.5.100 **Significance of Effect**: the unmitigated effect is considered to be **minor** and **not significant** in the context of the EIA Regulations.

7.5.101 Additional mitigation measures are set out in **Section 7.6** to avoid or otherwise minimise the potential for disturbance to breeding short-eared owl during operational maintenance works.

7.5.102 To further minimise the magnitude of potential operational effects upon breeding short-eared owl, proposed positive habitat management measures are outlined in **Section 7.6** for inclusion within the Proposed Developments BEMP.

Decommissioning Effects (all IOFs)

7.5.103 The potential significance of decommissioning phase effects for the Proposed Development are difficult to predict with any confidence because of the long timeframe until their occurrence.

7.5.104 For the purpose of this chapter, however, they are assumed to be similar in nature to those of construction impacts but of shorter duration. The significance of effects predicted in the construction (above) are therefore considered appropriately precautionary for assessing decommissioning effects on IOFs and which are concluded as **not significant** in the context of the EIA Regulations.

7.6 Mitigation

Mitigation during Construction

7.6.1 No significant unmitigated construction phase effects were predicted for any IOF, and therefore no additional mitigation measures are required.

7.6.2 The following additional species-specific measures are however outlined for inclusion within the Proposed Development's BDMP to be informed-by pre-commencement surveys and which will avoid or further minimise the potential for disturbance to sensitive breeding birds during the construction phase:

- Black grouse; no construction works will be undertaken within 750 m of any identified black grouse lek site before 9am in April and May; and
- Short-eared owl; no construction works will be undertaken within 30 m of any active short-eared owl nest site.

Mitigation during Operation

7.6.3 No significant unmitigated operational phase effects were predicted for any IOF, and therefore no additional mitigation measures are required.

Breeding Bird Disturbance Management Plan

7.6.4 The following additional species-specific measures are however outlined for inclusion within the Proposed Development's BDMP to be informed-by pre-commencement surveys and which will avoid or further minimise the potential for disturbance to sensitive breeding birds during the operational phase:

- Black grouse; no operational maintenance works will be undertaken within 750 m of any identified black grouse lek site before 9am in April and May; and,
- Short-eared owl; no operational maintenance works will be undertaken within 30 m of any active short-eared owl nest site.

7.6.5 The finalisation and implementation of the Proposed Developments BDMP would be undertaken by way of a suitably worded planning condition.

Breeding Short-eared Owl and Roosting Hen Harrier

7.6.6 To further minimise the magnitude of potential operational displacement impacts upon breeding short-eared owl and roosting hen harrier, species-specific habitat management measures will be undertaken within the Site and be included within the Proposed Development's finalised BEMP.

7.6.7 It is proposed that this will include for the identification of marsh/marshy grassland, wet modified bog, wet dwarf shrub heath and acid grassland areas within the Site, around Black Hill and south to the Duneaton Water, away from operational infrastructure. The area once defined in consultation with landowners and NatureScot, is proposed to be managed to provide areas of taller heather, tall rushes and/or rank grassland areas suitable to provide suitable opportunities for roosting and nesting hen harrier and short-eared owl. It is proposed that areas would be managed over the operational lifetime of the Proposed Development, alongside the prescriptions of Aims 1 and 8 of the OBEMP.

7.6.8 Management is proposed to be undertaken through changes in livestock grazing (or undertaking of mechanical cutting if necessary) and predator controls (as required and subject to trials as necessary). Detailed management prescriptions, aims and monitoring to be included within the Proposed Development's BEMP, will be finalised in consultation with, NatureScot and relevant stakeholders and submission to South Lanarkshire Council (SLC) for approval, all by way of a suitably worded planning condition.

Red Kite

7.6.9 To further minimise the magnitude of potential operational collision mortality risks to red kite, an operational carcass recovery protocol will be prescribed and implemented for the Proposed Development. This will include for regular searching of the turbine array area (and additional areas within the Site) for fallen livestock and removal to an agreed disposal site.

7.6.10 It is proposed that the finalisation of the protocol, including the frequency of searches, monitoring and review period together would be submitted to SLC for approval in consultation with SLC, NatureScot and other relevant stakeholders and then implemented, all by way of a suitably worded planning condition.

7.6.11 The protocol will also completement Aim 8 of the OBEMP, in reducing opportunities for other scavenging species within the Site and which may comprise predators of ground-nesting waders.

Mitigation during Decommissioning

7.6.12 No significant unmitigated decommissioning phase effects were predicted for any IOF, and therefore no additional mitigation measures are required.

7.7 Assessment of Residual Effects

7.7.1 Following additional mitigation measures detailed above, the residual effect for upon non-breeding roosting hen harrier and breeding short-eared owl is considered to remain **negligible** and therefore **not significant** in the context of the EIA regulations.

7.8 Cumulative Effects Assessment

7.8.1 Based on the conclusions of the assessment presented in Section 7.5, standard mitigation measures set out in Section 7.3 and additional mitigation measures set out in Section 7.6, the Proposed Development is not predicted to have a measurable effect on the respective regional populations of IOFs as a result of the following, and for which the potential for significant cumulative effects is scoped-out further assessment:

- Cumulative construction effects for all IOFs;
- Cumulative operation disturbance/displacement effects for hen harrier, red kite, short-eared owl and lapwing (negligible effects); and
- Cumulative collision mortality risks for all IOFs due to negligible or no predicted collision mortality risks.

7.8.2 The potential for significant cumulative operational disturbance/displacement effects for curlew are however assessed in further detail with reference to NatureScot guidance (SNH, 2018a) and as set out in **Technical Appendix 7.1**, **Annex F** at the regional NHZ 19 geographical scale.

Curlew

7.8.3 Of the 78 identified cumulative developments within NHZ 19 (see **Technical Appendix 7.1, Annex F**), 28 developments were identified as having the potential for displacement impacts on breeding curlew, with the remainder having either no relevant information available or not predicting displacement impacts.

7.8.4 **Table 7.6** summarises predicted unmitigated displacement impacts predicted for each development.

7.8.5 Combined the operational and under construction developments predict the potential displacement of a minimum (due to unavailable data) of 43-51 pairs of curlew, representing up to 1.33 % of the breeding population (3,843 pairs, as per **Table 7.5**).

7.8.6 Consented developments, assuming all are constructed as consented, predict the potential displacement of 19-24 pairs, representing up to an additional 0.62 % of the breeding population.

7.8.7 Including the Proposed Development, a further 13 sites at application stage predict the potential displacement of an additional 35-42 pairs, (up to 1.09 % of the breeding population).

7.8.8 The combined and unmitigated estimated number of curlew pairs predicted to be cumulatively displaced by onshore wind farm developments in NHZ 19, is 97 – 135 pairs, representing up to 3.51% of the breeding population (up to 2.94 % of the population in the absence of the Proposed Development).

7.8.9 The quantitative assessment presented above is however considered to represent an unlikely scenario for the regional NHZ 19 curlew population. In most cases, the available information presented within this chapter for the various cumulative projects considered relates to the number of breeding curlew territories located within 500 m of proposed infrastructure, and therefore beyond currently recommended buffers to avoid the potential for disturbance to breeding curlew (300 m as per Goodship and Furness, 2022[4]).

7.8.10 The assessment does also not take into account the potential for any overlap in "zones of influence" for each development, and the potential for some pairs to have been "double-counted" in the cumulative displacement figure as a result. The assessment does also not take into account that actual displacement may be variable between developments, on account of individual pair tolerance of disturbance sources.

7.8.11 Predicted losses presented will therefore almost certainly exceed reality, and furthermore the assessment does not consider the provision of positive enhancement measures that may be realised for curlew, such as those set out for the Proposed Development, for Kennoxhead, Clyde and extension (and likely other projects) to further reduce potential displacement effects and deliver enhancements for curlew (and other breeding waders) in the short-long term future.

7.8.12 Potential cumulative operational displacement effects upon for curlew is therefore considered to be no more than a **low** yet **permanent** magnitude, and which is a **minor adverse** and not significant effect in the context of the EIA Regulations.

Table 7.6: Summary of Predicted Cumulative Displacement Effects for Curlew (NHZ 19).

Development	**Status**	**Curlew Recorded**	**Potential Displacement (No. of Pairs)**
Afton	Operational	No	N/A
Airies	Operational	Yes	0
Andershaw	Operational	Yes	0
Arecleoch	Operational	Yes	0
Arecleoch Extension	Operational	Yes	0
Artfield Fell	Operational	Unknown	Unknown
Balmurrie Fell (Artfield Fell Extension)	Operational	Unknown	Unknown
Bankend Rig	Operational	Unknown	Unknown
Blackcraig Hill	Operational	Unknown	Unknown
Carscreugh	Operational	Yes	2-4
Clyde	Operational	Yes	10
Dalswinton (Pennyland Moor)	Operational	Yes	3
Dersalloch	Operational	Yes	4
Dungavel	Operational	Yes	0
Galawhistle	Operational	Yes	2-3
Glen App	Operational	Yes	0
Glenchamber	Operational	Unknown	Unknown
Hare Hill Phase 1	Operational	Unknown	Unknown
Hare Hill Phase 2	Operational	Unknown	Unknown
Harestanes	Operational	No	N/A
Harting Rig / Kype Muir Extension	Operational	Yes	0
Kennoxhead	Operational	Yes	3
Kilgallioch (Arecleoch Phase 2)	Operational	Yes	8
Kype Muir	Operational	Yes	1
Mark Hill	Operational	Unknown	Unknown
Middle Muir	Operational	Yes	Unknown
Minnygap	Operational	Yes	2-3[51]
Nutberry	Operational	Yes	0
Sanquhar Community Windfarm	Operational	Yes	3
South Kyle	Operational	Yes	1
Sunnyside	Operational	Yes	0
Twentyshilling Hill	Operational	Yes	1-2
Wether Hill	Operational	Yes	Unknown

[51] Based on operational monitoring data.

Table 7.6: Summary of Predicted Cumulative Displacement Effects for Curlew (NHZ 19).

Development	Status	Curlew Recorded	Potential Displacement (No. of Pairs)
Whiteside Hill	Operational	Yes	0
Windy Rig	Operational	No	N/A
Windy Standard – Phase 1	Operational	Unknown	Unknown
Wind Standard – Phase 2	Operational	Unknown	Unknown
Operational Cumulative Displacement = 40 – 45 pairs			
Benbrack	Construction	Yes	0
Cumberhead	Construction	Yes	0
Enoch Hill	Construction	Yes	0
Hagshaw Hill Repowering	Construction	Yes	1
North Kyle	Construction	Yes	1
Stranoch 2	Construction	Yes	1-4
Construction Cumulative Displacement = 3 – 6 pairs			
Chirmorie	Consented	Yes	1-6
Cornharrow	Consented	Yes	0
Crookedstane	Consented	Yes	3
Fell Wind Farm	Consented	No	N/A
Gass	Consented	No	N/A
Glenmuckloch	Consented	Yes	3
Hare Craig	Consented	No	N/A
Kilgallioch Extension	Consented	Yes	0-2
Knockman Hill	Consented	Yes	0-1
Lethans	Consented	Yes	0
Lion Hill (Crookedstane 2)	Consented	Yes	Unknown
Lorg	Consented	Yes	1
Margree	Consented	Yes	0
Mochrum Fell	Consented	No	N/A
Over Hill	Consented	Yes	1
Pencloe	Consented	Yes	3
Plascow Wind Cluster	Consented	Yes	2
Polquhairn	Consented	Yes	0
Poniel Wind Farm	Consented	Yes	Unknown
Sandy Knowe	Consented	Yes	2
Sanquhar 2	Consented	Yes	4
Sanquhar Six	Consented	Yes	0-1
Troston Loch	Consented	Yes	1-2
Windy Standard - Phase 3	Consented	Yes	0
Shepherds' Rig	Consented	Yes	0
Consented Cumulative Displacement = 19 - 30			

Table 7.6: Summary of Predicted Cumulative Displacement Effects for Curlew (NHZ 19).			
Development	**Status**	**Curlew Recorded**	**Potential Displacement (No. of Pairs)**
Bodinglee	Application	Yes	12
Carrick	Application (Appeal)	Yes	0
Cloud Hill	Application	Yes	5-11
Daer	Application	Yes	2
Euchanhead	Application	Yes	0
Harestanes South Extension	Application	Yes	0
Knockkippen	Application	Yes	0
Lorg	Application	Yes	3-7
Magheuchan Rig	Application	Unknown	Unknown
Mid Moile	Application	Yes	0
Sclenteuch	Application	Yes	0
The Drum	Application	No	N/A
Proposed Development	Application	Yes	13-22
Application Cumulative Displacement = 35-42			

7.9 Monitoring

Construction/Decommissioning Phase Monitoring

7.9.1 During the construction (and where relevant during the decommissioning phase) ornithological monitoring will be undertaken by the appointed ECoW (or qualified ornithologist) to determine the scope and effectiveness of embedded mitigation measures.

Operation Phase Monitoring

BEMP

7.9.2 During the operational phase monitoring will be undertaken to measure the effectiveness of additional mitigation measures set out for breeding curlew and habitat enhancement measures set out within the Proposed Development’s agreed BEMP.

7.9.3 Monitoring would be used to ensure that habitat management measures remain effective, respond to change in emerging research, stakeholder advice and available technology, and meet the aims and objectives of the BEMP over the operational lifetime of the Proposed Development.

Summary

7.9.4 Table 7.7 provides a summary of the assessment presented within Section 7.5.

Table 7. 7: Summary of Potential Significant Effects of the Proposed Development				
Ornithological Feature	**Likely Significant Effect**	**Mitigation Proposed**	**Means of Implementation**	**Outcome/Residual Effect**
Construction				

Table 7. 7: Summary of Potential Significant Effects of the Proposed Development

Ornithological Feature	Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Curlew	Temporary displacement during construction	None required	n/a	Not significant
Hen harrier	Temporary displacement during construction	None required	n/a	Not significant
Lapwing	Temporary displacement during construction	None required	n/a	Not significant
Red kite	Temporary displacement during construction	None required	n/a	Not significant
Short-eared owl	Temporary displacement during construction	BDMP to include for the restriction of construction works within 30 m of any active short-eared owl nest site	Suitably worded planning condition	Not significant
	Operation			
Curlew	Permanent displacement during operation	None required	n/a	Not significant
	Permanent collision mortality risks during operation	None required	n/a	Not significant
Hen harrier	Permanent displacement during operation	BEMP to include for the management of alternative habitats away from operational infrastructure	Suitably worded planning condition	Not significant
	Permanent collision mortality risks during operation	None required	n/a	Not significant
Lapwing	Permanent displacement during operation	None required	n/a	Not significant
	Permanent collision mortality risks during operation	None required	n/a	Not significant
Red kite	Permanent displacement during operation	None required	n/a	Not significant

Table 7. 7: Summary of Potential Significant Effects of the Proposed Development				
Ornithological Feature	**Likely Significant Effect**	**Mitigation Proposed**	**Means of Implementation**	**Outcome/Residual Effect**
	Permanent collision mortality risks during operation	Livestock carcass removal protocol	Suitable worded planning condition	Not significant
Short-eared owl	Permanent displacement during operation	BEMP to include for the management of alternative habitats away from operational infrastructure	Suitably worded planning condition	Not significant

8 Hydrology, Hydrogeology and Geology

8.1 Executive Summary

8.1.1 This chapter considers the likely significant effects on Hydrology, Hydrogeology and Geology associated with the construction, operation and decommissioning of the Proposed Development.

8.1.2 This chapter considers effects on water quality (including both surface water and groundwater bodies), flood risk, water resources (private and public water supplies), Groundwater Dependent Terrestrial Ecosystems (GWDTE) and, the potential for effects on carbon rich soils and deep peat, including potential for peat landslide effects.

8.1.3 The assessment is informed by hydrological surveying carried out by Ramboll in April 2024, Stage 1 peat probing by Fluid Environmental Consultants in August 2023 and Stage 2 Peat probing completed by Ramboll in April 2024.

8.1.4 The hydrological assessment has identified the presence of several watercourses within the Site and watercourses at the application boundary (notable Mill Burn, Black Burn, Duneaton Water and the River Clyde). Aquifers underlying the Site are found to be of Moderate and Low productivity, no Private Water supplies are identified on the Site and the Site is not within a Drinking Water Protected Area (surface).

8.1.5 Findings of detailed peat surveying and assessment of potential impacts on underlying peat resources are provided in Technical Appendix 8.1 (EIAR Volume 4). In summary, a total of 900 peat depth probes were taken during the Phase 1 peat survey and 1,515 peat probes during Phase 2 with a combined peat depth dataset of 2,415 probes. The findings of the peat depth survey found that the Site is either absent of peat or, where present, is relatively shallow (98% of samples found that peat was either absent or shallow (<0.5 m depth). These areas of shallow peat can be considered as organo-mineral soils.

8.1.6 The peat across the Site is generally intermediate or fibrous in nature, with the majority of the samples assessed as having moderate fine fibre content (F2). The results of the Von Post classification indicate that the majority of the samples tested scored between H5 and H7, indicating moderate to strong rates of decomposition. The mean water content of the peat at all sample locations was dry or semi-dry, which is consistent with the high degree of modification to the peatland integrity and composition through artificial drainage and overplanting with coniferous plantation forest.

8.1.7 Development has been located away from these deeper peat locations where practicable, taking into account other environmental and technical constraints, or microsited to minimise potential adverse effects. No infrastructure are proposed on deep peat.

8.1.8 Based on the design of the Site (including the siting of the Proposed Development at a suitable buffer from watercourses, minimising the number of proposed watercourse crossings and locating development away from deeper peat locations where practicable), the implementation of best practice measures during the construction, operational and decommissioning phases of development and the implementation of mitigation measures summarised in **Section 8.9** of this chapter, no significant effects to the water environment or to peat resources are predicted.

8.2 Introduction

8.2.1 This chapter considers the likely significant effects on Hydrology, Hydrogeology and Geology associated with the construction, operation and decommissioning of the Proposed Development. The specific objectives of the chapter are to:

- describe the hydrological, hydrogeological and geological baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

8.2.2 The assessment has been carried out by Jo Thorp of Ramboll UK Limited (Ramboll). Jo Thorp (MCIWEM) has seven years' experience of hydrological assessment for onshore wind farms and energy infrastructure.

8.2.3 This chapter is supported by the following figures and technical appendices:

- Volume 3a Figures:
  - Figure 8.1 Surface Water Features;
  - Figure 8.2 Drinking Water Protected Areas Water Resources;
  - Figure 8.3 Superficial Geology;
  - Figure 8.4 Bedrock Geology;
  - Figure 8.5 Hydrogeology;
  - Figure 8.6 SNH Carbon Peatland Mapping (2016);
  - Figure 8.7 Outline Peat Depth Plan; and
  - Figure 8.8 Habitats with the Potential to be Groundwater Dependent Terrestrial Ecosystems - National Vegetation Classification.
- Volume 4: Technical Appendices:
  - Technical Appendix 8.1: Peat Depth Survey Results;
  - Technical Appendix 8.2: Outline Peat Management Plan;
  - Technical Appendix 8.3: Peat Landslide Hazard Risk Assessment;
  - Technical Appendix 8.4: Watercourse Crossing Assessment;
  - Technical Appendix 8.5: GWDTE Assessment;
  - Technical Appendix 8.6: Private Water Supply (PWS) Assessment; and
  - Technical Appendix 8.7: Hydrology, Hydrogeology and Geology Assessment Methodology.

8.2.4 Figures and technical appendices are referenced in the text where relevant.

8.3 Assessment Methodology and Significance Criteria

Scope of Assessment

8.3.1 This Chapter considers the potential effects of the Proposed Development on the water environment taking account of the hydrological, hydrogeological, geological, and soil characteristics of the Proposed Development.

8.3.2 This chapter considers effects on:

- Water quality (including both surface water and groundwater bodies) and assessment of the impacts from pollution;

- Flood risk; both risk to the Proposed Development and the potential for direct and indirect impacts of the Proposed Development on off-site flood risk;
- Water resources, impacts on flow regimes and the geomorphological characteristics of watercourses as a result of proposed watercourse crossings;
- Any alterations to regimes of water supplying PWS and public water supplies, either in the locale of the Proposed Development or with potential hydrological connection to the Proposed Development;
- The potential for impacts of the Proposed Development on hydrology or hydrogeology to lead to secondary effects on Groundwater Dependent Terrestrial Ecosystems (GWDTE). It is noted, however, that the ecology or biodiversity effects (e.g. on sensitive habitats) are captured in Chapter 6 (EIAR Volume 2); and
- The potential for effects on carbon rich soils and deep peat, including potential for peat landslide effects.

8.3.3 The chapter assesses cumulative effects as arising from the addition of the Proposed Development to other developments, which are the subject of a valid planning application. Operational, under construction and consented developments are considered as part of the baseline.

8.3.4 The assessment is based on the Proposed Development as described in Chapter 2: Development Description (EIAR Volume 2) and takes into account the **Draft Outline Construction Environmental Management Plan (OCEMP) (Technical Appendix 2.1, EIAR Volume 4)**.

8.3.5 The scope of the assessment has been informed by consultation responses detailed in **Technical Appendix 1.1: Consultation Register (EIAR Volume 4)** and the following guidelines/policies:

- Water Environment and Water Services (Scotland) Act 2003[1];
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR)[2];
- The Water Environment (Miscellaneous) (Scotland) Regulations 2017[3];
- Flood Risk Management (Scotland) Act 2009[4];
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017[5];
- The Public and Private Water Supplies (Miscellaneous Amendments) (Scotland) Regulations 2015[6];
- The Public Water Supplies (Scotland) Regulations 2014[7]; and
- The Water Environment (Drinking Water Protected Areas) (Scotland) Order 2013[8]

[1] Scottish Government (2003). Water Environment and Water Services (Scotland) Act 2003.
[2] Scottish Government (2011) Water Environment (Controlled Activities) (Regulations) Scotland 2011 (CAR) . Available at: https://www.sepa.org.uk/regulations/water/
[3] Scottish Government (2017) The Water Environment (Miscellaneous) (Scotland) Regulations 2017.
[4] Scottish Government (2009) Flood Risk Management (Scotland) Act 2009.
[5] Scottish Government (2017) the Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017,
[6] Scottish Government (2015) the Private and Public Water Supplies (Miscellaneous Amendments) (Scotland) Regulations 2015.
[7] Scottish Government (2014) The Public Water Supplies (Scotland) Regulations 2014. Available at: https://www.legislation.gov.uk/ssi/2014/364/contents/made
[8] Scottish Government (2013) The Water Environment (Drinking Water Protected Areas) (Scotland) Order 2013

Guidance and Advice

- PPG 1[9]: Understanding your environmental responsibilities - good environmental practices (July 2013);
- GPP 2: Above ground oil storage tanks (January 2018);
- GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer (November 2017);
- GPP 5: Works and maintenance in or near water (January 2017);
- PPG 6: Working at construction and demolition sites (2012)[10];
- GPP 13: Vehicle washing and cleaning (April 2017);
- GPP 21: Pollution incident response planning (July 2017);
- PPG 22: Incident response - dealing with spills (October 2018);
- PAN 79: Water and Drainage (September 2006);
- LUPS-GU4[11]: Planning guidance on on-shore wind farm developments (2017);
- LUPS-DP-GU2a: Development Plan Guidance on Flood Risk (2018);
- LUPS-GU19: Planning advice on wastewater drainage (2011);
- LUPS-GU31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, Version 3 (September 2017);
- WAT-SG-25: Good Practice Guide - River Crossings (November 2010) [12];
- WAT-SG-26: Good Practice Guide - Sediment Management (September 2010);
- WAT-SG-29: Good Practice Guide - Temporary Construction Methods (March 2009);
- SEPA (2015), CAR - A Practical Guide, Version 9 (March 2022)[13];
- Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science and AEECoW (2019), Good Practice During Wind Farm Construction (4th Edition)[14]; and
- Scottish Government (2012) River Crossings and Migratory Fish[15].

Potential Effects Scoped Out

8.3.6 While some areas of the Site adjacent to watercourses are assessed by SEPA to be at risk of river flooding (or surface water flooding in the case of smaller watercourses/drains), no development is proposed that would interact with areas at risk of flooding. Where watercourse crossings are proposed these would be constructed to accommodate a 1 in 200 (0.5%) annual probability flow, taking in to account climate change (**Technical Appendix 8.4 Watercourse Crossing Assessment, EIAR Volume 4**). Only very limited, localised areas of the Site are assessed by SEPA to be at risk of surface water flooding, indicative of shallow localised surface water pooling, which would not represent a risk to the Proposed Development. Therefore, detailed assessment of flood risk has been scoped out of the EIAR. While consideration of

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9 Currently, review and replacement of Pollution Prevention Guidelines (PPGs) with Guidance for Pollution Prevention (GPPs). Current PPGs and GPPs are available online: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

10 Guidance provided in recent GPPs will be followed and take precedent over information provided in PPG 6, which was withdrawn on 14th December 2015, where there is overlap in the provision of advice. For example, guidance on the storage of handling of oils /fuels in GPP 2 will take precedent over guidance provided in Section 5 (Oil use, storage and refuelling) of PPG 6.

11 SEPA Guidance and Advice Notes. Available at: https://www.sepa.org.uk/environment/land/planning/guidance-and-advice-notes/

12 SEPA Engineering Guidance. Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/#position

13 SEPA The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), A Practical Guide. Version 9, January 2022. Available online: https://www.sepa.org.uk/regulations/water/ [Accessed March 2022]

14 Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science and AEECoW (2019), Good Practice During Wind Farm Construction (4th Edition). Available online https://www.nature.scot/doc/guidance-good-practice-during-wind-farm-construction [Accessed March 2022]

15 http://www.scotland.gov.uk/Topics/marine/science/Publications/publicationslatest/rivercrossings

flood risk is made in the EIAR, a detailed Flood Risk Assessment is scoped out. SuDS measures in the construction phase would be addressed in the CEMP and drainage design and calculations would be prepared by the appointed contractor at detailed design stage. Method of Baseline Characterisation

Extent of the Study Area

8.3.7 The Study Area for the assessment of hydrology and hydrogeology includes the Site and land within a 2 km radius, as well as receptors with downstream connectivity with the Proposed Development.

Desk Study

8.3.8 The methodology for baseline characterisation is set out as follows:

- describe surface water hydrology, including watercourses, springs and ponds;
- identify existing catchment pressures;
- identify private drinking water abstractions and PWS within the Study Area;
- identify any flood risks;
- describe the hydromorphological conditions of watercourses; and
- collect soil, geological and hydrogeological information.

8.3.9 Published information consulted to determine baseline conditions is outlined in Table 8.1 below

Table 8.1: Baseline Information Sources

Topic	Sources of Information
Topography	• Aerial Photography[16] • 5 m contour data derived from Ordnance Survey (OS) Digital Terrain Model (DTM) data[17] • 1:25,000 OS Raster Data[17]
Designated Nature Conservation Sites	• SNHi Sitelink website[18]
Solid and Superficial Geology	• British Geological Survey Digital Data provided at BGS online viewer[19] • BGS Borehole Records[19]
Soils and Peat	• SNH Carbon and Peatland Map (2016)[20] • BGS 1:50,000 and 1:625,000 geological maps (superficial and bedrock)[19]
Surface Water Hydrology	• 1:10,000 OS Raster Data[17] • 1:25,000 OS Raster Data[17] • OS Open Rivers[21]
Flooding	• Indicative River and Coastal Flood Map (SEPA)[22]
Water Quality	• SEPA, Water Classification Hub[23]
Water Resources	• Private water supply information provided by Aberdeenshire and Moray Councils' Environmental Health Department • Drinking Water Protected Areas (DWPAs) in the Scotland River Basin District (RBD) maps[24].

[16] Google Earth Imagery, Bing Maps
[17] Under license acquired from Ordnance Survey
[18] SNHi Sitelink. Available online: https://sitelink.nature.scot/map [Accessed June 2024]
[19] BGS Onshore GeoIndex. Available online: www.bgs.ac.uk [Accessed June 2024]
[20] National Soil Map of Scotland. Available online: https://soils.environment.gov.scot/maps/soil-maps/national-soil-map-of-scotland/ [Accessed June 2024]
[21] OS Open Rivers. Available online: https://osdatahub.os.uk/ [Accessed June 2024]
[22] SEPA Flood Maps. Available online: www.sepa.org.uk [Accessed June 2024]
[23] SEPA, Water Classification Hub. Available online: https://www.sepa.org.uk/ [Last accessed June 2024]
[24] Drinking Water Protected Areas (DWPAs) in the Scotland River Basin District (RBD) maps. Available online: https://www.gov.scot/publications/drinking-water-protected-areas-scotland-river-basin-district-maps/ [Accessed June 2024].

Table 8.1: Baseline Information Sources	
Topic	**Sources of Information**
	• 1:10,000 OS Raster Data[17] • 1:25,000 OS Raster Data[17]
Hydrogeology	• BGS 1:50,000 and 1:625,000 geological maps (superficial and bedrock)[19] • BGS Groundwater Vulnerability Maps[19] • BGS 1:625,000 hydrogeological map of the UK[19] • The River Basin Management Plan For The Scotland 2021 – 2027

Field Survey

HYDROLOGICAL SURVEYING

8.3.10 Site surveying was conducted by Ramboll in April 2024. The purpose of the site walkover was to:

- assess the general hydrological condition of the proposed development;
- characterise watercourses within the proposed development such that proposed watercourse crossing points could be assessed; and
- assess hydrological conditions at potential GWDTE locations.

8.3.11 The survey consisted of visual inspection and geolocated surveying of watercourses across the proposed development. Where potentially groundwater dependent vegetation communities were identified by ecological surveying (see Table 8.3) site specific review was conducted to identify visual evidence of groundwater emergence, association of habitats to surface water features, evidence of connection to upslope surface water runoff and the presence of deep peat in association with habitats.

8.3.12 Ecological surveying in order to identify potential groundwater dependent vegetation communities was carried out by MacArthur Green in September 2023. Further details of the methodology for National Vegetation Classification (NVC) surveying of habitats are provided in Chapter 6 (EIAR Volume 2).

PEAT SURVEY

8.3.13 Peat surveys were undertaken at the Site to understand the baseline peat conditions and potential constraints, and to inform the design of the Proposed Development to minimise, as far as practicable, the potential direct and indirect effects on peat and carbon rich soils.

8.3.14 The surveys were undertaken by Fluid Environmental Consultants and Ramboll on the following dates:

- Stage 1 peat probing was completed by Fluid Environmental Consultants in August 2023;
- Stage 2 Peat probing was completed by Ramboll in April 2024.

8.3.15 Surveys followed best practice guidance published at the time of the surveys with regard to surveying for developments on peatland[25,26]. Further information on the survey methodology is included in the Peat Depth Report Technical Appendix (**Technical Appendix 8.1, EIAR Volume 4**).

Method of Assessment

8.3.16 The assessment methodology, including criteria for assessing sensitivity of receptors, magnitude of change and cumulative effects, as well as overall significance criteria, is detailed

[25] Scottish Government, Scottish Natural Heritage, SEPA. (2017). Peatland Survey. Guidance on Developments on Peatland, online version only.
[26] Scottish Renewables and SEPA (2012). Development on Peatlands. Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.

in **Technical Appendix 8.7: Hydrology, Hydrogeology and Geology Assessment Methodology**.

Limitations and Assumptions

8.3.17 This assessment refers to, and uses, publicly available data sources and relies upon the accuracy of this data.

8.3.18 The assessment also relies on an assumption that the schedule of good practice measures set out in this chapter is implemented through the Outline Construction Environmental Management Plan OCEMP and Outline Peat Management Plan (OPMP). If significant effects are identified following the implementation of these good practice measures, then further mitigation will be identified.

8.4 Baseline Conditions

Current Baseline

Hydrology

8.4.1 The area of the turbine array to the north of the M74 motorway (including turbine locations 1, 2, 3, 6, 7, 8, 9, 15, and 16) is within the catchment of Mill Burn which is present at the north eastern boundary of the Site. The turbine array to the south of the M74 motorway (including turbines 10, 11, 12, 13, 17, 18, 19 and 20) drain to Black Burn which is present at the southern boundary of the Site. Turbines 4, 5 and 14 are on the watershed of these two catchments. Both watercourses flow in a generally south easterly direction past the Site and discharge to Duneaton Water. Turbine 22 is within an area that drains to Duneaton Water via Goat burn. Further smaller tributaries of Mill Burn and Black Burn are present crossing the Site. Turbine 21 crosses the watershed of land draining to the south east and Goat Burn and land to the north west of the turbine location which drains to an unnamed watercourse and further to Black Burn.

8.4.2 The northern area of the proposed solar array drains to Duneaton Water (which forms the northern boundary of the solar array) and eastwards to the River Clyde, to the east of the Site. It is noted that the smaller eastern parcels of the Site are bisected by significant road infrastructure (M74), and it is anticipated that catchments in this area are likely to be served by surface water drainage assets.

8.4.3 The Black Burn is assessed by SEPA to be of ‘Good’ overall condition under the Water Framework Directive classification scheme. Duneaton Water is assessed to be of Good overall condition and the stretch of the River Clyde closest to the Site (Portrail Water to Mouse Water) is assessed to be of Moderate overall condition. Mill Burn is not assessed under the WFD.

8.4.4 Temporary ponds are present in the north and central areas of the Site which were formed through the excavation of gravels/aggregates. It is understood that these were formed as part of the quarry site to the west of the M74 and are in use for attenuation/settlement of runoff from the quarry areas (c. 2020 according to Google aerial imagery). It is anticipated that these ponds will be infilled as part of the site restoration works planned on closure of the quarry which is scheduled for 2025. As such these ponds will not be present when construction of the Proposed Development commences and closure of the ponds will be carried out by the quarry operators. Therefore, while these temporary features form part of the drainage and treatment train for runoff from the quarry sites, conditions for their restoration are set out in consents for quarrying operations and they would no longer be present on commencement of construction activity for the Proposed Development.

8.4.5 The surface water features in relation to the Site are shown on **Figure 8.1 (EIAR Volume 3a)**.

Flood Risk

8.4.6 SEPA Flood Risk maps show that land in close proximity to Mill Burn, Black Burn, Duneaton Water and the River Clyde are within areas assessed to be at risk of flooding from rivers, including areas at a high risk of flooding (1 in 10 (10%) annual probability). Some marginal areas of the Site, in connection to the watercourses identified above, are within SEPA high risk flood areas.

8.4.7 SEPA mapping identifies some very limited areas of elevated surface water flood risk on the Site, the majority of which are within the flood risk areas identified above. Generally, the Site is at a very low risk of surface water flooding (less than a 1 in 1,000 (0.1%) annual probability).

Geology and Soils

8.4.8 According to the British Geological Survey's (BGS) 'Geology Viewer' website (1:625,000), the superficial deposits underlying the Site predominantly comprise Devensian Till (Diamicton) with alluvium, gravel, sands and silts mapped along the River Clyde and burns. Peat is recorded in the central part of the Site to the west of White Rig. Areas of glaciofluvial sands and gravels are also shown to the south of Mill Burn in the northern part of the Site, and in smaller areas across the Site. The higher parts of the Site are shown as unmapped indicating that there are potentially no superficial deposits present. Superficial geology is illustrated on **Figure 8.3 (EIAR Volume 3a)**.

8.4.9 The underlying bedrock across most of the western part of the Site is mapped as the Auchtitench Sandstone Formation, comprising volcaniclastic conglomerate. The central part of the Site is mapped as the Marchburn Formation, comprising wackes, and the eastern part of the Site is mapped as the Kirkcolm Formation, again comprising wackes. Bedrock geology is illustrated on **Figure 8.4 (EIAR Volume 3a)**

8.4.10 There are extant and disused quarries present at the Site which were observed to have been in use for sand and gravel extraction (central area between the B7078 and M74, and north of the M74) and rock extraction (north westernmost part of the Site, north of the M74).

8.4.11 A review of the SNH Carbon Rich Soil and Deep Peat and Peatlands Habitat Map (2016), an extract of which is shown on **Figure 8.6: SNH Carbon Soils Map (EIAR Volume 3a**), confirms that areas of peat and organic material are present across the western parts of the Site. Most of the peat is shown as Class 3 or Class 5, however, there is a large area of Class 1 peat indicated in the area to the south of the B7078 road ('nationally important carbon rich soils, deep peat and priority peatland habitat'). The majority of the western part of the Site is shown as comprising Class 3 peat with smaller areas of Class 5. The eastern part of the Site is shown as comprising mineral soils.

Water Resources

8.4.12 According to BGS 1:625k hydrogeological mapping (**Figure 8.5, EIAR Volume 3a**), the northern area of the Site (forming approximately 40% of the total Site area) is underlain by an aquifer of the Lanark Group which is classified by the BGS as a Moderately productive aquifer. The south of the Site is underlain by an aquifer of the Kirkcolm Formation which is classified by the BGS as a Low productivity aquifer which is characterised by highly indurated greywackes with limited groundwater in near surface weathered zone and secondary fractures.

8.4.13 Only two (2) PWS abstraction sources are recorded within 5 km of the Site and these are identified below in Table 8.2 and in **Figure 8.2 (EIAR Volume 3a)**. Further review of potential impacts of the Proposed Development on PWS is provided in **Technical Appendix 8.6 (EIAR Volume 4).**

Table 8.2: Private Water Supply Abstraction Sources

Reference (see Figure 8.2)	PWS Category	Source Type	X	Y	PWS User Name
1	Not Stated	Spring	291800	624500	Duneaton House
2	Not Stated	Spring	289970	623563	Nether Abington

8.4.14 Review of Scottish Water (SW) mapping has confirmed that there are no SW drinking water catchments designated as Drinking Water Protected Areas (DWPAs), in the area that may be affected by the Proposed Development.

GWDTE

8.4.15 Ecological surveying carries out by MacArthur Green has confirmed that areas of the Site are classified as potentially Groundwater Dependent Terrestrial Ecosystems (GWDTE), based on National Vegetation Classification habitat surveying. Therefore, further hydrological assessment has been carried out by Ramboll to determine the actual likelihood of groundwater dependency and the sensitivity of such habitats. Hydrological assessment of potential impacts of the Proposed Development on GWDTE is provided in **Technical Appendix 8.5 GWDTE Assessment (EIAR Volume 4)**.

Peat Depth and Character

8.4.16 Findings of peat surveys and an assessment of potential impacts on underlying peat resources are provided in **Technical Appendix 8.1 (Volume 4)**. In summary, a total of 900 peat depth probes were taken during the Phase 1 peat survey and 1,515 peat probes during Phase 2 with a combined peat depth dataset of 2,415 probes.

8.4.17 The findings of the peat depth survey found that the majority of the Site is either absent of peat or, where peat is present, it is relatively shallow (98% of samples found that peat was either absent or shallow in depth (0.5 m)). These areas of shallow peat can be considered as organo-mineral soils.

8.4.18 These are further summarised as follows:

- 1,720 no. samples (71.2%) located on land with no peat/ absent;
- 647 no. samples (26.8%) located on land with less than or equal to 0.5 m depth of peat (organo-mineral soil);
- 16 no. samples (0.7%) fell on land with between 0.51 m and 1.0 m depth of peat;
- 3 no. samples (0.1%) located on land with between 1.51 m to 2.0 m depth of peat;
- 10 no. samples (0.4%) located on land with between 2.1 m to 2.5 m depth of peat;
- 9 no. samples (0.4%) located on land with between 2.51 m to 3 m depth of peat and;
- 10 no. samples (0.4%) located on land with >3.1 m.

8.4.19 The mean peat depth recorded across the Site is 0.1 m. The deepest areas of peat, up to 4.4 m, were noted to be in the western area of the Site south of the B7078. Other smaller pockets of deeper peat were noted in the central part of the Site south of the M74. The Proposed Development has been located away from these deeper peat deposits where practicable, taking into account other environmental and technical constraints, or microsited to minimise potential adverse effects. No infrastructure is proposed in areas of deep peat.

8.4.20 The peat across the Site is generally intermediate or fibrous in nature, with the majority of the samples assessed as having moderate fine fibre content (F2), with three samples having a high fine fibre content (F3). The majority of the sample locations were assessed as having a low coarse fibre content (R1), with three locations having a high coarse fibre content (R3)

8.4.21 The results of the Von Post classification indicate that the majority of the samples tested scored between H5 and H7, indicating moderate to strong rates of decomposition.

8.4.22 The mean water content of the peat at all sample locations was dry or semi-dry, which is consistent with the potential high degree of modification to the peatland through artificial drainage (and to a lesser extent the small area of coniferous plantation). The drainage of the Site for the purposes of plantation forestry has caused drying, oxidation, and erosion of peat and carbon-rich soils, which has likely increased carbon release.

8.4.23 The peat was found to be acidic with a mean pH value of 4.2, and a range between 3.3 and 5.4, indicative of peat and carbon rich soils. Laboratory analysis of samples indicates that the peat has a high total carbon content.

Peat Geomorphology

8.4.24 Digital and aerial photography and DTM Lidar data was used to interpret and map geomorphological features within the Site. This interpretation and the resulting geomorphological map, as shown in **Technical Appendix 8.3: Peat Landslide Hazard and Risk Assessment, Figure 8.3.4 (EIAR Volume 4)**, were subsequently verified during a Site walkover and survey undertaken by an experienced peatland geotechnical engineer in April 2024.

8.4.25 No significant evidence of peat instability features was identified during the surveys, with very few haggs, groughs, or other peat erosion noted. Several localised areas of peat flushes were recorded across the Site which indicated basal erosion of peat due to surface water run-off. No major instability features, evidence of incipient instability or past landslides were noted. The lack of visible evidence of instability features during the site walkovers is consistent with the findings of the desk study information. The desk study review found there were no published articles, evidence from historical mapping or landowner accounts of land slips within the Site.

Cumulative Developments (Operational)

8.4.26 The following operational windfarms which are within potential hydrological connection to the Site are considered as part of the baseline characteristics of the surrounding area in assessing the potential for cumulative effects of the Proposed Development:

- Middle Muir Wind Farm (Operational), situated approximately 1 km southwest which is within the catchment of Black Burn; and
- Clyde Wind Farm (Operational) situated approximately 3.6 km east, within the catchment of Raggengill Burn, Colochapel Burn and Camps water, all of which flow to the River Clyde from the east from approximately 350 m east of the Site.

8.4.27 Both these wind farms are operational and have been constructed under applicable regulatory and planning requirements regarding the water environment. There is therefore a low potential for cumulative impacts as a result of hydrological alterations or impacts on water quality.

Future Baseline

8.4.28 There is potential for climate change to impact on future baseline conditions. Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside slightly higher average temperatures. This suggests that there may be greater pressures on water resources and rain-fed habitats in summer months in the future. However, summer storms are predicted to be of greater intensity. Therefore, peak fluvial flows associated with extreme storm events may also increase in volume and velocity. These climate change factors have been taken into account when considering the potential for significant effects.

8.4.29 Under a 'no development' scenario it is assumed that the Site would remain in agricultural use and that quarrying activity would remain in-situ for its permitted operational lifespan before reinstatement to grazing land.

Summary of Sensitive Receptors

Scoped Out Receptors

8.4.30 SW have stated that there are no SW drinking water catchments which are designated as Drinking Water Protected Areas (DWPAs) in the area that are in potential hydrological connection to the Proposed Development. Therefore, potential impacts on public drinking water supplies are scoped out of further assessment.

8.4.31 No element of the Proposed Development lies within an area classified by SEPA as being at risk of flooding from rivers. Additionally, SEPA mapping does not indicate the potential for significant surface water accumulation or surface water flows to occur within the Site. There are very limited areas assessed by SEPA's Flood Maps to be at risk of surface water flooding. Therefore, detailed assessment of the potential for flood risk to affect the Proposed Development is scoped out of further assessment.

Scoped In Receptors

Table 8.3: Summary of Receptor Sensitivity

Receptor	Sensitivity	Justification
Watercourses and surface water features	High	Watercourses crossing the site and adjacent to the Site boundary are considered to be of high sensitivity based on the water quality and hydrological characteristics.
GWDTE	High	Vegetation communities across the Site are classified to be of High and Medium potential of groundwater dependency according to NVC surveying. The sensitivity of GWDTE vegetation communities is assessed in **Technical Appendix 8.2 (EIAR Volume 4)** in line with Land Use Planning System SEPA Guidance Note 31. Further assessment takes in to account hydrological and hydrogeological conditions across the site.
Private water supplies	High	There is the potential for construction activity to result in alteration to hydrological and hydrogeological conditions, which could lead to downslope impacts on PWS.
Soils and Peat	Low to High	The majority of the Site is underlain by shallow peat deposits (<0.5 m depth) or are absent of peat deposits. There are areas of deep peat present, as shown in **Technical Appendix 8.1, EIAR Volume 4.**

Table 8.3: Summary of Receptor Sensitivity

Receptor	Sensitivity	Justification
		There is the potential for changes to the water table or soil loss through excavation or erosion to lead to a reduction in carbon sequestration at the Site, however areas of high sensitivity peatland habitat at the Site are limited in extent. Conversely, there is the potential to boost carbon sequestration and storage by restoring areas of degraded heath or bog, potentially raising the water table in targeted areas and providing enhanced flood storage. Where carbon rich soil and deep peat with high conservation value are present on the Site they are considered to be of high sensitivity.

8.5 Assessment of Likely Effects

Potential Construction Effects

Watercourses and Surface Water Runoff

8.5.1 There is the potential to alter in-channel or overland flow regimes through excavations, disruption to artificial drains, exposure of bare earth or rock and the construction of new or upgraded watercourse crossings as well as the crossing of forestry or field drains. There is the potential for the Proposed Development to lead to a reduced response time to peak flows following heavy rainfall due to the presence of artificial land drainage and therefore this could lead to indirect effects on aquatic ecology, and fluvial morphology upstream and downstream of the Proposed Development.

8.5.2 The layout of the Proposed Development is set out specifically to minimise interaction with watercourses and to maintain a 50 m buffer of development from watercourses as far as practicable. There are two locations, apart from track crossings of watercourses, identified in **Technical Appendix 8.2 (EIAR Volume 4)**, at which construction work is proposed within a 50 m buffer of watercourses:

- OS mapping records a straightened drain crossing the most southerly extent of the solar array, the drain would remain in situ and construction work in this area would be limited to the installation of solar panels. During the site visit the watercourse was observed to be a cut drain forming part of a number of drains flowing from west to east across this area; and
- the BESS area and substation are located on an area currently occupied by artificial ponds that form part of an active quarry site. These features will no longer be present on the commencement of construction activity for the Proposed Development and therefore no further assessment of these features is provided.

8.5.3 Watercourses are assessed to be of **Medium** sensitivity and, based on the limited scale of the Proposed Development in relation to the wider site, construction activity could result in a **Medium** magnitude of impact on surface water runoff rates and the hydrology of watercourses. Therefore, the potential effect significance of direct impacts to watercourses and surface water runoff rates is considered to be **Moderate Adverse** and **Significant** under the EIA Regulations, were no mitigation implemented.

Sedimentation and Increased Erosion Rates

8.5.4 There is the potential to increase erosion and transport of sediment to watercourses as a result of watercourse crossing construction, vegetation and soil stripping, excavations and dewatering activities. Potential effects include indirect effects on aquatic ecology, fluvial morphology and PWS downstream of the Proposed Development.

8.5.5 Seven watercourse crossings within the turbine array would be required as a result of the Proposed Development.

8.5.6 Crossing locations are identified in **Technical Appendix 8.2 (EIAR Volume 4)**, which also sets out best practice design measures and likely licensing requirement under CAR which would be delivered for each crossing location.

8.5.7 Watercourses and surface water receptors are assessed to be of **Medium** sensitivity and the potential magnitude of impact to watercourses as a result of engineering and construction of crossings is assessed to be **Medium**. Therefore, the potential effect significance of direct impacts to watercourses is considered to be **Moderate Adverse** and **Significant** under the EIA Regulations, were no mitigation implemented.

Chemical Pollution

8.5.8 There is the potential to impact on receiving soils, groundwater and watercourse quality through the release of contaminated water and stored chemicals used on-site during construction works. Potential effects include effects on water quality and indirect effects on aquatic ecology.

8.5.9 Watercourses and surface water receptors are assessed to be of **Medium** sensitivity. Bulk storage of potentially hazardous materials would be carried out for construction activity and the potential magnitude of impact is assessed to be **Medium**. Therefore, the potential effect significance of direct impacts to the water environment is considered to be **Moderate Adverse** and **Significant** under the EIA Regulations, were no mitigation implemented.

Effects on GWDTE

8.5.10 Excavation of soil and bedrock during the construction phase of the Proposed Development could cause localised disruption and interruption to groundwater flows. Interruption of such groundwater flows could potentially reduce the supply of groundwater to GWDTEs thereby causing an alteration/ change in the quality or quantity of and/ or the physical or biological characteristics of the GWDTE. Contamination of groundwater could also cause physical or chemical contamination to the GWDTE.

8.5.11 Based on baseline hydrological assessment of potential GWDTE habitats, these areas are assessed to be of **Medium** sensitivity. The potential magnitude of impact is assessed to be **Medium**. Therefore, the potential effect significance of direct impacts to GWDTE habitats is considered to be **Moderate Adverse** and **Significant** under the EIA Regulations, were no mitigation implemented.

Effects on Soils and Peat

On the basis of peat surveying carried out at the Site, a design strategy has been implemented such that most of the Site where development is proposed has either no peat present or has a shallow depth of peat present (~98% <0.5 m in depth). These areas of shallow peat can be considered as organo-mineral soils.

8.5.12 Detailed assessment of the baseline condition of peat soils and an Outline Peat Management Plan OPMP are provided in **Technical Appendices 8.1: Peat Depth Survey Results and 8.2: Outline Peat Management Plan (EIAR Volume 4)**. The OPMP (Technical Appendix 8.2) describes principles and best practice methods to be used by the Applicant's infrastructure contractor when excavating, moving and reinstating peat. It includes a volumetric peat balance and contains requirements for the final Peat Management Plan (PMP), that would be developed by the contractor post consent, prior to construction. A final PMP will be produced by the Applicant's Principal Contractor and will be submitted to the planning authority for approval prior to commencement of development, and thereafter implemented.

8.5.13 Peat resources are assessed to be of **Low to High** sensitivity. Further detailed assessment of peat depth and condition are provided in Technical Appendices 8.1 and 8.2 and the Site has been laid out such that most of the Proposed Development has either no peat present or has a shallow depth of peat present. The potential **magnitude of impact** is assessed to be **Small**. Therefore, **t**he effect significance of direct impacts to peat resources and GWDTE habitats is considered to be **Minor Adverse** and **Not Significant** under the EIA Regulations, were no mitigation included.

Potential Operational Effects

Alteration to Surface Water Flows and Runoff

8.5.14 There is the potential for hardstanding surfaces and compacted tracks and infrastructure to lead to increased rates of surface runoff, in turn leading to the potential for increased risk of surface erosion and downstream flood risk; however as described in **Chapter 2 (EIAR Volume 2)** and **Technical Appendix 2.1 (EIAR Volume 4)**, the Proposed Development will incorporate a drainage design using SuDS principles in accordance with The SuDS Manual (C753) 2015[27].

8.5.15 There is the potential for reduction in the release of sediment from activities carried out on the Site due to the redevelopment or reinstatement of areas in use for aggregate quarrying. This could lead to a reduction in the area of exposed soils and sediment on the Site and a reduction in working of superficial deposits which has the potential for the release of sediments.

8.5.16 In line with assessment of potential impacts on Surface Water Flows and Runoff identified during the construction phase there is the potential for a **Small** Magnitude of Impact and the potential effect significance is considered to be **Minor Adverse** and Not **Significant** under the EIA Regulations, were no mitigation implemented.

Sedimentation and Increased Erosion Rates

8.5.17 There is the potential that alteration of runoff volumes and rates could alter fluvial morphology during the operational phase or lead to increased erosion rates (increasing sediment loads) if surface water runoff from impermeable areas is not appropriately managed. The potential risk of the release of sediment from the activities relating to the operational phase of the Proposed Development is substantially lower than during construction because of the decreased levels of ground disturbance and the reinstatement of vegetation following the construction phase. Therefore, the potential Magnitude of Impact is **Small** and the potential effect significance is considered to be **Minor Adverse** and **Not Significant** under the EIA Regulations, were no mitigation implemented.

Chemical Pollution

8.5.18 Occasional maintenance and repair of turbines and solar panels would be required during the operational phase, which could involve the operation of plant at the Proposed Development. There is the potential for the release of small volumes of fuel from plant or for the accidental release of contaminative materials transported onto the Site for maintenance.

[27] URL: https://www.susdrain.org/resources/SuDS_Manual.html [Accessed February 2022]

8.5.19 Battery Energy Storage Systems (BESS) and electrical substations incorporate potentially contaminative materials (battery electrolyte and insulating oils) that could present a potential risk to the water environment. There is considered to be the potential for a Medium Magnitude of Impact and therefore, the potential effect significance is considered to be **Moderate Adverse** and **Significant** under the EIA Regulations, were no mitigation implemented.

GWDTE

8.5.20 An assessment of the status of habitats identified as potentially groundwater dependent is provided in **Technical Appendix 8.5 (EIAR Volume 4)** which shows that vegetation communities in the Site are primarily dependent on rainwater, surface water runoff or shallow soil water. While such habitats in the Proposed Development are assessed as unlikely to be dependent on groundwater sources, there is the potential for potential indirect impacts on habitats downslope of proposed infrastructure due to alteration in the quality or quantity of surface water flows. Therefore, there is considered to be the potential for a **Small** Magnitude of Impact and therefore **Minor Adverse** effects to GWDTE which could be **Not Significant** under the EIA Regulations, were no mitigation implemented.

Effects on Soils and Peat

8.5.21 There are not anticipated to be any impacts on soils and peat further to those identified during the construction phase; therefore, no operational effects are predicted.

Potential Decommissioning Effects

8.5.22 While the risks to water resources are similar to those identified during the construction phase, decommissioning shall additionally require the breaking up and removal of concrete structures and reinforcement (e.g. turbine bases, transformers substations or buildings); the excavation and removal of crushed rock, geotextile or geogrid reinforcement materials; lifting and removal of cables and the dismantling and laying down of turbine components prior to removal.

8.5.23 During the decommissioning phase there is the potential for construction activity to impair the condition of hydrological and hydrogeological resources on and downstream of the turbine array. NatureScot commissioned research[28] identifies potential risks to the ground and surface water environment; these may include the potential for:

- bank instability and increased erosion leading to effects on the quality of aquatic habitats and ecology;
- establishing rapid drainage paths leading to the potential for increased pollution extent;
- the drainage of water dependent habitats;
- sedimentation and pollution from suspended materials leading to effects on fisheries and protected habitats/ species;
- spills of fuels and oils from vehicles, turbine gearboxes and transformers leading to effects on fisheries and protected habitats/ species; and
- soil compaction leading to increased runoff and erosion potential leading to effects on fisheries and protected habitats/ species.

[28] Nature Scot, 2026. Guidance - Decommissioning and Restoration Plans for wind farms. Version 2. Available online: https://www.nature.scot/doc/guidance-decommissioning-and-restoration-plans-wind-farms-february-2016

8.5.24 In line with assessment of the highest potential Magnitude of Impact (**Medium**) during the construction phase, there is the potential for a **Moderate Adverse** effect on the water environment during the decommissioning phase, were no mitigation implemented.

Potential Cumulative Construction Effects

8.5.25 The potential for cumulative effects to occur as a result of the Proposed Development are assessed based on:

- the potential hydrological connection of other developments, which are the subject of a valid planning application;
- the potential for concurrent phases of construction with other developments with the potential for hydrological connection to the Proposed Development and
- applicable planning conditions with regards to the potential impact of other developments on the water environment.

8.5.26 The following schemes have been taken into account in assessing the potential for cumulative effects as a result of hydrological interaction with the Proposed Development:

- Bodinglee Wind Farm (In Planning), situated approximately 700 m north. Situated within the catchment of the Robertson Burn, which drains to the River Clyde approximately 4.2 km north east of the Site;
- Priestgill wind farm (Consented), situated approximately 1.8 km east within the catchment of an unnamed burn which drains to the River Clyde approximately 1.4 km north east from the Site;
- Little Gala Wind Farm (In Planning), situated approximately 3.5 km north, within the catchment of Garf Water, which drains to the River Clyde approximately 8 km north east of the Site;
- West Andershaw Windfarm (Scoping), situated approximately 3.5 km north-west, within the catchment of Glespin Burn, which flows to the north and Douglas water;
- Glentaggart Wind Farm (Scoping), situated approximately 3 km north west within the catchment of Glespin Burn, which flows to the north and Douglas water and one proposed turbine location within the catchment of Black Burn; and
- Knoxhead Wind Farm and extensions (Consented) situated approximately 13 km west at the headwaters of Duneaton Water.

8.5.27 Based on the distance from the Site to developments identified above and the limited productivity of the underlying aquifer in the area (Low or Moderate productivity) there is assessed to be a low risk of cumulative hydrogeological effects on the water environment.

8.5.28 The majority of proposed developments within 5 km of the site are not in hydrological connection with watercourses to which the area of the Site directly drains. While the Knoxhead Wind Farm and extensions are situated upstream of the site on Duneaton Water, the distance from the site is such that the potential for cumulative impacts during the construction phase is considered to be very low. Several of the proposed developments and operational wind farms are within the wider catchment of the River Clyde, however, the distance of these sites to the River Clyde is such that direct impacts are considered to be of a low probability.

8.5.29 One proposed turbine of the Glentaggart Wind Farm is also within the catchment of Black Burn 3 km west. The single turbine of the Glentaggart site is situated at a significant distance from the Proposed Development.

8.5.30 All proposed developments considered above would be subject to the same planning and regulatory requirements as the Proposed Development, with regards to protection of the water environment. At each site this would include management of construction activities under an authorisation[29] by SEPA and the implementation of construction environmental management procedures. There is therefore considered to be a very low likelihood of cumulative impacts during the construction phase of the Proposed Development.

8.5.31 Therefore, the potential for cumulative impacts is could result in a **Small** Magnitude of Impact such that the effect on the water environment would be **Minor** and **Not Significant** in EIA terms.

Potential Cumulative Operational Effects

8.5.32 The potential for impacts on the water environment is significantly lower during the operational phase of the Proposed Development and cumulative schemes assessed above. At all cumulative schemes, drainage design for the implementation of SuDS measures during construction would prevent alteration of runoff rates and hydrological conditions in the surrounding area. Additionally pollution prevention measures would be implemented for the management of any potentially deleterious materials. Therefore, there would be no cumulative impact on the water environment as a result of the potential interaction of the Proposed Development with operational wind farms.

8.6 Mitigation

Mitigation by Design

8.6.1 The Proposed Development has been subject to a number of design iterations and evolution in response to constraints identified as part of the baseline studies, intended to reduce environmental effects (see **Chapter 3 (EIAR Volume 2)**).

8.6.2 The design of the Proposed Development has been set out such that the number of watercourse crossings shall be minimised. Design of new watercourse crossings would maintain hydraulic connectivity and allow the free passage of fish and other wildlife beneath. Watercourse crossings would also 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).

8.6.3 The design of the Proposed Development has avoided the areas of deep peat at the Site, with infrastructure proposed where either no peat is present or a shallow depth of peat is present (~98% <0.5 m in depth). These areas of shallow peat can be considered as organo-mineral soils.

8.6.4 Best practice measures for the management of construction activities are set out in the outline Construction Environmental Management Plan (CEMP) (**Technical Appendix 2.1: Outline Construction Environmental Management Plan, EIAR Volume 4**) and OPMP (**Technical Appendix 8.2:Outline Peat Management Plan, EIAR Volume 4**) . A detailed CEMP and PMP would be prepared by th Principal Contractor prior to the commencement of construction, and submitted to the local authority for approval and implemented thereafter.

[29] Under The Water Environment (Controlled Activities) (Scotland) Regulations 2011

Mitigation during Construction

8.6.5 Details of construction phase SuDS would be included in the Pollution Prevention Plan (PPP) and the final CEMP, as required, to provide a surface water management and treatment train that would mitigate potential adverse impacts on the hydrology of the Site and surrounding areas during the construction phase of the Proposed Development. Measures would ensure that pre-development runoff rates are maintained and that rates of runoff to watercourses are not increased. A full SuDS solution would be developed prior to construction. Construction site plans and proposed drainage measures would form a PPP that would be compiled by the Principal Contractor.

8.6.6 At the limited number of locations where a track is required to cross a watercourse, or where other infrastructure is necessary within 50 m of a surface watercourse, either as described in this Chapter or as identified by the Environmental Clerk of Works (EnvCoW), the installation of SuDS measures would be supervised by the EnvCoW during the construction phase of works. Any requirement for monitoring of water quality within watercourses downstream of the Proposed Development would be agreed with SEPA. Procedures for this would be detailed in the CEMP.

8.6.7 There are two locations at which, in addition to watercourse crossings, construction work is proposed within a 50 m buffer of a watercourse (identified in paragraph 8.5.2 of this chapter).

- a straightened drain is present within the most southerly part of the proposed solar array. During the site visit the watercourse was observed to be a cut drain of limited sensitivity in hydrological terms. No significant excavations or ground works would be carried out as part of the installation of the solar array; and
- the BESS area and substation are located on an area currently occupied by artificial ponds that form part of an active quarry site. Reinstatement works at this location would be carried out as part of the closure of the quarry site. Drainage design for the BESS and substation would be prepared by the appointed contractor to ensure that pre-development runoff rates would be maintained.

Sedimentation and Erosion

8.6.8 The CEMP would include measures to minimise potential adverse effects related to surface water and groundwater discharge, including impacts associated with dewatering which may arise from the excavation of borrow pits and turbine foundations. Therefore, the Principal Contractor would be required to meet regulatory requirements and implement best practice measures as set out in SEPA planning guidance.

8.6.9 Should the Proposed Development be granted Section 36 consent, detailed proposals for the management of surface water runoff at the Site would be submitted to SEPA by the Principal Contractor under a Construction Runoff licence[30] to fulfil regulatory requirements.

8.6.10 Sediment capture methods to be implemented at the Site would be detailed in a Drainage Impact Assessment that would be prepared by the Principal Contractor post consent to be submitted to the local planning authority for approval and then the approved plan implemented thereafter.

GWDTEs

8.6.11 Hydrological and hydrogeological assessment of vegetation communities identified as potentially groundwater dependant (provided in **Technical Appendix 8.5, EIAR Volume 4**)

[30] https://www.sepa.org.uk/regulations/water/pollution-control/water-run-off-from-construction-sites/

finds that such vegetation communities on-site are either in direct connection to surface water features or are unlikely to be supported by groundwater supplies.

8.6.12 It is considered that the maintenance of quality and quantity in surface water distribution across habitats identified as potentially groundwater dependent would be important, as these areas are assessed to be predominantly supported by surface water supply. Suitable drainage and surface water measures would be implemented, utilising SuDS where possible, to maintain hydrological connectivity in peatland and wetland habitats and prevent deleterious impacts on surface water distribution, which would be addressed in a CEMP for the Proposed Development to be developed by the Principal Contractor.

8.6.13 At two locations where development is proposed upslope of areas identified as being of moderate groundwater dependency by Ramboll (identified through hydrological surveying and detailed in **Technical Appendix 8.5**, **EIAR Volume 4**) mitigation through drainage design would ensure that water supply is maintained to downslope habitats. Measures would include:

- installation of upslope cut off drains to collect surface water runoff from upslope locations and distribute runoff to downslope areas;
- installation of cross drains below tracks at regular intervals to ensure the distributed conveyance of runoff across linear features (i.e. the collection and downslope release of runoff should not create new preferential surface water flow paths);
- consideration to be given to the installation of floating track and granular, permeable sub-base materials on track at these locations to maintain flows of soil water; and
- installation of SuDS measures to ensure the settlement of sediments, prior to distributed release over downslope vegetated areas.

Soils and Peat

8.6.14 Measures to mitigate potential effects on soils and peat are set out in the outline CEMP (Technical Appendix 2.1: Outline Construction Environmental Management Plan, EIAR Volume 4) and OPMP (Technical Appendix 8.2: Outline Peat Management Plan, EIAR Volume 4) . A detailed CEMP and PMP would be prepared by the Principal Contractor prior to the commencement of construction and submitted to the local authority for approval and the approved plans implemented thereafter.

8.6.15 Proposed habitat management and peat restoration measures are included in the outline Biodiversity Enhancement Management Plan (BEMP) (**Technical Appendix 6.6: Outline Biodiversity Enhancement Management Plan, EIAR Volume 4**).

8.6.16 The BEMP sets out habitat management proposals for peatland restoration. This includes restoration of a management area split over two sub-units, comprising an area of predominantly blanket bog and wet modified bog habitats. The aim would be to enhance the existing and degraded peatland habitats and create favourable conditions for the re-establishment of peatland vegetation.

8.6.17 The area has been selected as a suitable candidate area for peatland restoration and enhancement due to the presence of peat hagging and drainage effects. Enhancement is proposed to be fulfilled through:

- peat hagg reprofiling;
- livestock exclusion/management; and
- removal of non-native self-seeding trees.

8.6.18 Although it appears that some drains are present, the implementation of peat damming is not proposed in the OBEMP.

8.6.19 A detailed BEMP would be produced by the Principal Contractor prior to commencement of construction and submitted to the local authority for approval and the approved plans implemented thereafter.

Mitigation during Operation

8.6.20 A site maintenance programme with regard to site plant and infrastructure would be implemented by the Principal Contractor.

8.6.21 A maintenance schedule would be developed for all SuDS and drainage assets installed at construction stage to ensure that the function and benefit provided by the asset remains for the lifetime of the Proposed Development.

8.6.22 A detailed PMP and BEMP would be produced by the Principal Contractor and submitted to the local authority for approval, and operational mitigation would be included in these as appropriate.

Mitigation during Decommissioning

8.6.23 It is anticipated that at the time of decommissioning, a Decommissioning Environmental Management Plan (DEMP) would be prepared and implemented by an appointed contractor to the extent that infrastructure is fully or partially decommissioned. Should full decommissioning of the Site be carried out following the lifespan of the Proposed Development, the Site would be returned to 'the same' or 'a better' condition such that natural drainage conditions would be replicated, as far as practicably possible based on the intended land use.

8.7 Assessment of Residual Effects

Residual Construction Effects

Watercourses and Surface Water Runoff

8.7.1 The potential for adverse impact on runoff volumes and rates and fluvial morphology through the alteration of drainage patterns would be mitigated through the implementation of best practice measures as outlined above and set out in the CEMP as detailed in **Technical Appendix 2.1 (EIAR Volume 4)**. The design of watercourse crossings and drainage features associated with infrastructure would be in line with CAR regulations and set out in a Construction Site License in consultation with SEPA and SLC. Where encroachment to within a 50 m buffer from watercourses has been identified, additional mitigation measures have been set out to further reduce the potential magnitude of alteration to surface water flows and runoff to none. Therefore, the residual effect would be **Negligible** and **Not Significant**.

Sedimentation and Increased Erosion Rates

8.7.2 The potential for adverse impact on water quality and fluvial morphology associated with sediment-laden runoff or impacts on bank integrity is taken into account in the design of the Proposed Development and the maintenance of a suitable buffer to watercourses from areas in which infrastructure is proposed. Furthermore, SuDS design shall ensure the capture of any additional sediment load that could be released in the construction phase. Where a section of access track is proposed within a 50 m buffer of a watercourse, the implementation of additional sediment control measures would be overseen by the EnvCoW, who would also carry out daily inspection of sediment control measures and the watercourse. Therefore, the residual effect would be **Negligible** and **Not Significant**.

Chemical Pollution

8.7.3 The potential for impacts on the water environment through the release of pollutants or sediments during the construction phase shall be managed through the implementation of a CEMP as detailed in **Technical Appendix 2.1, EIAR Volume 4)**. The CEMP would incorporate measures to ensure that the release of sediments or pollutants to the surrounding environment is avoided. Therefore, the residual effect would be **Negligible** and **Not Significant**.

GWDTE

8.7.4 The potential for adverse impact on GWDTE habitats (**Technical Appendix 8.5**, **EIAR Volume 4**) would be managed through the implementation of suitable cross drainage measures and SuDS measures incorporated with on-site infrastructure. Therefore, the residual effect would be **Negligible** and **Not Significant**.

Soils and Peat

8.7.5 The potential for impacts on soils and peat during the construction phase has been managed thorough design to avoid deeper areas of peat. In addition, mitigation and good practice measures to minimise potential impacts on soils and peat are set out in the CEMP, PMP and BEMP, as detailed in **Technical Appendices 2.1: Outline Construction Environmental Management Plan, 8.2: Outline Peat Management Plan, EIAR Volume 4**) and **6.6: Outline Biodiversity Enhancement Management Plan**.

8.7.6 The residual effects on soils and peat would be **Negligible** and **Not Significant**.

Residual Operational Effects

8.7.7 The assessment has identified that there are no significant effects arising from the Proposed Development, taking in to account mitigation measures implemented in the construction phase. Therefore, the residual effect would be **Negligible** and **Not Significant**.

Residual Decommissioning Effects

8.7.8 At the point of full or partial decommissioning of the Proposed Development, the CEMP, PMP and BEMP developed during the construction phase shall provide guidance for the management of risk to the water and soils environment. These would be reviewed (along with any changes in legislation, climate, designations, habitats or water use) and used to plan decommissioning activity. Assessment provided above sets out that no significant effects would occur as a result of decommissioning of the Proposed Development. Minimisation of construction footprint during decommissioning and the re-use of excavated material would be carried out where possible, and the potential for material to remain in situ where applicable assessed. Therefore, the residual effect would be **Negligible** and **Not Significant**.

Residual Cumulative Construction Effects

8.7.9 No residual cumulative construction effects would occur as a result of the Proposed Development and cumulative schemes identified.

Residual Cumulative Operational Effects

8.7.10 No residual cumulative operational effects would occur as a result of the Proposed Development and cumulative schemes identified.

8.8 Monitoring

Construction Phase Monitoring

8.8.1 Best practice monitoring measures would be set out in the CEMP, PMP and BEMP, to be prepared by the Principal Contractor, and submitted to the local authority for approval and the approved plans implemented thereafter.

8.8.2 At the limited number of locations where a track is required to cross a watercourse, or where other infrastructure is necessary within 50 m of a surface watercourse, either as described in this chapter or as identified by the Environmental Clerk of Works (EnvCoW), the installation of SuDS measures would be supervised by the EnvCoW during the construction phase of works.

Operation Phase Monitoring

8.8.3 No operational phase monitoring is required.

Decommissioning Phase Monitoring

8.8.4 Monitoring at the decommissioning phase would be in line with recommendations set out for the construction phase and detailed in the DEMP., which would be prepared and implemented by the appointed contractor at the time of decommissioning.

8.9 Summary

Table 8. 4: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/ Residual Effect
Construction			
Alteration to Surface Water Flows and Runoff	Drainage management proposals to ensure pre-construction rates/ volumes of run-off maintained. The drainage management works would be supervised by the EnvCoW.	CEMP, including detailed watercourse crossing proposals, to be submitted to and approved by the LPA/ SEPA to be secured by an appropriately worded planning condition and the application for a Construction Runoff Licence by the Principal Contractor.	Not Significant
Sedimentation and Increased Erosion	Drainage management proposals to ensure water quality is maintained through use of good practice silt mitigation. The drainage management works would be supervised by the EnvCoW.	CDEMP, including detailed watercourse crossing proposals, to be submitted to and approved by the LPA/ SEPA to be secured by an appropriately worded planning condition and the application for a Construction Runoff Licence by the Principal Contractor.	Not Significant
Chemical Pollution	Storage of potentially contaminative materials at least 50 m from watercourses. Fuels, oils or chemicals stored on-site would be sited over an impervious base and according with the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR).	CEMP including a Pollution Prevention Plan to be submitted to and approved by the LPA/ SEPA to be secured by an appropriately worded planning condition.	Not Significant

Table 8. 4: Summary of Potential Significant Effects of the Proposed Development			
Likely Significant Effect	**Mitigation Proposed**	**Means of Implementation**	**Outcome/ Residual Effect**
	Petrol interceptors and spill kits will be utilised where chemical spillage is a possibility.		
Effects on GWDTE	Drainage management proposals to ensure groundwater flow, hydraulic continuity and water quality is maintained.	CEMP to be submitted to and approved by the LPA/ SEPA to be secured by an appropriately worded planning condition.	Not Significant
Effects on Soils and Peat	Implementation of detailed PMP to be prepared by the appointed Contractor. Implementation of good practice measures as outlined by the PMP, BEMP, Peat Landslide Hazard Risk Assessment and CEMP. Micrositing tolerances to be used in the event of encountering unexpected pockets of deep peat. Peat restoration would be undertaken in appropriate areas of the Site.	Detailed PMP, BEMP and CEMP to be submitted to and approved by the LPA/ SEPA to be secured by an appropriately worded planning condition.	Not Significant
Operation			
Alteration to Surface Water Flows and Runoff	On-going maintenance for all proposed drainage measures on the site, particularly including water crossings and sustainable drainage features designed to manage water quality and runoff rate.	To be implemented and monitored by the site operator, through operational maintenance schedule.	Not Significant
Sedimentation and Increased Erosion	On-going maintenance for all proposed drainage measures on the site, particularly including water crossings and sustainable drainage features designed to manage water quality and runoff rate.	To be implemented and monitored by the site operator, through operational maintenance schedule.	Not Significant
Chemical Pollution	All ongoing maintenance to be carried out in accordance with pollution prevention guidance. No fuelling, storage of oils or laydown of plant to be carried out on-site.	Maintenance schedule to be implemented by the Principal Contractor.	Not Significant
Effects GWDTE	Infrastructure would incorporate measures to ensure the conveyance of shallow groundwater and surface water across the Proposed Development, such as the use of suitably graded sub-base aggregate on tracks and cross drainage	To be implemented as set out in construction phase mitigation above. Maintenance schedule to be implemented the Principal Contractor.	Not Significant

Table 8. 4: Summary of Potential Significant Effects of the Proposed Development			
Likely Significant Effect	**Mitigation Proposed**	**Means of Implementation**	**Outcome/ Residual Effect**
	measures to ensure the continued distribution of surface water runoff.		
Effects on Soils and Peat	Peat restoration would be undertaken in appropriate areas of the Site.	To be implemented as set out in construction phase above and through Detailed PMP and BEMP to be implemented by the Principal Contractor.	Not Significant
Decommissioning			
Impacts due to construction activity assessed above).	A Decommissioning Plan would set out environmental protection measures and restoration principles which would be implemented. It is anticipated that similar mitigation as required during construction would be necessary.	Decommissioning measures to be carried out in line with Decommissioning Plan and best practice measures, and where applicable approved with SEPA through CAR licensing.	Not Significant
Disturbance of established habitats or drainage pathways.	Minimisation of construction footprint during decommissioning. Excavated material re-used where possible, and potential for material to remain in situ where applicable assessed.	Decommissioning measures to be approved with SEPA through CAR licensing.	Not Significant
Cumulative Construction			
No significant cumulative construction effects are predicted	N/A	N/A	N/A
Cumulative Operation			
No significant cumulative operational effects are predicted	N/A	N/A	N/A

9 Traffic and Transport

9.1 Executive Summary

9.1.1 This chapter considers the potential effects of the Proposed Development on Access, Traffic and Transport during construction of the Proposed Development, considering three categories of receptor:

- traffic flows in the surrounding study area;
- local road users; and
- local residents.

9.1.2 The Proposed Development will be mainly accessed via the following:

- a main site entrance for use during construction and operation, at the current entrance to Thirstone Quarry on the B7078;
- two site entrances to the south of the B7078 and one site entrance off of the B740 directly south of the B7078, which will be designed to accommodate abnormal indivisible loads (AIL) required for turbine component delivery;
- a further site entrance from the M74 motorway to the northern part of the site only, to allow delivery of AIL required for turbine component delivery. Empty loads will return to the road network via the existing underpass and the B7078, rejoining the M74 at Junction 13;
- five further site entrances to the solar array area, four from the B7078 (two to the north and two to the south) and one from the A702 immediately north of Abington Services;
- The maximum traffic impact associated with construction is predicted to occur in Month 10 of the indicative construction programme. The traffic associated with the Proposed Development, at the peak of construction, would result in an additional 263 total movements per day which comprises an average of 175 HGV movements per day (87 inbound and 87 outbound) and 88 Cars & Lights movements per day (44 inbound and 44 outbound). A sensitivity review was undertaken to inform the relevant planning authorities of possible issues if consented schemes in the area, whose construction traffic would impact the study area, were constructed concurrently. The review found that there would be more than sufficient spare road capacity to accommodate all consented schemes being constructed at the same time. It is proposed that effects of all the sites being constructed at the same time would be mitigated through the use of an overarching Traffic Management and Monitoring Plan.

9.1.3 Paths along the Core Path / Right of Way network are located within the vicinity of the Proposed Development and National Cycle Network Route Number 74 is located along the B7078, and mainly comprises segregated paths. The assessment of significance suggests that traffic flows interacting with the Core Path / Wider Path network are considered moderate adverse, prior to the application of mitigation measures.

9.1.4 With the implementation of appropriate mitigation, no significant residual effects are anticipated in respect of traffic and transport issues. The residual effects are all assessed to be minor or negligible. As they will occur during the construction phase only, they are temporary and reversible.

9.2 Introduction

9.2.1 This chapter considers the likely significant effects on Traffic and Transport associated with the construction, operation and decommissioning of the Proposed Development. The specific objectives of the chapter are to:

- describe the Traffic and Transport baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

9.2.2 The assessment has been carried out by Laura Mackey MSc (Hons), Senior Transport Planner, Pell Frischmann. Laura has more than six years' experience preparing transport assessments for new developments. The technical reviewer of the traffic and transport assessment is Gordon Buchan BEng (Hons), MSc, CEng, CMILT, FCIHT, Sector Director for Energy of Pell Frischmann. Gordon has over 27 years of undertaking transport assessment associated with new developments and has worked on renewable energy and energy distribution projects across the UK, Ireland and Northern Europe.

9.2.3 This chapter is supported by the following technical appendices:

- Volume 4: Technical Appendices
  - Technical Appendix 9.1: Transport Assessment.

9.2.4 Figures and technical appendices are referenced in the text where relevant.

9.3 Assessment Methodology

Scope of Assessment

9.3.1 The following effects were identified at the scoping stage for consideration in this assessment:

- Direct effects during construction on traffic flows in the surrounding study area;
- Direct effects upon local road users; and
- Direct effects on local residents as a result of increased traffic.

9.3.2 Where the predicted magnitude of change to baseline conditions of roads within the study area meet the criteria set out in the IEMA guidance[1] a review of the effects on severance, driver delay, pedestrian delay, non-motorised user amenity, fear and intimidation, road safety, road safety audits and large loads has been undertaken.

9.3.3 The chapter assesses cumulative effects as arising from the addition of the Proposed Development to other cumulative developments, which are the subject of a consented planning application. Operational, under construction and consented developments are considered as part of the baseline. Developments close to the end of their operational life will be included as part of the baseline to present 'worst case scenario'.

9.3.4 The assessment is based on the Proposed Development as described in Chapter 2: Development Description (EIAR Volume 2).

[1] Institute of Environmental Management & Assessment (2023) -Environmental Assessment of Traffic and Movement

9.3.5 The scope of the assessment has been informed by consultation responses detailed in **Technical Appendix 1.1: Consultation Register (EIAR Volume 4)** and the following guidelines/policies:

- Planning Policy
  - National Planning Framework 4 (2023)[2];
  - South Lanarkshire Local Development Plan 2 (2021)[3]; and
  - South Lanarkshire Local Development Plan 2 – Supporting Planning Guidance: Renewable Energy (2021)[4].
- Guidance
  - Environmental Assessment of Traffic and Movement (IEMA), 2023)[5];
  - Planning Advice Note (PAN) 75 (2005)[6];
  - Transport Assessment Guidance (2012)[7]; and
  - Onshore Wind Turbines, Online Renewables Planning Advice (2014)[8].

Potential Effects Scoped Out

9.3.6 On the basis of the desk and field survey work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, and feedback received from consultees, the following topic areas have been 'scoped out' of detailed assessment, as proposed in the Scoping Report:

- Operational Phase: The traffic effects during the operational phase of the Proposed Development are likely to be insignificant as expected traffic flows will be up to two vehicle movements per week, far below the recognised thresholds for triggering a formal transport assessment. As such, the effects during the operational phase are scoped out of the assessment.
- Decommissioning Phase: The traffic effects during the decommissioning phase can only be fully assessed closer to that period, 40 years on from the completion of the Site. As elements of the Proposed Development are likely to remain in-situ (such as cable trenches, access tracks, etc), the traffic flows associated with the decommissioning works will be lower than those associated with the construction phase. The construction phase therefore represents a worst case assessment and as such, no further assessment of the decommissioning phase has been considered at this point in time and has been scoped out of the assessment.

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[2] The Scottish Government, National Planning Framework 4 (2023). Available at: https://www.gov.scot/publications/national-planning-framework-4/documents/

[3] South Lanarkshire Council, South Lanarkshire Local Development Plan 2 (2020). Available at: https://www.southlanarkshire.gov.uk/developmentplan2

[4] South Lanarkshire Council (2021), South Lanarkshire Local Development Plan 2 – Supporting Planning Guidance: Renewable Energy. Available at: South Lanarkshire Local Development Plan 2 – Supporting Planning Guidance: Renewable Energy

[5] Institute of Environmental Management & Assessment (2023) -Environmental Assessment of Traffic and Movement

[6] The Scottish Government (2005), Planning Advice Note (PAN) 75. Available at: https://www.gov.scot/publications/planning-advice-note-pan-75-planning-transport/

[7] The Scottish Government (2012), Transport Assessment Guidance. Available at: https://www.transport.gov.scot/media/4589/planning_reform_-_dpmtag_-_development_management__dpmtag_ref__17__-_transport_assessment_guidance_final_-_june_2012.pdf

[8] The Scottish Government (2014), Onshore wind turbines: planning advice. Available at: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/

Method of Baseline Characterisation

Extent of the Study Area

9.3.7 The study area includes local roads that are likely to experience increased traffic flows resulting from the Proposed Development. The geographic scope was determined through a review of Ordnance Survey (OS) plans and an assessment of the potential origin locations of construction staff and supply locations for construction materials.

9.3.8 Strategic access to the Site is available from the M74 which forms part of the trunk road network. Access for construction materials would be predominantly from the north via the M74 or from quarries along the B7078.

9.3.9 The Proposed Development will take access directly from accesses along the B7078 and M74. All vehicular traffic will use these accesses including Abnormal Indivisible Loads (AIL). Where feasible, local materials will be sourced which will avoid traffic impacting on local communities as much as possible.

9.3.10 The study area for this assessment is as follows:

- B7078, between M74 Junction 13 and A70;
- B740, between the B7078 and Black Burn bridge;
- A70, between West of Douglas and Rigside;
- M74 between junction 11 and junction 14; and
- A702 (T), between M74 Junction 13 and A73 / A702 Roundabout.

9.3.11 The study area network is shown in Appendix 9.1

9.3.12 This study area includes areas of material supply (quarries, etc), the Site access junctions, the trunk road network and the construction material and abnormal load delivery routes. It is also of sufficient size to include the main areas of workforce accommodation during the construction period.

Desk Study

9.3.13 The location of data collection count sites and likely points of origin for materials were reviewed to assist in developing a suitable study network.

9.3.14 A desk study was undertaken which comprised a review of the following:

- Relevant transport planning policy;
- Accident data;
- Sensitive locations;
- Any other traffic sensitive receptors in the area (core paths, routes, communities, etc.);
- Ordnance Survey (OS) plans;
- Potential origin locations of construction staff and supply locations for construction materials to inform extent of local area roads network to be included in the assessment;
- Constraints to the movement of AILs through a Route Survey including swept path assessments.

Field Survey

9.3.15 Field surveys were also undertaken and comprised:

- A detailed site visit to the Site to review the potential access routes and potential constraints was undertaken; and
- Collection of traffic flow and speed data.

Criteria for Assessing Significance

Criteria for Assessing the Sensitivity of Receptors

9.3.16 The IEMA 'Guidelines for Environmental Impact Assessment' (2005) notes that the separate IEMA Guidelines should be used to characterise the environmental traffic and transport effects (offsite effects) and the assessment of significance of major new developments. Recent guidance published by the IEMA, namely 'Environmental Assessment of Traffic and Movement' (2023) provides an update to the previously used guidance, 'Guidelines for the Environmental Assessment of Road Traffic' (1993) document, that should be used to characterise the environmental traffic and transport effects (off-site effects) and the assessment of significance of major new developments. The guidelines intend to complement professional judgement and the experience of trained assessors.

9.3.17 In terms of traffic and transport impacts, the receptors are the users of the roads within the study area and the locations through which those roads pass. The 2023 IEMA Guidelines include guidance on how the sensitivity of receptors should be assessed. Using that as a base, professional judgement was used to develop a classification of sensitivity for users based on the characteristics of roads and locations. This is summarised in Table 9.1.

Table 9.1: Classification of Receptor Sensitivity

Receptor	Sensitivity			
	High	Medium	Low	Negligible
Users of Roads	Where the road is a minor rural road, not constructed to accommodate frequent use by HGVs. Includes roads with traffic control signals, waiting and loading restrictions, traffic calming measures.	Where the road is a local A or B class road, capable of regular use by HGV traffic. Includes roads where there is some traffic calming or traffic management measures.	Where the road is Trunk or A-class, constructed to accommodate significant HGV composition. Includes roads with little or no traffic calming or traffic management measures.	Where roads have no adjacent settlements. Includes new strategic trunk roads that would be little affected by additional traffic and suitable for Abnormal Loads and new strategic trunk road junctions capable of accommodating Abnormal Loads.
Users / Residents of Locations	Where a location is a large rural settlement containing a high number of community and public services and facilities.	Where a location is an intermediate sized rural settlement, containing some community or public facilities and services.	Where a location is a small rural settlement, few community or public facilities or services.	Where a location includes individual dwellings or scattered settlements with no facilities.

9.3.18 Where a road passes through a location, road users (pedestrian, cyclists, drivers, etc.) are considered subject to the highest level of sensitivity defined by either the road or location characteristics.

Criteria for Assessing the Magnitude of Change

9.3.19 The following rules, also taken from the IEMA Guidelines are used to determine which links within the study area should be considered for detailed assessment:

- Rule 1 – include highway links where traffic flows are predicted to increase by more than 30% (or where the number of heavy goods vehicles is predicted to increase by more than 30%); and
- Rule 2 – include any other specifically sensitive areas where traffic flows are predicted to increase by 10% or more.

9.3.20 The IEMA Guidelines identify the key impacts that are most important when assessing the magnitude of traffic impacts from an individual development. The impacts and levels of magnitude are discussed below:

- Severance – the IEMA Guidance advises that, "The Department for Transport has historically set out a range of indicators for determining the significance of severance. Changes in traffic flow of 30 %, 60 % and 90 % are regarded as producing 'slight', 'moderate' and 'substantial' changes in severance respectively. Although these thresholds no longer appear in Department for Transport guidance, they have not been superseded by subsequent changes to guidance and are established through planning case law. However, caution needs to be observed when applying these thresholds as very low baseline flows are unlikely to experience severance impacts even with high percentage changes in traffic." (Para 3.16). The Guidelines acknowledge that changes in traffic flows should be used cautiously, stating that "the assessment of severance should pay full regard to specific local conditions, e.g. sensitivity of adjacent land uses, prevalence of vulnerable people, whether or not crossing facilities are provided, traffic signal settings, etc." (Para 3.17).
- Driver delay – the IEMA Guidelines note that these delays are only likely to be "significant when the traffic on the network surrounding the development is already at, or close to, the capacity of the system" (Para 3.20).
- Pedestrian delay (incorporating delay to all non-motorised users) – the IEMA Guidance advises that "pedestrian delay and severance are closely related effects and can be grouped together. Changes in the volume, composition or speed of traffic may affect the ability of people to crossroads. In general, increases in traffic levels are likely to lead to greater increases in delay. Delays will also depend on the general level of pedestrian activity, visibility and general physical conditions of the development site." (Para 3.24). Furthermore, the guidance advises that "…it is not considered wise to set down definitive thresholds. Instead it is recommended that the competent traffic and movement expert use their judgement to determine whether pedestrian delay constitutes a significant effect." (Para 3.26).
- Non-motorised user amenity - the IEMA Guidance advises that, "The 1993 Guidelines suggest that a tentative threshold for judging the significance of changes in pedestrian amenity would be where the traffic flow (or HGV component) is halved or doubled. Although these thresholds no longer appear in Department for Transport guidance, they have not been superseded by subsequent changes to guidance and are established through planning case law." (Para 3.30).
- Fear and intimidation – there are no commonly agreed thresholds for estimating levels of fear and intimidation, from known traffic and physical conditions. However, as the impact is considered to be sensitive to traffic flow, changes in traffic flow of 30 %, 60 % and 90 % are regarded as producing minor, moderate and substantial changes respectively in the guidelines. (Para 2.19). As such, this has been used to assess the potential impacts associated with construction activities around fear and intimidation on people in close proximity to the proposed development.
- Road safety – professional judgement would be used to assess the implications of local circumstances, or factors which may elevate or lessen risks of accidents. In line with the IEMA Guidance, those areas of collision clusters would be subject to detailed review.
- Road safety audits – It would be proposed to undertake any necessary Road Safety Audits (RSA) post consent and it is considered that this can be secured via a planning condition.

- Large loads – The movement of the AILs associated with the construction of the proposed development have been considered in full, within a separate route survey assessment, which identifies physical mitigation measures required to accommodate the predicted loads. Additional mitigation in terms of addressing potential impacts on sensitive receptors are included as standard within the mitigation proposals in Section 9.7.

9.3.21 While not specifically identified as a more vulnerable road user, cyclists are considered in similar terms to pedestrians.

9.3.22 It is not anticipated that any vehicle movements will be carrying hazardous loads (with the exception of small amounts of fuel for the construction plant and compound generators) to or from the Site during the construction phase.

Criteria for Assessing Cumulative Effects

9.3.23 In traffic and transport terms, only developments that have been consented can be assumed to be committed developments.

9.3.24 Trips associated with committed developments which are deemed to be permanent on the road links within the Study Area have been included as part of the future year baseline.

9.3.25 Trips associated with consented developments which are considered to be temporary or transitory on road links within the Study Area have been included in a sensitivity review.

9.3.26 The sensitivity review is undertaken as part of the cumulative assessment to inform the planning authorities of possible issues if all consented developments were to be constructed concurrently.

9.3.27 The use of National Road Traffic Forecast (NRTF) low growth factors for background traffic is considered robust for addressing smaller, non-significant traffic generation caused by smaller developments within the study area. As such, a robust assessment case has been provided in this report.

Criteria for Assessing Significance

9.3.28 The Design Manual for Roads & Bridges (DMRB) defines four levels against which the magnitude of impacts should be assessed as follows:

- Major: These effects are considered to be material in the decision-making process;
- Moderate: These effects may be important but are not likely to be material factors in decision making. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a receptor;
- Minor: These effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in improving the subsequent design of the project; and
- Negligible: No effects or those that are imperceptible.

9.3.29 To determine the overall significance of effects, the results from the receptor sensitivity and magnitude of impact assessments are correlated and classified using a scale set out in the DMRB LA 104 Environmental Assessment and Monitoring (Revision 1) and summarised in Table 9.2.

Table 9.2: Significance of Effects

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

9.3.30 In terms of the EIA Regulations, effects would be considered of significance where they are assessed to be major or moderate. Where an effect could be one of Major/Moderate or Moderate/Minor, professional judgement would be used to determine which option should be applicable. Therefore in some cases moderate/minor effects based on the table may be judged to be minor and therefore not significant.

Project Design Assumptions, Good Practice Measures And Embedded Design

9.3.31 The Site layout allows for the use of on-site borrow pits to provide material for the creation of the access tracks, hardstandings and compound bases. It is estimated that these can provide sufficient material for the construction of 100% of the aggregate requirements for the Site; however, to ensure that a robust assessment is undertaken, it has been assumed that 100% of stone material for capping and 100% of stone material for fill will be delivered to the Site. It is assumed that stone material will be delivered from the quarry located along the B7078, to the south of the access to the Site or from quarries further afield via the M74.

9.3.32 Batching of concrete for use on-site is considered feasible and economic and facilities to enable this are being provided at the Proposed Development. The assessment, has, however, taken into consideration the importation of 100% of concrete batching materials.

Limitations and Assumptions

9.3.33 The assessment is based upon average traffic flows in one month periods. During the month, activities at the Site may fluctuate between one day and another and it is not possible to fully develop a day by day traffic flow estimate as no Balance of Plant (BoP) contractor has been appointed and external factors can impact upon activities on a day by day basis (weather conditions, availability of materials, time of year, etc.).

9.4 Baseline Conditions

Current Baseline

9.4.1 To assess the impact of development traffic on the study area, existing ATC information from a neighbouring scheme[9] was obtained from the online planning portal. The ATC surveys were conducted over a 7-day period between 29 September and 05 October 2021.

9.4.2 The count sites used were as follows:

1. B7078, between Junction 13 and A70; and
2. A70, between the B7078 junction and Junction 12 of the M74.

[9] ECU00004839 Bodinglee Wind Farm, Volume 2 – EIAR – Chapter 9 – Access, Taffic and Transport

9.4.3 In addition to the ATC data, further traffic count data was obtained from the Department for Transport (DfT) database on the A70, M74, and A702 (sites 3, 4, 5 and 6). A National Road Traffic Forecast (NRTF) low growth factor was applied to the 2021 ATC survey traffic flows to forecast 2024 traffic flows. The NRTF low growth factor for 2021 to 2024 is 1.0216.

9.4.4 The DfT count sites are as follows:

3. A70, between M74 Junction 12 and Rigside (DfT Count Point 10827);
4. M74, between Junction 11 and Junction 12 (TS Count Point JTC00245);
5. A70, West of Douglas (DfT Count Point 40825);
6. A702, between M74 Junction 13 and A73 / A702 Roundabout (DfT Count Point 732);
7. M74, between Junction 12 and Junction 13 (TS Count Point ATC6_11); and
8. M74, between Junction 13 and Junction 14 (TS Count Point ATC6_21);

9.4.5 In order to avoid travel restriction associated with the Covid-19 pandemic, available 2019 traffic information was retrieved from the DfT Database. A NRTF low growth factor was applied to the existing information obtained from DfT in order to estimate 2024 flows. The NRTF low growth factor for 2019 to 2024 is 1.0366.

9.4.6 The traffic counters allowed the traffic flows to be split into vehicle classes and the data has been summarised into cars / light good vehicles (LGVs) and heavy goods vehicles (HGVs) (all goods vehicles >3.5 tonnes gross maximum weight, as well as buses).

9.4.7 Table 9.3 summarises the 24 hour average seven day traffic data collected at the count sites.

Table 9.3: Average Daily Two-Way Traffic Flows (2024)

Site ID	Survey Location	Count Source	Cars & LGV	HGV	Total
1	B7078, between M74 Junction 13 and A70	ATC Survey	591	299	890
2	A70, between B7078 junction and Junction 12 of the M74	ATC Survey	3,551	1,095	4,645
3	A70, between M74 Junction 12 and Rigside	DfT	3,431	786	4,217
4	M74, between junction 11 and junction 12	TS	23,600	9,363	32,963
5	A70, West of Douglas	DfT	1,697	290	1,987
6	A702, between M74 Junction 13 and A73 / A702 Roundabout	DfT	5,814	828	6,642
7	M74, between junction 12 and junction 13	TS	23,682	11,135	34,816
8	M74, between junction 13 and junction 14	TS	25,758	11,986	37,744

9.4.8 Table 9.4 presents the results of the two-way seven-day average and 85th percentile speeds observed at the count locations.

Table 9.4: Speed Summary

Site ID	Survey Location	Count Source	Mean Speed (mph)	85%ile (mph)	Speed Limit (mph)
1	B7078, between M74 Junction 13 and A70	ATC Survey	59	60	60
2	A70, between B7078 junction and Junction 12 of the M74	ATC Survey	30	60	60

Table 9.4: Speed Summary					
Site ID	**Survey Location**	**Count Source**	**Mean Speed (mph)**	**85%ile (mph)**	**Speed Limit (mph)**
3	A70, between M74 Junction 12 and Rigside	DfT	No data available		40
4	M74, between junction 11 and junction 12	TS	66	75	70
5	A70, West of Douglas	DfT	No data available		60
6	A702, between M74 Junction 13 and A73 / A702 Roundabout	DfT	No data available		60
7	M74, between junction 12 and junction 13	TS	65	75	70
8	M74, between junction 13 and junction 14	TS	68	77	70

9.4.9 The speed survey data indicates that there is non-compliance with current speed limits on the B7078 or M74, however there is compliance on the A70 between the B7078 junction and Junction 12 of the M74. This indicates that traffic management measures will be required on the B7078 and that Police Scotland may wish to consider enforcement spot checks in this area.

Accident Review

9.4.10 Road traffic accident data for the five-year period commencing 01 January 2018 through to the 31 December 2022 was obtained from the online resource crashmap.co.uk which uses data collected by the police about road traffic crashes occurring on British roads. Accident data recorded along the local roads within the study area, and in the vicinity of junctions joining the local road network, was analysed.

9.4.11 The statistics are categorised into three categories, namely "Slight" for damage only incidents, "Serious" for injury accidents and "Fatal" for accidents that result in a death.

9.4.12 A70

- There were a total of 10 incidents on the A70, of which eight were categorised as "Slight", one "Serious" and one "Fatal".
- Two of these incidents (20%) involved an HGV, of which one was fatal. This incident occurred within Rigside.
- A total of 50% of all incidents on the A70 occurred either on or on approach to a junction.
- Three of the incidents on the A70 occurred within Rigside.

9.4.13 B7078

- Only two incidents occurred on the B7078, one categorised as "Slight" and one "Serious".
- The serious incident occurred at a T-junction with the B740, close to an access to the Proposed Development.
- The "Slight" incident involved a young driver.

9.4.14 M74

- There were a total of 28 incidents on the M74, of which 20 were categorised as "Slight", six as "Serious", and two as "Fatal".
- A total of 18 (64%) of these incidents occurred between Junction 12 and Junction 13, six (21%) occurred between Junction 13 and Junction 14, and the remaining four (14%) occurred between Junction 11 and Junction 12.

- Nine (32%) of the incidents on the M74 involved an HGV.
- A total of 14 (50%) of the incidents on the M74 only involved one vehicle.
- The M74 accounts for more than half (61%) of the incidents within the study area.
- One of the fatal incidents occurred at Junction 14 on a slip road travelling towards the M74 roundabout with the A702. This incident involved one motorcyclist.

9.4.15 A702

- There were a total of six incidents on the A702, five of which were categorised as "Slight", and the remaining one as "Serious".
- Five of the six (83.3%) incidents on the A702 occurred on a roundabout by Junction 13.
- Two (33.3%) of the incidents on the A702 involved an HGV.
- The "Serious" incident on the A702 occurred on the roundabout with the B7078 and involved two cars, resulting in three casualties.

9.4.16 Summary

- A total of 46 incidents occurred within the study area within a five-year period.
- Of these incidents, 34 (74%) were categorised as "Slight", nine (19.5%) as "Serious", and three (6.5%) as "Fatal".
- A total of 13 (28%) of the incidents within the study area involved an HGV.
- Three (6.5%) of the incidents within the study area involved a motorcycle and nine (19.5%) involved a young driver.
- The majority of incidents (61%) occurred on the M74.
- A total of 12 (26%) incidents within the study area occurred at a junction.
- Only one child casualty was recorded and the accident occurred in a "Slight" incidents at the A702 / B7078 Roundabout.
- There were two pedestrian casualties, one within Rigside, and one with Douglas, both were categorised as a "Slight" incidents.

9.4.17 In general, there are no clusters of accidents at any location in the assessed area or high numbers of accidents involving HGVs along the local road network. The majority of accidents recorded occurred at or on approach to junctions / access to properties, where there is an increased interaction between vehicles, and on bends.

9.4.18 Based on the information available, it has been established that there are no specific road safety issues within the immediate vicinity of the Proposed Development that currently require to be addressed or would be exacerbated by the construction of the Proposed Development.

Active Travel Networks

9.4.19 A review of South Lanarkshire Council's (SLC) Core Path Network[10] shows that Core Path CL/3463/1, CL/3464/1, CL/3465/1, CL/5949/1, and CL/5951/1 are located along sections of the B7078 within the study area and along segregated paths adjacent to the B7078. Other Core Paths along the B7078 include CL/3463/4, CL/3462/2, CL/3463/3 and CL/3463/2. This route also forms part of the National Cycle Network Route (NCR) Number 74.

9.4.20 Wider Network paths CL/5115/1 and CL/5112/1 which are located within the Site boundary.

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[10] southlanarkshire.maps.arcgis.com/apps and shown in Table 6 Core Path Network in the vicinity of the Site in Appendix 9.1 Transport Assessment

9.4.21 South of Abington along the M74, Core Paths CL/3495/1, CL/5960/2, CL/3496/1, CL/3497/1, CL/3499/4, CL/3499/6, CL/3503/1, CL/3504/2, CL/3505/1, and CL/5957/2 sit within the study area on segregated paths alongside the M74.

9.4.22 NCR 74 is designated as a traffic-free route along the western side of the B7078 in the vicinity of the Site access. NCR 74 is a mixture of on-road and traffic-free path which connects Strathclyde Country Park and NCR 75, north of Hamilton.

Future Baseline

9.4.23 Construction of the Proposed Development is expected to commence in Q2 of 2027 if consent is granted and it is expected to take up to 18 months, depending on weather conditions and ecological considerations.

9.4.24 To assess the likely effects during construction and typical operational phase, base year traffic flows were determined by applying a National Road Traffic Forecast (NRTF) low growth to the obtained traffic flows. The NRTF low growth factor for 2024 to 2028 is 1.0289.

9.4.25 The 24-hour two-way average traffic flows for each of the traffic count locations are presented in Table 9.5 These have been used in the Construction Peak Traffic Impact Assessment.

Table 9.5: 24-Hour Two-Way Average Traffic Data (2028)

Site ID	Survey Location	Cars & LGV	HGV	Total
1	B7078, between M74 Junction 13 and A70	608	307	916
2	A70, between B7078 junction and Junction 12 of the M74	3,653	1,126	4,780
3	A70, between M74 Junction 12 and Rigside	3,530	808	4,339
4	M74, between junction 11 and junction 12	24,283	9,634	33,916
5	A70, West of Douglas	1,746	299	2,045
6	A702, between M74 Junction 13 and A73 / A702 Roundabout	5,982	852	6,834
7	M74, between junction 12 and junction 13	24,366	11,457	35,823
8	M74, between junction 13 and junction 14	26,503	12,333	38,836

Please note minor variances due to rounding may occur

Summary of Sensitive Receptors

9.4.26 A review of sensitive receptors has been undertaken within the study area. Table 9.6 details the receptors and their sensitivities for use within the following assessment. A justification for the sensitivity has also been provided, based upon the details contained in Table 9.1.

Table 9.6: Summary of Receptor Sensitivity

Receptor	Sensitivity	Justification
B7078 Users	Medium	This road is a local A or B class road, capable of regular use by HGV traffic.
B7078 Residents	Negligible	This location includes individual dwellings or scattered settlements with no facilities.
A70 Users	Low	This road is Trunk or A-class, constructed to accommodate significant HGV composition.
Douglas Residents	Medium	Douglas is an intermediate sized rural settlement, containing some community or public facilities and services.
A70 Residents (west of M74)	Low	This location includes individual dwellings or scattered settlements with no facilities.

Table 9.6: Summary of Receptor Sensitivity		
Receptor	**Sensitivity**	**Justification**
A70 Residents (east of M74)	Low	This location includes individual dwellings or scattered settlements with no facilities.
Rigside Residents	Medium	Rigside is an intermediate sized rural settlement, containing some community or public facilities and services.
M74 Users	Negligible	The M74 has no adjacent settlements.
A702(T) Users	Low	The road is Trunk or A-class, constructed to accommodate significant HGV composition.
Core Path / Path Users	High	Minor path used by walkers and cyclists, not constructed to accommodate HGV traffic flows.

9.4.27 Based on the indicators which are stated within the IEMA Guidelines, the town of Douglas, the settlement at Rigside and Core Paths / Right of Ways are identified as sensitive receptors in this assessment. These locations will therefore be subject to 'Rule 2' of the IEMA Guidelines which requires a full assessment of effects if the traffic count locations are anticipated to be subject to an increase in 10% of total traffic.

9.4.28 All other locations within the study area are subject to 'Rule 1' and are assessed if traffic flows (or HGV flows) on highway links are anticipated to increase by more than 30% as a result of the construction of the Proposed Development.

Modifying Influences

9.4.29 If the Proposed Development did not proceed, traffic growth will occur and the links within the study network will experience increased traffic flows resulting from other development pressures, tourism traffic and population flows.

9.4.30 The climate change projections in the west of Scotland, in the 2060s (which is when the operational period of the Proposed Development is likely to end) highlight that summer and winter temperatures are likely to be greater than the current baseline (greater for summer), with winter rainfall increasing and summer rainfall decreasing.

9.4.31 It is considered that climate change projections will not have a discernible impact on the baseline conditions for road traffic within the timescales of the Proposed Development.

9.4.32 It is assumed that, at the regional level, appropriate measures will be put in place to ensure flood risk is managed and does not have long term effects on transport infrastructure.

9.5 Impact Assessment

Potential Construction Effects

9.5.1 During the 18-month construction period, the following traffic will require access to the Site:

- Staff transport, in either cars or minibuses;
- Construction equipment and materials, deliveries of machinery and supplies such as concrete and crushed rock as well as battery components; and
- Abnormal loads comprising wind turbine sections, substation, and also heavy lift crane(s).

9.5.2 Average monthly traffic flow data were used to establish the construction trips associated with the Site based on the assumptions detailed in the following sections.

9.5.3 The distribution of Proposed Development traffic on the network will vary depending on the types of loads being transported. The assumptions for the distribution of construction traffic during the peak months would be as follows:

- All HGV construction traffic will enter the Site through the appropriate access junctions along the B7078, B740 and A702. It should be noted that only AIL delivery vehicles will be permitted to use the newly constructed access junction along the M74 leading to the eastern side of the Site. ;
- Deliveries associated with stone materials for tracks and hardstandings are expected to be delivered from the quarries off the B7078 or from further afield via the M74;
- Deliveries associated with the batching of concrete on Site will arrive from the north via the M74. Sand and aggregate materials for use in the on-site batching plant will be sourced from local quarries. As a worst-case assessment, it is assumed that all material will be sourced from a concrete plant to the north of the Site via the M74 and access the Site from the B7078 and B740. The Balance of Plant (BoP) contractor will confirm final quarry and material sourcing with South Lanarkshire Council in the Construction Traffic Management Plan (CTMP);
- HGV deliveries associated with the substation electrical installation, control buildings, batteries, inverters, etc will arrive from the north via the M74 and B7078 route;
- Staff working at the Site are likely to be based locally. It is assumed that 40% of staff will arrive from Douglas, 20% from locations accessing the Site via the A70, 20% from the north via the M74, and 20% from the southeast (10% from the M74 and 10% from the A702); and
- General Site deliveries will arrive from the north via the M74 and B7078 to Site. These are generally smaller rigid HGV vehicles.

9.5.4 Loads relating to the turbine components would be delivered from the proposed Port of Entry (PoE) at King George V (KGV) Docks on the Clyde. The port is the closest, suitable port to Site and as such is in line with the Government's "Water Preferred" policy towards AIL movements.

9.5.5 All abnormal loads will be unloaded at King George V Docks (KGV) in Glasgow and will join the M8 at Junction 25a. Loads will then proceed under the A8 before joining the M8 and proceeding eastbound. Loads will then transfer onto the M74 and will continue southbound towards the general study area.

9.5.6 Turbine components for the development area to the north of the M74 will use a temporary access that is to be constructed as part of the Proposed Development. This access will be controlled and only used for AIL access and will be removed following deliveries. It is recommended that a detailed transport management plan for the operation of the temporary access be secured via planning condition and agreed with Transport Scotland and Police Scotland. Agreement in principle has been secured for the junction.

9.5.7 All other AIL loads will access via the B7078 and B740, having departed the M74 at Junction 13.

9.5.8 Based on the indicative construction traffic profile outlined in Technical Appendix 9.1[11], Month 10 is likely to be the peak period for the construction phase. This corresponds with deliveries of aggregate material for tracks and hardstandings, concrete material deliveries, turbine deliveries and general Site deliveries and staff. The activities are anticipated to generate an

[11] Volume 4: Technical Appendix 9.1 Transport Assessment, Table 10 Construction Traffic Profile

additional 263 total movements which comprises an average of 175 HGV movements per day (87 inbound trips and 87 outbound trips) and 88 Cars & Lights movements per day (44 inbound trips and 44 outbound trips).

9.5.9 The traffic impact assessment focuses on the peak period traffic flows to illustrate the potential effects on the study network.

9.5.10 Using the distribution of traffic described in Technical Appendix 9.1, the proposed traffic flows on the study area network at the peak of construction are presented in Table 9.7.

Table 9.7: Peak Construction Month Daily Traffic Data (Month 10)

Site ID	Survey Location	Cars & LGV	HGV	Total
1	B7078, between M74 Junction 13 and A70	70	155	226
2	A70, between B7078 junction and Junction 12 of the M74	18	0	18
3	A70, between M74 Junction 12 and Rigside	18	0	18
4	M74, between junction 11 and junction 12	18	19	37
5	A70, West of Douglas	35	0	35
6	A702, between M74 Junction 13 and A73 / A702 Roundabout	9	0	9
7	M74, between junction 12 and junction 13	18	19	37
8	M74, between junction 13 and junction 14	9	0	9

Please note minor variances due to rounding may occur

9.5.11 The peak month traffic data was combined with the future year (2028) traffic data to allow a comparison between the baseline results to be made. The increase in traffic volumes is presented below as predicted flows and in percentage increases for each class of vehicle in Table 9.8

Table 9.8: Peak Construction Month Daily Traffic Data (Month 10)

Site ID	Survey Location	Cars & LGVs	HGVs	Total	Cars / LGVs % Increase	HGV % Increase	Total % Increase
1	B7078, between M74 Junction 13 and A70	679	463	1,142	11.57%	50.57%	24.66%
2	A70, between B7078 junction and Junction 12 of the M74	3,671	1,126	4,797	0.48%	0.00%	0.37%
3	A70, between M74 Junction 12 and Rigside	3,548	808	4,356	0.50%	0.00%	0.41%
4	M74, between junction 11 and junction 12	24,300	9,653	33,953	0.07%	0.20%	0.11%
5	A70, West of Douglas	1,781	299	2,080	2.02%	0.00%	1.72%
6	A702, between M74 Junction 13 and A73 / A702 Roundabout	5,991	852	6,843	0.15%	0.00%	0.13%
7	M74, between junction 12 and junction 13	24,384	11,476	35,860	0.07%	0.17%	0.10%
8	M74, between junction 13 and junction 14	26,512	12,333	38,844	0.03%	0.00%	0.02%

9.5.12 The total traffic movements are not predicted to increase by more than 30% overall on all of the study network. The percentage increase in HGVs is however above 30% on the B7078, where it reaches 51%.

9.5.13 The total increase in traffic levels in all locations outwith the B7078 are below 10%.

9.5.14 It should be noted that the construction phase is transitory in nature and the peak of construction activities is short-lived.

9.5.15 A review of existing road capacity has been undertaken using the DMRB, Volume 15, Part 5 “The NESA Manual”. The theoretical road capacity has been estimated for each of the road links that makes up the study area and the assessment is presented in Technical Appendix 9.1. The assessment clearly indicates that there are no road capacity issues associated with the Proposed Development as spare network capacity ranges between 64% and 96% within the study area.

9.5.16 With regards to Rule 1 of the IEMA Guidelines (see Table 9.1), the impact will exceed 30% increases in HGV flows on the B7078, near the Site Access. As such, the receptors of the B7078 (Users and Residents) will be taken forward for further assessment.

9.5.17 While traffic information is not available for the Wider Network path routes within the Site, it is assumed that traffic would increase by 100% on these routes and as a worst case, this (including Core Path / Wider Path Users) will be assessed on that basis. For the purpose of this assessment it is also assumed that the impact of construction traffic experienced on the B740 will be equal to the impact on the B7078.

9.5.18 A further assessment is undertaken and the summary of construction phase effects prior to the application of mitigation measures is presented in Table 9.9.

Table 9.9: Construction Phase Effects Summary

Receptors	Potential Effect	Magnitude of Change	Significance of Effect	Comment
B7078 / B740 Users	Severance	Minor	Minor (Not Significant)	Increase in total traffic is anticipated to be 24.66%. Changes in flows less than 30% are considered minor.
	Driver Delay	Minor	Minor (Not Significant)	There is ample spare capacity along the existing link road, therefore the effect of driver delay is considered minor.
	Pedestrian Delay	Minor	Minor (Not Significant)	The total number of additional constructior vehicles expected on this link is 226 vehicl which equates to approximately 19 vehicle per hour, which equates to less than one vehicle every two minutes. The effect is therefore considered minor.
	Non-motorise User Amenity	Moderate	Moderate (Significant)	Existing baseline HGV flows equate to 307 HGVs and the Proposed Development will s an additional 155 HGVs daily during peak construction activities. This will result in th baseline of approximately 26 HGVs per hou increasing to approximately 39 HGVs per hour during peak construction activities. Th effect on NMU amenity is therefore considered moderate.
	Fear & Intimidation	Minor	Minor (Significant)	Increase in total traffic is anticipated to be 24.66%. Changes in flows less than 30% a considered moderate.
	Road Safety	Minor	Minor (Not Significant)	From the accident review, only one accider along the B7078 in the vicinity of the Site access has been recorded in the previous 5 years’ worth of available data. The effects therefore considered minor.

Table 9.9: Construction Phase Effects Summary				
Receptors	**Potential Effect**	**Magnitude of Change**	**Significance of Effect**	**Comment**
B7078 Residents	Severance	Minor	Minor (Not Significant)	Increase in total traffic is anticipated to be 24.66%. Changes in flows less than 30% are considered minor.
	Driver Delay	Minor	Minor (Not Significant)	There is ample spare capacity along the existing link road, therefore the effect of driver delay is considered minor.
	Pedestrian Delay	Minor	Minor (Not Significant)	The total number of additional constructior vehicles expected on this link is 226 vehicle which equates to approximately 19 vehicle per hour, which equates to less than one vehicle every two minutes. The effect is therefore considered minor.
	Non-motorise User Amenity	Minor	Minor (Not Significant)	Baseline HGV flows equate to 307 HGVs ar the Proposed Development will see an additional 155 HGVs daily during peak construction activities. This will result in th baseline of approximately 26 HGVs per hou increasing to approximately 39 HGVs per hour during peak construction activities. Th effect on pedestrian amenity is therefore considered minor.
	Fear & Intimidation	Minor	Minor (Not Significant)	Increase in total traffic is anticipated to be 24.66%. Changes in flows less than 30% a considered minor.
	Road Safety	Minor	Minor (Not Significant)	From the accident review, only one accider along the B7078 in the vicinity of the Site access has been recorded in the previous 5 years' worth of available data. The effects therefore considered minor
Core Path / Wider Path Users	Severance	Major	Major (Significant)	The presence of construction traffic within the Site where there was previously no traffic could lead to a severance of some of the path network. The effect is therefore considered to be major.
	Driver Delay	Negligible	Negligible (Not Significant)	Not applicable
	Pedestrian Delay	Moderate	Major / Modera (Significant)	Pedestrians could experience delays if their movements interact with construction traff along the Right of Way network which wou not be experienced prior to the constructio period. The impact is therefore considered moderate.
	Non-motorise User Amenity	Major	Major (Significant)	The presence of traffic flows along a locatic where there would have been no/low traffi prior to the construction phase would affec the amenity of the path network for users. Likewise regarding the increase in traffic along the Core Path Network along the B7078.
	Fear & Intimidation	Major	Major (Significant)	The presence of traffic flows along a locatic where there would have been no traffic pri to the construction phase, could cause fear and intimidation of the path network for users.
	Road Safety	Moderate	Major / Modera (Significant)	There is potential to impact the safety of th Rights of Way users interacting with

Table 9.9: Construction Phase Effects Summary				
Receptors	Potential Effect	Magnitude of Change	Significance of Effect	Comment
				construction delivery vehicles. It is anticipated that site specific speed limits w be adhered to within the Site boundary. Th impact is therefore considered moderate.

9.5.19 The assessment of significance suggests that total traffic flows along B7078 during the peak construction works are considered to result in significant adverse effects, prior to the application of mitigation measures.

9.5.20 It is worth noting that while it is anticipated that the increased total flow along the B7078 will be statistically high, in relative traffic number terms, the number of additional vehicles is considered low.

9.5.21 The assessment of significance carried out in Table 9.13 indicates that traffic flows interacting with the Core Path / Wider Path network are considered to result in significant adverse effects, prior to the application of mitigation measures.

9.5.22 It is also noted that the effects relate solely to the peak of construction activities (Month 10), and that the construction period is short lived and the effects transitory in nature.

Potential Operational Effects

9.5.23 It is predicted that during the operation of the Site there would be up to two vehicle movements per fortnight for maintenance purposes. There may be occasional abnormal load movements to deliver replacement components in the unlikely event of a major failure. Any abnormal load deliveries would be undertaken subject to consultation and agreement with the appropriate contacts at SLC and Transport Scotland (TS).

9.5.24 Given the low level of traffic generation associated with the operational phase, no further assessment has been undertaken.

Potential Decommissioning Effects

9.5.25 When the Proposed Development is decommissioned, it is likely that elements of the Site such as access tracks will be retained. As such, the traffic generated by future decommissioning works would be less than that associated with the construction phase and have been scoped out.

Potential Cumulative Construction Effects

9.5.26 A review of the consented significant developments which have been considered as cumulative developments are presented in Appendix 9.1.

9.5.27 As noted in Technical Appendix 9.1, there are three other onshore wind farm developments which have been granted planning consent and are anticipated to use part of the proposed construction and AIL delivery routes, within the Proposed Development’s study area, during their peak construction periods, which are:

- Kennoxhead Extension II Wind Farm;
- Priestgill Wind Farm; and
- Cumberhead Wind Farm.

9.5.28 While it is unlikely that all of these developments would be constructed concurrently and that their peak construction months would align, a combined sensitivity review has been undertaken to inform the relevant planning authorities of possible issues if all four of the sites were to be constructed concurrently.

9.5.29 The peak flows for the sites were obtained from their respective planning application documents (see Table 9.10) and then compared to the 2028 future baseline year in Table 9.11.

Table 9.10: Cumulative Development Traffic											
Site ID	**Survey Location**	**Kennoxhead Extension II Wind Farm**		**Priestgill Wind Farm**		**Cumberhead Wind Farm**		**M74 West Wind Farm**		**Total**	
		Cars & LGV	**HGV**	**Cars & LGV**	**HGV**	**Cars & LGV**	**HGV**	**Cars & LGV**	**HGV**	**Cars & LGV**	**HGV**
1	B7078, between M74 Junction 13 and A70	60	138	0	0	0	0	70	155	130	293
2	A70, between B7078 junction and Junction 12 of the M74	0	0	0	0	0	0	18	0	18	0
3	A70, between M74 Junction 12 and Rigside	60	28	0	0	0	0	18	0	78	28
4	M74, between junction 11 and junction 12	0	0	0	0	80	126	18	19	98	145
5	A70, West of Douglas	0	0	0	0	0	0	35	0	35	0
6	A702, between M74 Junction 13 and A73 / A702 Roundabout	0	0	48	148	0	0	9	0	57	148
7	M74, between junction 12 and junction 13	0	0	0	0	0	0	18	19	18	19
8	M74, between junction 13 and junction 14	0	0	0	0	0	0	9	0	9	0

Table 9.11: Combined Scheme Sensitivity Impact (2028)							
Site ID	**Survey Location**	**Cars & LGV**	**HGV**	**Total**	**Cars / LGV % Increase**	**HGV % Increase**	**Total % Increase**
1	B7078, between M74 Junction 13 and A70	130	293	424	21.43%	95.46%	46.28%
2	A70, between B7078 junction and Junction 12 of the M74	18	0	18	0.48%	0.00%	0.37%
3	A70, between M74 Junction 12 and Rigside	78	28	106	2.20%	3.46%	2.43%
4	M74, between junction 11 and junction 12	98	145	243	0.40%	1.51%	0.72%
5	A70, West of Douglas	35	0	35	2.02%	0.00%	1.72%
6	A702, between M74 Junction 13 and A73 / A702 Roundabout	57	148	205	0.95%	17.37%	3.00%
7	M74, between junction 12 and junction 13	18	19	37	0.07%	0.17%	0.10%
8	M74, between junction 13 and junction 14	9	0	9	0.03%	0.00%	0.02%

9.5.30 The combined traffic flows indicates that there is an increase in traffic flows on roads within the study area within a 12 hour period, however, these roads would have more than sufficient spare road capacity to accommodate this in the event of the four sites being constructed at the same time, as shown in Table 9.12.

Table 9.12: 2028 Daily Traffic Data – Cumulative Development (12 hour)					
Site ID	**Survey Location**	**2028 Baseline Traffic**	**2028 Baseline + Cumulative Development Traffic + Development Flows**	**Theoretical Capacity**	**Spare Road Capacity %**
1	B7078, between M74 Junction 13 and A70	916	1,340	28,800	95%
2	A70, between B7078 junction and Junction 12 of the M74	4,780	4,797	28,800	83%
3	A70, between M74 Junction 12 and Rigside	4,339	4,444	21,600	79%
4	M74, between junction 11 and junction 12	33,916	34,159	91,200	63%
5	A70, West of Douglas	2,045	2,080	21,600	90%
6	A702, between M74 Junction 13 and A73 / A702 Roundabout	6,834	7,039	28,800	76%
7	M74, between junction 12 and junction 13	35,823	35,860	136,800	74%
8	M74, between junction 13 and junction 14	38,836	38,844	136,800	72%

9.5.31 Any effects of all four sites being constructed at the same time could be mitigated through the use of an overarching Traffic Management and Monitoring Plan for all four sites and by introducing a phased delivery plan which would be agreed with SLC and Police Scotland.

9.5.32 It should be noted that it is extremely unlikely that the potential traffic flow increases could occur within the study area for the following reasons:

- It is extremely unlikely that the peak traffic conditions would occur at the same time due to differences in construction programmes, material supplies and developer resources;
- All abnormal load deliveries cannot occur at four separate sites on the same day due to restrictions on the numbers of loads moving on the network at the same time set by Police Scotland.

Potential Cumulative Operational Effects

9.5.33 No potential significant cumulative operational effects are predicted as part of the Proposed Development and this topic has been scoped out of the assessment.

9.6 Mitigation and Monitoring

Mitigation and Monitoring during Construction

9.6.1 During the construction period, a project website, blog or web-based communication tools which may include social media will be regularly updated to provide the latest information relating to traffic movements associated with vehicles accessing the Site. This will be agreed with SLC and TS.

9.6.2 The following measures will be implemented during the construction phase through the CTMP and would be secured by means of a suitably worded planning condition:

- Agree AIL route modifications and improvements with SLC, TS and other relevant stakeholders.
- Where possible the detailed design process following site investigations will minimise the volume of material to be imported to Site to help reduce HGV numbers.
- A Site worker transport and travel arrangement plan, including transport modes to and from the worksite (including pick up and drop off times).
- An AIL Transport Management Plan;
- All materials delivery lorries (dry materials) should be sheeted to reduce dust and stop spillage on public roads.
- Specific training and disciplinary measures should be established to ensure the highest standards are maintained to prevent construction vehicles from carrying mud and debris onto the carriageway.
- Wheel cleaning facilities may be established at the Site entrance, depending upon the views of SLC.
- Unless otherwise agreed with SLC, normal Site working hours will be limited to between 0700 and 1900 (Monday to Friday) and 0700 and 1300 (Saturday), with no working on Sundays or public holidays. Activities outside of normal working hours, such as component delivery and turbine erection, would be discussed and agreed with SLC.
- Appropriate traffic management measures will be put in place along the Site access roads to avoid conflict with general traffic, subject to the agreement of the roads authority. Typical measures will include HGV turning and crossing signs and banksman where necessary.
- Provide construction updates on the project website and or a newsletter to be distributed to residents within an agreed distance of the Site.
- Adoption of a voluntary speed limit of 15 miles per hour (mph) for all construction vehicles along the B7078.

- All drivers will be required to attend an induction to include:
  - A tool box talk safety briefing;
  - The need for appropriate care and speed control;
  - A briefing on driver speed reduction agreements (to slow Site traffic at sensitive locations); and
  - Identification of the required access routes and the controls to ensure no departure from these routes.

9.6.3 Before the AILs traverse the route, the following tasks will be undertaken to ensure load and road user safety:

- Ensure any vegetation which may foul the loads is trimmed back to allow passage;
- Confirm there are no roadworks or closures that could affect the passage of the loads;
- Check no new or diverted underground services on the proposed route are at risk from the abnormal loads; and
- Confirm the police are satisfied with the proposed movement strategy.

9.6.4 SLC may require an agreement to cover the cost of abnormal wear and tear on the B7078 and A70.

9.6.5 Video footage of the pre-construction phase condition of the abnormal loads access route and the construction vehicles route will be recorded to provide a baseline of the state of the road prior to any construction work commencing. This baseline will inform any change in the road condition during the construction stage of the Proposed Development. Any necessary repairs will be coordinated with the Roads Authority. Any damage caused by traffic associated with the Proposed Development, during the construction period that would be hazardous to public traffic, will be repaired immediately.

9.6.6 Any damage to road infrastructure caused directly by construction traffic will be made good, and street furniture that is removed on a temporary basis will be fully reinstated.

9.6.7 There will be a regular road edge review and any debris and mud will be removed from the public carriageway to keep the road clean and safe during the initial months of construction activity, until the construction junction and immediate access track works are complete. The exact requirements of this, including the proposed schedule would be agreed in full with SLC.

Abnormal Load Transport Management Plan

9.6.8 An Abnormal Load Transport Management Plan will be prepared to cater for all movements to and from the Proposed Development. This will include:

- Procedures for liaising with the emergency services to ensure that police, fire, and ambulance vehicles are not impeded by the loads. This is normally undertaken by informing the emergency services of delivery times and dates and agreeing communication protocols and lay over areas to allow overtaking.
- A diary of proposed delivery movements to liaise with local communities to avoid key dates such as popular local events etc.
- A protocol for working with local businesses to ensure the construction traffic does not interfere with deliveries or normal business traffic.
- Proposals to establish a construction liaison committee to ensure the smooth management of the Proposed Development / public interface with the Applicant, the Contractor, the local community, and if appropriate, the police forming the committee.

This committee will form a means of communicating and updating on forthcoming activities and dealing with any potential issues arising.

Onsite Measures Delivered Using an Access Management Plan

9.6.9 Within the Site, consideration has been given to pedestrians and cyclists alike due to potential interactions between construction traffic and users of the Core Paths and the Wider Network. These measures will be formulated into an Access Management Plan.

9.6.10 Where feasible, users of the Core Paths and the Wider Network paths will be separated from construction traffic using barriers. Crossing points will be provided where required, with path users having right of way. Appropriate Traffic Signs Manual, Chapter 8 compliant temporary road signage will be provided to assist at these crossing for the benefit of all users.

9.6.11 The Principal Contractor will ensure that speed limits are always adhered to by their drivers and associated subcontractors. This is particularly important within close proximity to the paths and at crossing points. Advisory speed limit signage will also be installed on approaches to areas where path users may interact with construction traffic.

9.6.12 Signage will be installed on the Site exit that makes drivers aware of local speed limits and reminding drivers of the potential presence of pedestrians and cyclists in the area. This will also be emphasised in the weekly tool box talks.

9.6.13 The British Horse Society (BHS) has made recommendations on the interactions between HGV traffic and horses. Horses are normally nervous of large vehicles, particularly when they do not often meet them. Horses are flight animals and will run away in panic if really frightened. Riders will do all they can to prevent this but, should it happen, it could cause a serious accident for other road users, as well as for the horse and rider.

9.6.14 The main factors causing fear in horses in this situation are:

- Something approaching them, which is unfamiliar and intimidating;
- A large moving object, especially if it is noisy;
- Lack of space between the horse and the vehicle;
- The sound of air brakes; and
- Anxiety on the part of the rider.

9.6.15 The BHS recommends the following actions that will be included in the Site training for all HGV staff:

- On seeing riders approaching, drivers must slow down and stop, minimising the sound of air brakes, if possible.
- If the horse still shows signs of nervousness while approaching the vehicle, the engine should be shut down (if it is safe to do so).
- The vehicle should not move off until the riders are well clear of the back of the HGV.
- If drivers are wishing to overtake riders, please approach slowly or even stop in order to give riders time to find a gateway or lay by where they can take refuge and create sufficient space between the horse and the vehicle. Because of the position of their eyes, horses are very aware of things coming up behind them.
- All drivers delivering to the Site must be patient. Riders will be doing their best to reassure their horses while often feeling a high degree of anxiety themselves.

Mitigation and Monitoring during Operation

9.6.16 The Site entrances will be well maintained and monitored during the operational life of the Proposed Development. Regular maintenance will be undertaken to keep the Site access track drainage systems fully operational and the road surface in good condition and to ensure there are no adverse issues affecting the public road network.

Mitigation and Monitoring during Decommissioning

9.6.17 It is proposed that a decommissioning phase Traffic Management Plan will be agreed with SLC and Transport Scotland prior to decommissioning and will form a planning condition.

9.7 Assessment of Residual Effects

Residual Construction Effects

9.7.1 An evaluation of the potential effects of the increase in traffic on the study area roads used for construction traffic has been considered. The summary of this assessment is provided in Table 9.13.

9.7.2 The assessment confirms the significance of residual effects would be Minor in nature and therefore Not Significant. The traffic effects are transitory in nature. No long-lasting detrimental transport or access issues are associated with the construction phase of the Proposed Development.

Residual Operational Effects

9.7.3 There are no significant residual effects associated with the operational phase of the Proposed Development.

Residual Decommissioning Effects

9.7.4 There are no residual effects associated with the decommissioning phase of the Proposed Development.

9.8 Summary

9.8.1 The Proposed Development would lead to a temporary increase in traffic volumes on the study area during the construction phase. Traffic volumes would fall considerably outside the peak period of construction.

9.8.2 The maximum traffic impact associated with construction is predicted to occur in Month 10 of the indicative construction programme.

9.8.3 The traffic associated with the Proposed Development, at the peak of construction, would result in an additional 263 total movements which comprises an average of 175 HGV movements per day (87 inbound and 87 outbound) and 88 Cars & Lights (44 inbound and 44 outbound).

9.8.4 The greatest impact would occur along the B7078 and the Core Path network.

9.8.5 A sensitivity review was undertaken to inform the planning authorities of possible issues if consented schemes in the area, whose construction traffic would impact the study area, were constructed concurrently. The review found that there would be more than sufficient spare road capacity to accommodate all schemes being constructed at the same time. It is proposed that any effects of all the sites being constructed at the same time would be mitigated through the use of an overarching Traffic Management and Monitoring Plan which would be agreed with SLC and Police Scotland.

9.8.6 With the implementation of appropriate mitigation, no significant residual effects are anticipated in respect of traffic and transport issues. The residual effects are all assessed to be minor or negligible. Furthermore, as they will occur during the construction phase only, they are temporary and reversible.

Table 9. 13: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome /Residual Effect
Construction			
Severance	CTMP proposals	Via a condition of consent. CTMP to be agreed with SLC prior to construction activities commencing.	Not Significant
Driver delay	CTMP Proposals and improved signage	Via a condition of consent. CTMP to be agreed with SLC prior to construction activities commencing.	Not Significant
Pedestrian delay	CTMP and AMP proposals	Via a condition of consent. CTMP and AMP to be agreed with SLC prior to construction activities commencing.	Not Significant
Pedestrian amenity	CTMP and AMP proposals	Via a condition of consent. CTMP and AMP to be agreed with SLC prior to construction activities commencing.	Not Significant
Fear and intimidation	CTMP and AMP proposals	Via a condition of consent. CTMP and AMP to be agreed with SLC prior to construction activities commencing.	Not Significant
Accidents and safety	CTMP and AMP proposals	CTMP Proposals, improved signage and develop signage strategy and agree works with TS and SLC. Access junctions to be designed in accordance with SLC guidelines.	Not Significant
Operation			
None	None	None	None
Decommissioning			
None	None	None	None

10 Noise and Vibration

10.1 Executive Summary

10.1.1 A noise assessment was undertaken to determine the likely significant noise effects from the operational and construction phases of the Proposed Development, at nearby noise sensitive receptors.

10.1.2 Construction noise activities associated with the Proposed Development were assessed in accordance with guidance and acceptable threshold noise values presented within BS 5228. Predicted noise levels from construction activities were found to be below the appropriate threshold value at all receptors and therefore no significant effects are anticipated.

10.1.3 The operational wind farm noise assessment involved setting the Total ETSU-R-97 Noise Limits (which are limits for noise from all wind farms in the area) relative to background noise levels at the nearest noise sensitive receptors, predicting the likely effects (undertaking a cumulative noise assessment where required) and setting Site Specific Noise Limits which could be conditioned for the operation of the Proposed Development on its own.

10.1.4 Background noise monitoring was undertaken at five locations at properties close to the Proposed Development. The background noise data measured has been used to set the Total ETSU-R-97 Noise Limits for the Proposed Development at a number of noise assessment locations which are representative of the surrounding noise sensitive receptors.

10.1.5 Predictions of wind turbine noise from the Proposed Development were made in accordance with good practice using a candidate wind turbine, the Siemens SG 6.6-155 6.6 MW with a hub height of 122.5 m. Predicted cumulative operational wind farm noise levels indicate that for noise sensitive receptors neighbouring the Proposed Development, cumulative wind turbine noise resulting from nearby operational, consented and proposed wind farms (planning application submitted), as well as the Proposed Development, would meet the Total ETSU-R-97 Noise Limits.

10.1.6 The Total ETSU-R-97 Noise Limit is applicable to all operational, consented and proposed wind farms (planning application submitted) in the area so Site Specific Noise Limits have also been derived to inform conditioning of the noise levels from the Proposed Development on its own. Predicted operational noise levels from the Proposed Development on its own indicate that it would meet the Site Specific Noise Limits at all nearby noise sensitive receptors and the effects are therefore deemed to be not significant. In order to meet the Site Specific Noise Limits at NAL9 Red Moss Hotel, mitigation would be required based on current candidate turbine for certain wind speeds and wind directions.

10.1.7 The use of Site Specific Noise Limits would ensure that the Proposed Development could operate concurrently with other operational, consented and proposed wind farm developments in the area and would also ensure that the Proposed Development's individual contribution could be measured and enforced if required.

10.1.8 The wind turbine model for the Proposed Development was chosen in order to allow a representative assessment of the noise impacts. Should the Proposed Development receive consent, the final choice of wind turbine would be subject to a competitive tendering process. The final choice of wind turbine would, however, meet the Site Specific Noise Limits presented in the noise assessment and contained in any operational noise condition.

10.1.9 Operational noise from the co-located Battery Energy Storage System (BESS), substation and solar array (which forms part of the Proposed Development as a whole) was also assessed. Predicted levels were assessed in accordance with the guiding principles set out in BS 4142 and the guideline internal noise levels presented in BS 8233. Assessment of predicted noise levels from the BESS, substation and solar array against both sets of standards resulted in no significant effects

10.2 Introduction

10.2.1 This chapter considers the likely significant effects with respect to the noise associated with the construction and operation of the Proposed Development. The specific objectives of the chapter are to:

- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the baseline following a noise survey which measured existing background noise levels;
- describe the potential effects (including cumulative effects);
- describe the mitigation measures proposed to address likely significant effects (if required); and
- assess the residual effects remaining following the implementation of mitigation (if required).

10.2.2 The assessments has been carried out by Tom Suddaby of TNEI Services Ltd. The assessments have been reviewed by Gemma Clark (operational noise) and Jim Singleton (construction noise and BESS, substation and solar array noise) of TNEI Services Ltd. Gemma is a Principal Consultant and full member of the Institute of Acoustics and has over 17 years of experience in undertaking noise assessments for wind farm developments. Jim is a Specialist Consultant who has over 16 years experience in undertaking a wide variety of noise assessments. Jim holds the Diploma in Acoustics and Noise Control and is a full member of the Institute of Acoustics (see Technical Appendix 1.2: Technical Team (EIAR Volume 4)).

10.2.3 This chapter is supported by the following figures and technical appendices:

- Volume 3a: Figures
  - Figure 10.1: Construction Noise Assessment Locations
  - Figure 10.2: Operational Noise Assessment and Noise Monitoring Locations
  - Figure 10.3: Cumulative Wind Turbine Locations
  - Figure 10.4: BESS, Substation and Solar Array Noise Assessment Locations
- Volume 4: Technical Appendices
  - Technical Appendix 10.1: Construction Noise Report; and
  - Technical Appendix 10.2: ETSU-R-97 Operational Noise Report; and
  - Technical Appendix 10.3: Battery Energy Storage System, Substation and Solar Array Operational Noise Report

10.2.4 Figures and technical appendices are referenced in the text where relevant.

10.3 Assessment Methodology and Significance Criteria

Scope of Assessment

10.3.1 Wind farms have the potential to create noise during their construction and operational phases. This chapter assesses the potential noise impacts at the nearest noise sensitive receptors (NSRs) during each of the project phases. The assessment is based on the Proposed Development as described in Chapter 2: Development Description (EIAR Volume 2).

10.3.2 The scope of the assessment has been informed by the following guidelines/policies:

- National Planning Framework 4, (Scottish Government, 2023)[1];
- The Onshore Wind Policy Statement, (The Scottish Government 2022)[2];
- Planning Advice Note (PAN) 1/2011: 'Planning and Noise' (Scottish Government, 2011)[3];
- Web Based Renewables Advice: 'Onshore Wind Turbines' (Scottish Government, 2014)[4];
- BS 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open developments - Noise'[5];
- ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' (Noise Working Group (NWG), 1996)[6];
- ISO 9613-2: 1996 'Acoustics - Attenuation of sound during propagation outdoors Part 2: General method of calculation'[7];
- Institute of Acoustics (IOA) 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG, 2013)[8];
- British Standard BS 4142:2014+A1:2019 'Methods for Rating and Assessing Industrial and Commercial Sound'[9]; and
- British Standard BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'[10].

10.3.3 Further information on the documents can be found in the sections below and they are discussed in detail within Section 2 of Technical Appendices 10.1 - 10.3 (EIAR Volume 4), where relevant.

Construction Noise Methodology

10.3.4 The construction noise assessment was undertaken using guidance contained in BS 5228: Part 1 2009+A1:2014 (BS 5228). The prediction of construction noise levels was undertaken using the calculation methodology presented in ISO 9613-2:1996, together with published noise data for appropriate construction plant. To undertake an assessment of the construction noise impact using relevant data from BS 5228, the following steps have been undertaken:

- identify the NSRs near potential construction activities and select representative Construction Noise Assessment Locations;
- identify the applicable threshold of significant effects from BS 5228;
- predict the noise levels for various construction noise activities;

1 Scottish Government (2023). National Planning Framework 4
2 Scottish Government (2022) The Onshore Wind Policy Statement
3 Scottish Government (2011). PAN 1/2011 Planning and Noise Scotland
4 Scottish Government (2014) Web Based Renewables Advice: 'Onshore Wind Turbines' [Online] Available From https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/ [Accessed 17 July 2024]
5 British Standard BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' – Part 1: Noise
6 The Working Group on Noise from Wind Turbines (1996). ETSU-R-97 The Assessment and Rating of Noise From Wind Farms. UK: Energy Technology Support Unit
7 International Standards Organisation, ISO9613: 1996 'Acoustics - Attenuation of sound during propagation outdoors' -Part 2: General method of calculation
8 IOA (2013). A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'. UK: Institute of Acoustics.
9 British Standard BS 4142:2014 + A1:2019 'Methods for Rating and Assessing Industrial and Commercial Sound'
10 British Standard BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'

- compare predicted noise levels against the applicable threshold;
- where necessary, develop suitable mitigation measures to minimise any significant adverse effects during the construction phase; and, if required
- assess any residual adverse effects taking into account any identified mitigation measures.

10.3.5 Construction of the Proposed Development would be undertaken in several successive phases. During each phase the plant and equipment, and the associated traffic, would influence the noise generated. The selection of plant and equipment to be used would be determined by the main contractor and detailed arrangements for on-site management would be decided at that time. This assessment has therefore been based upon a typical selection of plant for a project of this size and assesses a number of construction scenarios which have been chosen to represent the likely noisiest activities that would occur across the construction phases. For each scenario the plant has been modelled operating in the closest activity areas to each receptor for any given activity, whereas in reality plant will move around the site and for much of the time would be operating at more distant locations.

10.3.6 The core hours for construction activity are anticipated to be 07:00 - 19:00 Monday to Friday and 07:00 – 13:00 on Saturdays. The requirement for out-of-hours work could arise, for example, from delivery and unloading of abnormal loads or health and safety requirements, or to ensure optimal use is made of fair weather windows for the erection of turbine blades and the erection and dismantling of cranes. No scheduled construction is anticipated during the night-time, although, there may be a requirement for some plant to be operational during night-time, for example, a portable generator to provide lighting. A night-time scenario was therefore also considered within the construction noise assessment.

10.3.7 Chapter 2: Development Description (EIAR Volume 2) describes the outline tasks that will be undertaken during the construction period, which is estimated to last 18 months. For the purposes of this assessment noise modelling has been undertaken for a number of construction scenarios, which simulate the likely overlap of several tasks that would occur throughout the construction period:

- Scenario 01 (Month 1): Forestry felling. Construction of temporary construction compounds and junction construction off the B7078.
- Scenario 02 (Month 2): Forestry felling. Construction compounds are in operation. Access tracks to borrow pits are being established.
- Scenario 03 (Month 5): Construction compounds and borrow pits are in operation. Access tracks are being constructed to turbines 13, 14, 15, 16, 20, 21, and 22.
- Scenario 04 (Month 7): Construction compounds and borrow pits are in operation. Access tracks are being constructed to turbines 10, 11, 12, 17, 18, and 19. Turbine foundations and hardstandings are being created at turbines 20, 21, and 22.
- Scenario 05 (Month 8): Construction compounds and borrow pits are in operation. Access tracks are being constructed to turbines 3, 8 and 9. Turbine foundations and hardstandings are being created at turbines 10, 17 and 19. Construction of the substation and BESS is underway.
- Scenario 06 (Month 11): Construction compounds and borrow pits are in operation. Access tracks are being created to the solar array site. Turbine foundations and hardstandings are being created at turbine 16. The substation and BESS are still under construction.

- Scenario 07 (Month 13): Construction compounds and borrow pits are in operation. Turbines 17, 20, 21, and 22 and being erected. Construction of solar array is underway.
- Scenario 08 Night-time: No construction activities are occurring. Generators in construction compounds are operational.

10.3.8 The modelled scenarios represent the assumed 'noisiest' activities. Other construction activities not included in the noise models would occur, however, the noise output from these would be less than those considered above.

10.3.9 The noise-generating equipment assessed for each construction phase is detailed in **Technical Appendix 10.1: Construction Noise Report (EIAR Volume 4**). It is noted that for much of the working day the noise associated with construction activities would be less than predicted, as the assessment has assumed all equipment is constantly operating at full power, and is located at the closest point to each receptor, whereas in practice equipment load and precise location would vary.

10.3.10 To protect the amenity of local residents, construction noise activities would be controlled under the Control of Pollution Act 1974 (COPA) (HM Government, 1974)[11], which includes provisions on the control of noise pollution. In particular, Part III Section 60 of the COPA refers to the control of noise on construction sites. It provides that a Local Authority can serve a notice imposing requirements regarding the way in which works are to be carried out, including controlling noise from construction sites to prevent disturbance occurring. The COPA also includes provision that the Secretary of State may prepare codes of practice to give guidance on methods of minimising noise, and requires the Secretary of State to approve a code of practice for carrying out works to which section 60 applies. BS-5228 has been approved as a code of practice by the Secretary of State. (see **Technical Appendix 2.1: Outline CEMP (EIAR Volume 4**)).

Cumulative Construction Noise

10.3.11 There is the potential that construction activities could occur at the same time as the construction for the proposed Bodinglee Wind Farm and in this case it would be necessary to consider the cumulative impacts that could occur from cumulative construction noise. The first stage of the cumulative assessment would be to compare the predicted levels from the construction of the Proposed Development to the noise thresholds and establish the available margin. Where noise levels are predicted to be at least 10 dB below the threshold levels then no further assessment is required. This is because the influence of noise from the construction of the Proposed Development would be such that it could not increase the overall cumulative construction noise to above the threshold levels. If predicted levels are within 10 dB of the threshold levels then it is necessary to predict the cumulative noise levels from the construction of the neighbouring developments and compare this to the threshold level.

Operational Wind Farm Noise Methodology

10.3.12 In Scotland, The Onshore Wind Policy Statement 2022 web-based planning advice states:

''The Assessment and Rating of Noise from Wind Farms' (Final Report, Sept 1996, DTI), (ETSU-R-97) provides the framework for the measurement of wind turbine noise, and all applicants are required to follow the framework and use it to assess and rate noise from wind energy developments.'

[11] HM Government. Control of Pollution Act 1974.

10.3.13 The web-based document then refers to the Institute of *Acoustics 'A Good Practice Guide to the Application of ETSU-R-97*' (IOA GPG) stating that it supports:

'the use of ETSU-R-97 when designing potential windfarm schemes, and the monitoring of noise levels from generating sites. The Scottish Government recognises this guide as a useful tool which developers can use in conjunction with ETSU-R-97.'

10.3.14 The web-based document concludes that:

'The Scottish Government is aware that the UK Government has been considering the extent to which ETSU-R-97 may require updating to ensure it is aligned with the potential effects from more modern turbines. The Scottish Government supports this work and we anticipate the results of a short-term review project in due course.'

'Until such time as new guidance is produced, ETSU-R-97 should continue to be followed by applicants and used to assess and rate noise from wind energy developments.'

10.3.15 Therefore, the wind farm operational noise assessment has been undertaken in accordance with ETSU-R-97 *'The Assessment and Rating of Noise from Wind Farms'* and the IOA GPG. ETSU-R-97 provides a robust basis for determining acceptable noise limits for wind farm developments. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise levels at nearby noise sensitive properties would be below the noise limits derived in accordance with ETSU R 97.

10.3.16 Limits differ between daytime and night-time periods. The daytime criteria are based upon background noise levels measured during the 'quiet periods of the day' comprising:

- All evenings from 18:00 - 23:00;
- Saturday afternoons from 13:00 - 18:00; and
- All day Sunday 07:00 - 23:00.

10.3.17 For the avoidance of doubt the limits set based upon the background data collected during the quiet daytime period apply to the entire daytime period (07:00 – 23:00).

10.3.18 Night-time periods are defined as 23:00 - 07:00 with no differentiation made between weekdays and weekends.

10.3.19 ETSU-R-97 recommends that wind farm noise for the daytime periods should be limited to 5 dB(A) above the prevailing background or a fixed minimum level (FML) within the range 35 - 40 dB $L_{A90,10min}$, whichever is the higher. The precise choice of criterion level within the range 35 - 40 dB(A) depends on a number of factors, including:

- the number of dwellings in the neighbourhood of the wind farm (relatively few dwellings suggest a figure towards the upper end);
- the effect of noise limits on the number of kWh generated (larger sites tend to suggest a higher figure); and;
- the duration and level of exposure to any noise.

10.3.20 Following a review of the guidance in ETSU-R-97, the three factors listed in Section 10.3.19, as well as a review of the noise limits for other wind farm/turbine developments in the surrounding area, the 'Total ETSU-R-97 Noise Limits' for the Proposed Development operating in conjunction with other cumulative schemes has been set at 40 dB(A) or background plus 5 dB whichever is the greater during the daytime period and at 43 dB(A) or background plus 5 dB whichever is the greater during the night time period. This 'Total' limit relates to noise from all wind farm developments in the area.

10.3.21 The daytime 'Site Specific Noise Limits' have been derived based on the lower FML of 35 dB(A), or background plus 5 dB whichever is the greater whilst taking account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other schemes. Where wind turbine immission from the other wind turbines at a given receptor were found to be at least 10 dB below the Total ETSU-R-97 Noise Limit, it is considered that they will be using a negligible proportion of the limit[12], as such it was considered appropriate to allocate the entire noise limit to the Proposed Development. For the receptors where turbine predictions were found to be within 10 dB of the Total ETSU-R-97 Noise Limit, apportionment of the Total ETSU-R-97 Noise Limits was undertaken in accordance with current good practice.

10.3.22 For night-time periods the recommended limits are 5 dB(A) above prevailing background or a fixed minimum level of 43 dB $L_{A90,10min}$, whichever is higher whilst taking account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other schemes.

10.3.23 The exception to the setting of both the daytime and night-time fixed minimum on the noise limits occurs where a property occupier has a financial involvement in the wind farm development where the fixed minimum limit can be increased to 45 dB(A) or a higher permissible limit above background during the daytime and night-time periods.

10.3.24 In addition to ETSU-R-97, the recommendations included in the IOA GPG have been considered in the noise assessment.

10.3.25 The exact model of turbine to be installed on the site will be the result of a future tendering process should consent be granted. Achievement of the Site Specific Noise Limits determined by this assessment will be a key determining factor in the final choice of turbine for the Proposed Development. Predictions of wind turbine noise for the Proposed Development were made, based upon the sound power level data for a single candidate wind turbine, the Siemens Gamesa SG6.6-155 6.6 MW with serrated blades and a hub height of 122.5 m, as it is considered representative of the type of turbine that would be installed at the site.

10.3.26 Noise predictions have been undertaken using the propagation model contained within Part2 of International Standard ISO 9613-2, 'Acoustics – Attenuation of sound during propagation outdoors' (ISO,1996). The model calculates, on an octave band basis, attenuation due to geometric spreading, atmospheric absorption and ground effects. The noise model was set up to provide realistic noise predictions, including mixed ground attenuation (G=0.5) and atmospheric attenuation relating to 70% Relative Humidity and 10ºC and a receiver height of 4 m.

10.3.27 Typically wind farm noise assessments assume all properties are downwind of all turbines at all times (as this would result in the highest wind turbine noise levels). However, where properties are located in between groups of turbines they cannot be downwind of all turbines simultaneously, so it is appropriate to consider the effect of wind direction on predicted noise levels; the impact of directivity has been considered in the assessment. Further information on the methodology adopted where this condition comes into effect is provided in Section 6.3 of Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4).

10.3.28 The wind turbine noise immission levels are based on the $L_{A90,10\ minute}$ noise indicator in accordance with the recommendations in ETSU-R-97, which were obtained by subtracting 2 dB(A) from the turbine sound power level data (L_{Aeq} indicator).

12 For example - 40 dB + 30 dB = 40.4 dB and this is considered to be a negligible change.

10.3.29 In line with the IOA GPG, an assessment has been undertaken to determine whether a concave ground profile correction (+3 dB) or barrier correction (-2 dB), is required due to the topography between the turbines and the NSRs. Propagation across a valley (concave ground) increases the number of reflection paths, and in turn, has the potential to increase sound levels at a given receptor. Terrain screening effects (barrier corrections) act as blocking points, subsequently reductions in sound levels at a given receptor can potentially be observed. A concave ground and barrier correction was found to be required for a number of turbines at a number of receptors as detailed in Annex 6, **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4)**.

10.3.30 More information relating to all the parameters for operational noise discussed above and on other topics such as Amplitude Modulation (AM) and Low Frequency Noise (LFN) has been provided in Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4). There is no evidence that LFN has adverse impacts on the health of wind farm neighbours and at the time of writing there is no agreed methodology which can be used to predict the occurrence of AM or an agreed methodology that can be used to determine whether the effects of AM, should it occur, are likely to be significant.

Cumulative Wind Farm Noise

10.3.31 The need for a cumulative noise assessment was considered in accordance with the guidance contained within the IOA GPG. There are a number of operational, consented and proposed wind turbine developments within the vicinity of the Proposed Development; as such, and where required, a cumulative noise assessment was undertaken. The noise assessment was undertaken in three separate stages:

- Stage 1 – establish the Total ETSU-R-97 Noise Limits for each Noise Assessment Location (NAL) using the measured background noise levels to derive new limits;
- Stage 2 – undertake noise modelling to determine whether noise predictions from the Proposed Development on its own are within 10 dB of the noise predictions from other wind turbines within the area. Where turbine predictions are within 10 dB then a likely cumulative noise assessment will be undertaken; and
- Stage 3 – establish the Site Specific Noise Limits for the Proposed Development (through apportioning the Total ETSU-R-97 Noise Limits) and compare the noise predictions from the Proposed Development on its own against the Site Specific Noise Limits.

10.3.32 The aim of the operational noise assessment therefore is to establish the Total ETSU-R-97 Noise Limits, determine the likely impacts of the Proposed Development and other schemes at the nearest NSRs, derive Site Specific Noise Limits and, where applicable, Cumulative Noise Limits and to demonstrate that the Proposed Development could meet those limits.

10.3.33 All the turbines modelled in the cumulative noise assessment (Stage 2), are summarised in Annex 6 of **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4)**. Uncertainty in sound power data for the Proposed Development has been accounted for using the guidance contained within Section 4.2 of the IOA GPG. The location of the wind turbines for the Proposed Development and the other schemes are shown on EIAR Volume 3a: Figure 10.3: Cumulative Wind Turbine Locations.

BESS, Substation and Solar Array Operational Noise

10.3.34 The operational noise assessment for the BESS, solar arrays and substation was undertaken in accordance with BS 4142. The process of undertaking a BS 4142 assessment can be summarised as follows:

- Measure existing background sound levels at or close to the nearest NSRs for daytime and night-time periods;
- Predict the noise levels likely to be received at the NSRs from the Proposed Development;
- Add penalties, as required, to account for the characteristics of the sound source to determine the Rating Level;
- Compare the Rating Level with the measured background sound levels to assess the likelihood of adverse impacts; and
- If required, determine appropriate mitigation measures to reduce the Rating Level to within acceptable levels.

10.3.35 The assessment requires that the context in which the sound occurs is considered and as such there is no definitive pass/fail element defined. The standard states:

'Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following…

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.'

10.3.36 BS 8233 presents guideline internal ambient noise levels for daytime and night-time periods for a number of different building types; for residential developments these are based on guidelines issued by the World Health Organisation (WHO). In order to help provide context to the BS 4142 assessment, an assessment of the predicted noise levels against the BS 8233 guideline levels has also been made. In this case the most stringent of the BS 8233 levels have been used, which are 35 dB $L_{Aeq\ (16hour)}$ for daytime (07:00 to 23:00) and 30 dB $L_{Aeq\ (8hour)}$ for night-time (23:00 to 07:00).

10.3.37 As the BS 8233 criteria are for internal noise levels an allowance of 15 dB for the attenuation of a partially open window can be added to the internal levels to inform a set of external noise level limits. This allows a direct comparison between the predicted external levels and the internal guidelines. Application of this attenuation value would result in an equivalent external noise level limit of 45 dB $L_{Aeq(8hour)}$ for night-time (23:00 to 07:00).

10.3.38 Noise level predictions for the BESS, substation and solar array have been calculated in accordance with ISO 9613 2:1996.

Consultation

10.3.39 An EIA Scoping Opinion for the Proposed Development was issued in February 2024 by the Energy Consents Unit (ECU) on behalf of the Scottish Government. A summary of consultation responses received as part of the scoping exercise and response/actions taken, is given in Table 10.1 below. Consultation was undertaken directly with the Environmental Health Department at South Lanarkshire Council (SLC) and a summary of the response provided is also included within Table 10.1 below. A full copy of the consultation letter and subsequent responses is included in Annex 2 of **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4)**.

Table 10.1: Consultation Responses			
Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
ECU (6th February 2024)	Scoping	SLC did not respond to the consultation undertaken in relation to the scoping request. Scottish Ministers requested that the noise assessment be carried out in line with relevant legislation and standards as detailed in the scoping report and that the noise assessment report is formatted as per Table 6.1 in the IOA GPG.	All noise assessments were undertaken in accordance with the standards and guidance documents detailed in the scoping report and **Technical Appendix 10.2: Operational Noise Report, (EIAR Volume 4**) provides all the relevant information detailed within Table 6.1 of the IOA GPG.
The MOD (7th March 2024)	Scoping	Raised concerns in relation to noise on the operation and capability of the Eskdalemuir Seismological Recording Station due to no seismic noise budget being available within the 50 km radius from the array.	Initial calculation of the anticipated likely seismic impact of a representative candidate turbine at an early layout has been undertaken, which confirms that a wind farm can be delivered at the Site within an established SIL on the assumption that an appropriate seismic budget allocation can be made available to the Proposed Development. Calculations are included at **Technical Appendix 1.5 (EIAR Volume 4)**.
The Environmental Health Department (5th January 2024)	Other Consultation: direct consultation was undertaken with the SLCs Environmental Health Officer (EHO) to provide further methodology on the proposed scope for the noise assessment and the proposed baseline noise monitoring locations.	No response was received from the EHO at SLC	No actions required
The Environmental Health Department (22nd February 2024)	Other Consultation: direct consultation was undertaken with the EHO to provide a copy of the installation report	The EHO responded to the consultation and provided comment on two of the noise monitoring locations.	Observations made during the site visits did not suggest that the climbing frame was in use (it appeared to have been unused for some

Table 10.1: Consultation Responses			
Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
	following the installation of the noise monitoring equipment.	The EHO exercised caution in relation to the proximity of the equipment to a childrens climbing frame at one receptor and the presence of polytunnel located within the amenity areas at another receptor. The point was raised that measured data has the potential to be influenced by noise from these structures and that caution should be exercised.	time) and no wind induced noise was heard from the polytunnel. As a precautionary measure the noise kit was moved to a position around 15 m away from the polytunnel. Upon the analysis of measured data no atypical data points were detected suggesting that no wind induced noise was caused by the polytunnel or through the use of the climbing frame. Further information can be found in Section 5.2.5 of Technical Appendix 10.2 (EIAR Volume 4).

Potential Effects Scoped Out

Decommissioning

10.3.40 Activities that would occur during the decommissioning of the Proposed Development are unlikely to produce higher noise levels than those produced during construction and many of the activities would be similar in nature. As such it is assumed that if construction noise levels are predicted to be below the threshold levels then decommissioning noise would also be below the threshold levels.

Vibration

10.3.41 Vibration from wind turbines is low therefore on that basis it was not considered necessary to carry out a specific assessment of perceptible vibration and it has been scoped out of the EIA. However, further information on vibration can be found in Section 3.2 of **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4)**.

Blasting

10.3.42 The extent of any blasting requirement cannot be determined until intrusive site investigation tests are completed. Nevertheless should blasting be required, a series of tests would be undertaken by the appointed contractor in accordance with guidance outlined in BS 5228-2:2009+A1:2014[13]. In addition, blasts would be designed through appropriate specification of Maximum Instantaneous Charge (MIC) to ensure that vibration levels at the nearest NSR's would not exceed the guideline limits presented in BS 7385-2: 1993 'The Evaluation and

[13] British Standard BS 5228-2: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' – Part 2: Vibration

measurement for vibration in buildings. Guide to damage levels from groundborne vibration'[14] and BS 6472-2: 2008 'Guide to evaluation of human exposure to vibration in buildings. Blast-induced vibration'[15]. A condition could be attached to the consent to require compliance with these limits. Given the relative distances between the potential locations of blasting and the closest noise sensitive receptors, there is no reason to suggest that the guidance within BS 7385 and BS 6472 would not be met, and therefore this issue can be scoped out of further detailed consideration.

Potential Effects Scoped In

Wind farm, BESS, Substation and Solar Array construction

- Potential impacts from construction activities at the nearest NSRs.

Wind farm, BESS, Substation and Solar Array Operation

- Potential impact of operational wind turbine noise from the Proposed Development at NSRs located in proximity to the Proposed Development;
- Potential impact of operational noise from the Proposed Development operating concurrently with other operational, consented and proposed (in planning) developments in the area; and

Potential impact of operational noise from the BESS, substation and Solar array at NSRs located in proximity to the Proposed Development.

Method of Baseline Characterisation

Extent of the Study Area

10.3.43 The Proposed Development is located within a rural location, where existing background noise levels at the NSRs vary greatly depending on their proximity to the M74 motorway which passes through the centre of the site. The predominant noise sources in the area are road traffic noise from the M74 motorway and B7078, wind induced noise (wind passing through vegetation and around buildings), agricultural noise and birdsong.

10.3.44 Prior to the commencement of the baseline noise survey, initial desktop noise modelling was undertaken in order to identify suitable locations at which to monitor background noise. The proposed noise monitoring locations (NMLs) were included in a consultation letter issued to SLC as part of the consultation process.

10.3.45 There are a number of operational, consented and proposed wind farms located in the vicinity of the Proposed Development, referred to as the cumulative developments (as shown on Figure 10.3 (EIAR Volume 3a), and summarised in Table 1.1 of Technical Appendix 10.2 (EIAR Volume 4).

Field Survey

10.3.46 The noise survey to determine the existing background noise environment at the NSRs neighbouring the Proposed Development was undertaken in accordance with the guidance contained within ETSU-R-97 and the IOA GPG.

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[14] British Standard BS 7385-2: 1993 'The Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'

[15] British Standard BS 6472: 2008 'Guide to evaluation of human exposure to vibration in buildings. Blast-induced vibration'

10.3.47 Background noise monitoring was undertaken from February to April 2024 at five NSRs as detailed in Table 10.2 and shown on Figure 10.2. The selection of the noise monitoring locations considered local noise sources such as the M74, local watercourses, vegetation and the existing operational wind turbines at Middle Muir. More information on the NMLs including exact survey dates, noise monitoring equipment used, the maximum calibration drift and dominant noise sources noted at each of the five NMLs can be found in Section 5 of Technical Appendix 10.2 (EIAR Volume 4).

Table 10.2: Summary of Noise Monitoring Locations

NML/ Receptor Name	Easting	Northing
NML1 – Over Balgray	288047	624648
NML2 – Duneaton Bridge House	291629	624561
NML3 – Netherton Farm	290936	625425
NML4 – Maidencots Farm	292798	626245
NML5 – Crawfordjohn Mill Farm	289688	624128

10.3.48 The sound level meters were set to log the L_{A90} (as required by ETSU-R-97) and L_{Aeq} noise levels over the required ten-minute intervals continuously over the deployment period.

Method of Assessment

Significance Criteria

CONSTRUCTION NOISE

10.3.49 The significance criteria adopted for this assessment are based on Appendix E part E.3.2 of BS 5228-1:2009+A1:2014 and detailed in Table 10.3 below.

Table 10.3: Construction Noise Category A Criteria

Significance of Effect	Criteria Thresholds	
	Criteria Met	Criteria Exceeded
Category A Daytime (07:00 - 19:00) and Saturdays (07:00 - 13:00)	≤65dB $L_{Aeq, 12\ hr}$	>65dB $L_{Aeq, 12\ hr}$
Category A Evenings and Weekends (19:00 - 23:00)	≤55dB $L_{Aeq, 12\ hr}$	>55dB $L_{Aeq, 12\ hr}$
Category A Night-time (23:00 - 07:00)	≤45dB $L_{Aeq, 12\ hr}$	>45dB $L_{Aeq, 12\ hr}$

10.3.50 It should be noted that exceedance of the limit does not in itself indicate a significant effect, rather, the standard states 'If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect.'

OPERATIONAL WIND FARM NOISE

10.3.51 Planning Advice Note PAN 1/2011 'Planning and Noise' provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. PAN 1/2011 refers to the web-based planning advice on renewable technologies for Onshore Wind Turbines, which states that ETSU-R-97 should be used to assess and rate noise from wind energy developments. ETSU-R-97 does not define significance criteria, but describes a framework for the measurement of wind farm noise and gives indicative noise levels considered to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development. Achievement of ETSU-R-97 derived noise limits ensures that wind turbine noise will comply with current Government guidance.

10.3.52 The use of the term 'significance' in this Chapter in relation to operational wind turbine noise refers to compliance/non-compliance with the ETSU-R-97 derived noise limits. The proposed noise limits for the Proposed Development are detailed above in sections 10.3.20 - 10.3.23. For situations where predicted wind turbine noise meets or is less than the noise limits defined in ETSU-R-97, then the noise effects are deemed to be not significant. Any breach of the ETSU-R-97 derived noise limits due to the Proposed Development is deemed to result in a significant effect in terms of the EIA Regulations.

10.3.53 For the purposes of this assessment, residential properties that lawfully exist or have extant planning permission are considered to be NSRs.

BESS, SUBSTATION AND SOLAR ARRAY OPERATIONAL NOISE

10.3.54 BS 4142 does not define significance criteria; rather it describes a framework for the measurement of noise and provides a method to determine the likelihood of adverse impact.

10.3.55 The assessment has been undertaken in two parts; firstly, a comparison is made between the Rating Level and the Background Sound Level. Secondly, the assessment considers the context in which the sound occurs to determine a qualitative assessment outcome. As such there is no definitive pass/fail. This is described in the standard as follows:

'Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following…

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.'

10.3.56 To determine a Magnitude of Impact, the following criteria has been adopted:

- Where BS 4142 indicates a significant adverse impact, this is a Major Magnitude of Impact;
- Where BS 4142 indicates adverse impact, this is a Moderate Magnitude of Impact;
- Where BS 4142 indicates no adverse impact, this is a Minor Magnitude of Impact;

- Where the BS 4142 Rating Level is less than the measured background sound levels, this is a Negligible Magnitude of Impact.

10.3.57 With due regard to the sensitivity of the assessed residential receptors being high, the following criteria has been adopted to determine the significance criteria:

- Where a Major Magnitude of Impact is predicted, this is a Major Significant Effect;
- Where a Moderate Magnitude of Impact is predicted, this is a Moderate Significant Effect;
- Where a Minor Magnitude of Impact is predicted, this results in No Significant Effects;
- Where a Negligible Magnitude of Impact is predicted, this results in No Significant Effect.

Limitations and Assumptions

10.3.58 A candidate wind turbine has been used for predictions of operational noise from the Proposed Development. The final model of wind turbine to be used may differ from that presented here, however the operational noise levels from the Proposed Development would have to comply with the noise limits imposed within the noise condition attached to any consent. Similarly, candidate plant has been used for the prediction of BESS, substation and Solar array operational noise and final plant specifications may differ. No other assumptions or data gaps have been identified.

10.4 Baseline Conditions

Current Baseline

10.4.1 Table 10.4 and Table 10.5 provide a summary of the background noise levels measured during the monitoring period for the ETSU-R-97 quiet daytime and night-time periods. Further information of the data recorded during the noise survey can be found in Section 5 of Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4).

Table 10.4: Summary of Prevailing Background Noise Levels during Quiet Daytime Periods ($L_{A90,\ 10mins}$ dB)

Noise Monitoring Location (NML)	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1 – Over Balgray	26.4	26.8	27.6	29.0	31.0	33.5	36.5	40.0	44.1	48.7	53.9	59.6
NML2 – Duneaton Bridge House	32.7	33.2	34.0	35.0	36.3	37.7	39.4	41.2	43.2	45.3	47.6	50.0
NML3 – Netherton Farm	40.3 *	40.3 *	40.3	40.5	41.2	42.4	44.0	46.2	48.7	51.7	55.0	58.7
NML4 – Maidencots Farm	46.7	46.9	47.1	47.3	47.6	47.9	48.3	48.8	49.4	50.2	51.2	52.4

NML5 – Crawfordjohn Mill Farm	29.7 *	29.7	29.8	30.5	31.6	33.0	34.7	36.4	38.1	39.7	41.0	42.0

* Flatlined where derived minimum occurs at lower wind speeds, see Section 5.7 of Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4).

Table 10.5: Summary of Prevailing Background Noise Levels during Night-time Periods ($L_{A90,\ 10mins}$ dB)

Noise Monitoring Location (NML)	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1 – Over Balgray	21.8	22.8	24.3	26.2	28.5	31.2	34.4	38.0	42.0	46.4	51.3	56.6
NML2 – Duneaton Bridge House	29.8	30.1	30.9	32.1	33.6	35.5	37.6	40.0	42.4	44.9	47.4	49.9
NML3 – Netherton Farm	37.2*	37.2*	37.2	37.8	38.9	40.3	42.3	44.6	47.3	50.3	53.8	57.5
NML4 – Maidencots Farm	43.1*	43.1*	43.1	43.2	43.4	43.9	44.6	45.7	47.2	49.1	51.5	54.4
NML5 – Crawfordjohn Mill Farm	29.2*	29.2*	29.2	29.7	30.7	32.0	33.6	35.3	36.9	38.4	39.7	40.5

* Flatlined where derived minimum occurs at lower wind speeds, see Section 5.7 of Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4).

10.4.2 In line with the recommendations included in Section 3.1.19 of the IOA GPG, a polynomial line of best fit has been derived through each dataset for the daytime and night-time periods as shown on Figures A1.3a-e included within Annex 1 of Technical Appendix 10.2 (EIAR Volume 4). Any data that has been excluded due to rain, directional filtering or manual exclusions (where data was considered to be atypical) are shown on the Figures. The polynomial background curve has been flatlined (where applicable) at the lower wind speeds where the derived minimum occurs.

Future Baseline

10.4.3 It is possible that noise propagation and resulting noise immission levels could change over the life of the Proposed Development due to climate change (as noise attenuation is influenced by air temperature, relative humidity and ground conditions). However, noise limits are set based on current background noise levels in the absence of wind turbine noise and would be set for the lifetime of the project. The operator would be required to meet them for the duration of the consent.

Summary of Noise Assessment Locations

Scoped Out Receptors

10.4.4 The following receptors have been scoped out of the noise assessment:

- Thirstone Cottage (289178, 626315) is financially involved (FI) with the Proposed Development and will be repurposed as a site office; and
- Strand (290086, 625408) is FI with the Proposed Development and will be repurposed as a site spares store.

Scoped In Receptors

CONSTRUCTION NOISE

10.4.5 A total of twelve Construction Noise Assessment Locations (CNALs) were chosen as representative of the nearest NSRs. The CNALs chosen were the closest receptors to the Proposed Development and access tracks and these are presented in **Figure 10.1: Construction Noise Assessment Locations (EIAR Volume 3a**).

10.4.6 The CNALs refer to the position on the curtilage of a property where the predictions of construction noise levels have been made, as detailed in Table 10.6 below.

Table 10.6: Summary of Construction Noise Assessment Locations

Receptor	**Eastings**	**Northings**
CNAL1 – Greenfield	288097	624999
CNAL2 – Blackburn	289013	625359
CNAL3 - Netherton Farm	290783	625537
CNAL4 - Maidencots Farm	292647	626248
CNAL5 - Duneaton Bridge House	291590	624581
CNAL6 - Crawfordjohn Mill Farm	289660	624172
CNAL7 - Redshaw	286042	628519
CNAL8 – Littlegill	293972	626085
CNAL9 – Dykefoot	293696	624926
CNAL10 - Craighead Farm	291395	623691
CNAL11 - Nether Abington	293119	624359
CNAL12 - Netherton Farm House 2	290916	625441
CNAL13 – Red Moss Hotel	287417	627010

10.4.7 Red Moss Hotel (to the west of the Proposed Development) has been uninhabited for some time and the land on which it is situated has been the subject of an EIA screening request for a large BESS facility. The developer of the BESS facility, Green Switch Capital, has indicated that they anticipate a planning application being submitted by the end of 2024. Due to the current status of the hotel and the uncertainty regarding its future use, for completeness, it has been considered as an NSR for assessing construction noise due to proximity to the turbines in the west part of the site.

WIND FARM OPERATIONAL NOISE

10.4.8 A total of nine Noise Assessment Locations (NALs) were chosen as representative of the nearest NSRs to the wind turbines and they are shown on Figure 10.2 (EIAR Volume 3a) and detailed in Table 10.7 below. They were selected based on them having the loudest predicted noise levels within a group of nearby properties both around the Proposed Development and the other wind farm developments included in the cumulative assessment.

10.4.9 The NALs refer to the position on the curtilage of a property closest to the Proposed Development. Predictions of wind turbine noise have been made at each of the NALs as detailed in Table 10.7. This approach ensures that the assessment considers the worst case (highest) noise immission level expected at the NSR. Table 10.7 also details which NML has been used to set noise limits for each NAL.

Table 10.7: Summary of Wind Farm Operational Noise Assessment Locations

Receptor	Eastings	Northings	Background Noise Data Used
NAL1 - Greenfield	288097	624999	NML1
NAL2 - Blackburn	289013	625359	NML1
NAL3 - Netherton Farm	290783	625537	NML3
NAL4 – Maidencots Cottage	292636	626346	NML4
NAL5 - Duneaton Bridge House	291590	624581	NML2
NAL6 - Crawfordjohn Mill Farm	289660	624172	NML5
NAL7 - Redshaw	286042	628519	Data collected as part of noise survey undertaken for the proposed Bodinglee Wind Farm
NAL8 - Over Balgray	288054	624662	NML1
NAL9 – Red Moss Hotel	287458	627018	Data collected as part of noise survey undertaken for the proposed Bodinglee Wind Farm

10.4.10 As detailed above, due to the uncertainty regarding the status of Red Moss Hotel it has also been considered as a NAL for operational noise due to its proximity to the Proposed Development.

BESS, SUBSTATION AND SOLAR ARRAY OPERATIONAL NOISE

10.4.11 A total of eleven BESS, Substation and Solar Noise Assessment Locations (BNALs) were chosen as representative of the nearest NSRs. The NALs chosen were the closest receptors to the proposed BESS, substation and solar array and these are presented in EIAR Volume 3a: Figure 10.4 and are detailed below in Table 10.8 below.

Table 10.8: Summary of BESS, Substation and Solar Array Noise Assessment Locations

Receptor	Eastings	Northings	Background Noise Data Used
BNAL01	289013	625359	NML1
BNAL02a	290783	625537	NML3
BNAL02b	290916	625441	NML3
BNAL03	289704	624153	NML5

BNAL04	291395	623691	NML2
BNAL05a	291582	624577	NML2
BNAL05b	291629	624579	NML2
BNAL06	292829	626161	NML4
BNAL07	293972	626085	NML4
BNAL08	293562	624701	NML4
BNAL09	293119	624359	NML4

10.5 Assessment of Likely Effects

Potential Construction Effects

10.5.1 The construction noise impact results summarised in Table 10.9 below show that the predicted construction noise levels are below the Category A Threshold Levels at all CNALs for all assessment scenarios therefore there would be **no significant effects**. Further details of the modelling and assessment can be found in Technical Appendix 10.1: Construction Noise Report (EIAR Volume 4).

Table 10.9: Predicted Construction Noise Immission Levels

CNAL	Category A Threshold dB $L_{Aeq,t}$			Immission Level, dB $L_{Aeq,t}$ for each Scenario							
	Daytime (07:00 – 19:00) and Saturdays (07:00 - 13:00)	Evenings (19:00-23:00 weekdays) Weekends (13:00-23:00 Saturdays and 07:00-23:00 Sundays)	Night-Time (23:00 - 07:00)	01	02	03	04	05	06	07	Night
CNAL1 - Greenfield	65	55	45	36	39	39	40	40	40	39	22
CNAL2 - Blackburn	65	55	45	41	43	43	45	44	43	44	26
CNAL3 - Netherton Farm	65	55	45	34	49	50	50	49	50	50	20
CNAL4 - Maidencots Farm	65	55	45	26	35	35	35	35	42	40	23
CNAL5 - Duneaton Bridge House	65	55	45	27	40	41	41	40	45	49	13
CNAL6 - Crawfordjohn Mill Farm	65	55	45	29	33	34	35	34	33	34	16
CNAL7 - Redshaw	65	55	45	25	28	27	29	30	27	28	8
CNAL8 - Littlegill	65	55	45	21	32	32	32	32	39	39	18

Table 10.9: Predicted Construction Noise Immission Levels											
CNAL	**Category A Threshold dB $L_{Aeq, t}$**			**Immission Level, dB $L_{Aeq, t}$ for each Scenario**							
	Daytime (07:00 – 19:00) and Saturdays (07:00 - 13:00)	**Evenings (19:00-23:00 weekdays) Weekends (13:00-23:00 Saturdays and 07:00-23:00 Sundays)**	**Night-Time (23:00 - 07:00)**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**Night**
CNAL9 - Dykefoot	65	55	45	31	32	33	33	33	42	40	30
CNAL10 - Craighead Farm	65	55	45	24	29	30	30	30	34	41	11
CNAL11 - Nether Abington	65	55	45	32	34	34	34	34	43	39	32
CNAL12 - Netherton Farm House 2	65	55	45	23	50	50	50	50	50	50	16
CNAL13 – Red Moss Hotel	65	55	45	46	45	32	45	51	33	51	15

Potential Wind Farm Operational Effects

Setting the Total ETSU-R-97 Noise Limits (Stage 1)

10.5.2 Based on the prevailing background noise levels, the Total ETSU-R-97 Noise Limits have been established for each of the NALs detailed in Table 10.7 above. The Total ETSU-R-97 Noise Limits are as detailed in Table 10.10 and Table 10.11 below and have been based on an upper fixed minimum of 40 dB (Daytime) or background plus 5 dB and 43 dB (Night-time) or background plus 5 dB.

Table 10.10: Total ETSU-R-97 Noise Limits - Daytime												
NAL	**Wind speed (ms^{-1}) as standardised to 10m height**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
NAL1 - Greenfield	40.0	40.0	40.0	40.0	40.0	40.0	41.5	45.0	49.1	53.7	58.9	64.6
NAL2 – Blackburn*	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	49.1	53.7	58.9	64.6
NAL3 - Netherton Farm*	45.3	45.3	45.3	45.5	46.2	47.4	49.0	51.2	53.7	56.7	60.0	63.7
NAL4 – Maidencots Cottage	51.7	51.9	52.1	52.3	52.6	52.9	53.3	53.8	54.4	55.2	56.2	57.4
NAL5 - Duneaton Bridge House	40.0	40.0	40.0	40.0	41.3	42.7	44.4	46.2	48.2	50.3	52.6	55.0
NAL6 - Crawfordjohn Mill Farm	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.4	43.1	44.7	46.0	47.0
NAL7 – Redshaw**	43.1	43.1	43.1	43.1	43.1	43.2	43.5	44.0	44.8	45.8	47.1	48.6

Table 10.10: Total ETSU-R-97 Noise Limits - Daytime												
NAL	**Wind speed (ms^{-1}) as standardised to 10m height**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
NAL8 - Over Balgray	40.0	40.0	40.0	40.0	40.0	40.0	41.5	45.0	49.1	53.7	58.9	64.6
NAL9 – Red Moss Hotel**	43.1	43.1	43.1	43.1	43.1	43.2	43.5	44.0	44.8	45.8	47.1	48.6

**Occupiers are FI with the Proposed Development*
*** Taken from Table 4 of the Bodinglee Wind Farm Environmental Noise Assessment, dated 9th June 2023.*

Table 10.11: Total ETSU-R-97 Noise Limits – Night-time												
NAL	**Wind speed (ms^{-1}) as standardised to 10m height**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
NAL1 - Greenfield	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	47.0	51.4	56.3	61.6
NAL2 – Blackburn*	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.0	51.4	56.3	61.6
NAL3 - Netherton Farm*	45.0	45.0	45.0	45.0	45.0	45.3	47.3	49.6	52.3	55.3	58.8	62.5
NAL4 – Maidencots Cottage	48.1	48.1	48.1	48.2	48.4	48.9	49.6	50.7	52.2	54.1	56.5	59.4
NAL5 - Duneaton Bridge House	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0	47.4	49.9	52.4	54.9
NAL6 - Crawfordjohn Mill Farm	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.4	44.7	45.5
NAL7 – Redshaw**	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NAL8 - Over Balgray	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	47.0	51.4	56.3	61.6
NAL9 – Red Moss Hotel**	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0

**Occupiers are FI with the Proposed Development*
*** Taken from Table 5 of the Bodinglee Wind Farm Environmental Noise Assessment, dated 9th June 2023.*

Predicting the Likely Effects and the Requirement for a Cumulative Noise Assessment (Stage 2)

10.5.3 Predicted cumulative noise levels were compared to the Total ETSU-R-97 Noise Limits. For some turbine models considered in the cumulative assessment noise data was not available for wind speeds less than 5 ms^{-1} therefore no cumulative predictions are included for wind speeds less than 5 ms^{-1}.

10.5.4 As shown in Table 10.12 and Table 10.13, the predicted cumulative wind turbine noise immission levels are below the Total ETSU-R-97 Noise Limits under all conditions and at NALs 1-8 during both daytime and night-time periods. As such, there would be **no significant effects**.

10.5.5 At NAL9, an exceedance of the Total ETSU-R-97 Noise Limit was predicted during the daytime and night-time periods for certain wind speeds and wind direction due to the noise immission from the Proposed Development. This would result in a **significant effect** for certain wind speeds and wind directions. This is discussed in further detail in Section 10.5.10 below.

Table 10.12: Total ETSU-R-97 Noise Limits – Daytime

NAL		Wind speed (ms^{-1}) as standardised to 10m height											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
NAL1 - Greenfield	Total Noise Limit L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	41.5	45.0	49.1	53.7	58.9	64.6
	Predictions L_{A90}	-	-	-	-	36.3	38.5	38.7	38.7	38.7	38.7	38.7	38.7
	Exceedance Level	-	-	-	-	-3.7	-1.5	-2.8	-6.3	-10.4	-15.0	-20.2	-25.9
NAL2 - Blackburn	Total Noise Limit L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	49.1	53.7	58.9	64.6
	Predictions L_{A90}	-	-	-	-	40.8	42.7	42.8	42.8	42.8	42.8	42.8	42.8
	Exceedance Level	-	-	-	-	-4.2	-2.3	-2.2	-2.2	-6.3	-10.9	-16.1	-21.8
NAL3 – Netherton Farm	Total Noise Limit L_{A90}	45.3	45.3	45.3	45.5	46.2	47.4	49.0	51.2	53.7	56.7	60.0	63.7
	Predictions L_{A90}	-	-	-	-	40.5	42.4	42.4	42.4	42.4	42.4	42.4	42.4
	Exceedance Level	-	-	-	-	-5.7	-5.0	-6.6	-8.8	-11.3	-14.3	-17.6	-21.3
NAL4 – Maidencots Cottage	Total Noise Limit L_{A90}	51.7	51.9	52.1	52.3	52.6	52.9	53.3	53.8	54.4	55.2	56.2	57.4
	Predictions L_{A90}	-	-	-	-	32.5	34.7	35.0	35.0	35.0	35.0	35.0	35.0
	Exceedance Level	-	-	-	-	-20.1	-18.2	-18.3	-18.8	-19.4	-20.2	-21.2	-22.4
NAL5 – Duneaton Bridge House	Total Noise Limit L_{A90}	40.0	40.0	40.0	40.0	41.3	42.7	44.4	46.2	48.2	50.3	52.6	55.0
	Predictions L_{A90}	-	-	-	-	32.9	35.0	35.1	35.2	35.2	35.2	35.2	35.2
	Exceedance Level	-	-	-	-	-8.4	-7.7	-9.3	-11.0	-13.0	-15.1	-17.4	-19.8
NAL6 – Crawfordjohn Mill Farm	Total Noise Limit L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.4	43.1	44.7	46.0	47.0
	Predictions L_{A90}	-	-	-	-	34.8	36.8	36.9	36.9	36.9	36.9	36.9	36.9
	Exceedance Level	-	-	-	-	-5.2	-3.2	-3.1	-4.5	-6.2	-7.8	-9.1	-10.1
NAL7 - Redshaw	Total Noise Limit L_{A90}	43.1	43.1	43.1	43.1	43.1	43.2	43.5	44.0	44.8	45.8	47.1	48.6
	Predictions L_{A90}	-	-	-	-	35.7	38.7	38.9	38.9	39.0	39.0	39.0	39.0
	Exceedance Level	-	-	-	-	-7.4	-4.5	-4.6	-5.1	-5.8	-6.8	-8.1	-9.6
NAL8 – Over Balgray	Total Noise Limit L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	41.5	45.0	49.1	53.7	58.9	64.6
	Predictions L_{A90}	-	-	-	-	35.4	37.7	37.9	38.0	38.0	38.0	38.0	38.0
	Exceedance Level	-	-	-	-	-4.6	-2.3	-3.6	-7.0	-11.1	-15.7	-20.9	-26.6
NAL9 – Red Moss Hotel	Total Noise Limit L_{A90}	43.1	43.1	43.1	43.1	43.1	43.2	43.5	44.0	44.8	45.8	47.1	48.6
	Predictions L_{A90}*	-	-	-	-	42.0 *	40.7 *	41.0 *	41.9 *	43.1 *	44.5 *	45.3	45.3
	Exceedance Level	-	-	-	-	-1.1	-2.5	-2.5	-2.1	-1.7	-1.3	-1.8	-3.3

**Mitigation applied to M74 West (see Section 10.5.10 below for further information)*

Table 10.13: Total ETSU-R-97 Noise Limits – Night-time

NAL		Wind speed (ms^{-1}) as standardised to 10m height											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
NAL1 – Greenfield	Total Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	47.0	51.4	56.3	61.6
	Predictions L_{A90}	-	-	-	-	36.3	38.5	38.7	38.7	38.7	38.7	38.7	38.7
	Exceedance Level	-	-	-	-	-6.7	-4.5	-4.3	-4.3	-8.3	-12.7	-17.6	-22.9
NAL2 - Blackburn	Total Noise Limit L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.0	51.4	56.3	61.6
	Predictions L_{A90}	-	-	-	-	40.8	42.7	42.8	42.8	42.8	42.8	42.8	42.8
	Exceedance Level	-	-	-	-	-4.2	-2.3	-2.2	-2.2	-4.2	-8.6	-13.5	-18.8
NAL3 – Netherton Farm	Total Noise Limit L_{A90}	45.0	45.0	45.0	45.0	45.0	45.3	47.3	49.6	52.3	55.3	58.8	62.5
	Predictions L_{A90}	-	-	-	-	40.5	42.4	42.4	42.4	42.4	42.4	42.4	42.4
	Exceedance Level	-	-	-	-	-4.5	-2.9	-4.9	-7.2	-9.9	-12.9	-16.4	-20.1
NAL4 – Maidencots Cottage	Total Noise Limit L_{A90}	48.1	48.1	48.1	48.2	48.4	48.9	49.6	50.7	52.2	54.1	56.5	59.4
	Predictions L_{A90}	-	-	-	-	32.5	34.7	35.0	35.0	35.0	35.0	35.0	35.0
	Exceedance Level	-	-	-	-	-15.9	-14.2	-14.6	-15.7	-17.2	-19.1	-21.5	-24.4
NAL5 – Duneaton Bridge House	Total Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0	47.4	49.9	52.4	54.9
	Predictions L_{A90}	-	-	-	-	32.9	35.0	35.1	35.2	35.2	35.2	35.2	35.2
	Exceedance Level	-	-	-	-	-10.1	-8.0	-7.9	-9.8	-12.2	-14.7	-17.2	-19.7
NAL6 – Crawfordjohn Mill Farm	Total Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.4	44.7	45.5
	Predictions L_{A90}	-	-	-	-	34.8	36.8	36.9	36.9	36.9	36.9	36.9	36.9
	Exceedance Level	-	-	-	-	-8.2	-6.2	-6.1	-6.1	-6.1	-6.5	-7.8	-8.6
NAL7 - Redshaw	Total Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions L_{A90}	-	-	-	-	35.7	38.7	38.9	38.9	39.0	39.0	39.0	39.0
	Exceedance Level	-	-	-	-	-7.3	-4.3	-4.1	-4.1	-4.0	-4.0	-4.0	-4.0
NAL8 – Over Balgray	Total Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	47.0	51.4	56.3	61.6
	Predictions L_{A90}	-	-	-	-	35.4	37.7	37.9	38.0	38.0	38.0	38.0	38.0
	Exceedance Level	-	-	-	-	-7.6	-5.3	-5.1	-5.0	-9.0	-13.4	-18.3	-23.6
NAL9 – Red Moss Hotel	Total Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predictions L_{A90}*	-	-	-	-	41.9 *	40.4 *	40.1 *	40.1 *	40.1 *	40.1 *	40.1 *	40.1 *
	Exceedance Level	-	-	-	-	-1.1	-2.6	-2.9	-2.9	-2.9	-2.9	-2.9	-2.9

**Mitigation applied to M74 West (see Section 10.5.10 below for further information)*

Operational Phase- Derivation of Site Specific Noise Limits for the Proposed Wind Farm (Stage 3)

10.5.6 In order to protect residential amenity, in accordance with ETSU-R-97 cumulatively, all wind farms (including the Proposed Development) should operate within the Total ETSU-R-97 Noise Limits, as demonstrated in the Stage 2 above.

10.5.7 Another recommendation is that each wind farm should operate within their own limit, whilst the cumulative situation of Stage 2 is still met. To allow this to occur, a set of Site Specific Noise Limits for the Proposed Development are required and these have been derived for each NAL. The apportionment options provided in the IOA GPG were considered to determine the most appropriate option for each NAL as summarised in Table 6.8 of in **Technical Appendix 10.2: Operational Noise Report (EIAR Volume 4**).

10.5.8 The Site Specific Noise Limits and noise predictions for the Proposed Development on its own, based on a Siemens Gamesa SG6.6-155 6.6 MW, are summarised in Table 10.14 and Table 10.15 below.

10.5.9 The results show that the predicted wind turbine noise levels from the Proposed Development operating on its own meet the Site Specific Noise Limits under all conditions at NALs 1-8 during the daytime and night-time period. As such there would be **no significant effects.**

10.5.10 At NAL 9, an exceedance of the Site Specific Noise Limit was predicted, ranging from 0.8 dB up to 4.7 dB between 5ms^{-1} and 9 ms^{-1} during the daytime and 1.7 dB up to 5.3 dB between 5 ms^{-1} and 12 ms^{-1} during the night time period when the turbines were modelled operating in full mode. At those wind speeds, this would result in a **significant effect** for certain wind directions.

Table 10.14: Site Specific Noise Limits – Daytime

NAL		Wind speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Greenfield	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	36.0	37.2	39.5	44.2	48.8	53.6	58.9	64.6
	Predictions L_{A90}	-	-	24.8	30.0	34.7	36.6	36.6	36.6	36.6	36.6	36.6	36.6
	Exceedance Level	-	-	-10.2	-5.0	-1.3	-0.6	-2.9	-7.6	-12.2	-17.0	-22.3	-28.0
NAL2 - Blackburn	Site Specific Noise Limit L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	49.1	53.7	58.9	64.6
	Predictions L_{A90}	-	-	30.7	35.9	40.7	42.5	42.5	42.5	42.5	42.5	42.5	42.5
	Exceedance Level	-	-	-14.3	-9.1	-4.3	-2.5	-2.5	-2.5	-6.6	-11.2	-16.4	-22.1
NAL3 – Netherton Farm	Site Specific Noise Limit L_{A90}	45.3	45.3	45.3	45.5	46.2	47.4	49.0	51.2	53.7	56.7	60.0	63.7
	Predictions L_{A90}	-	-	30.3	35.5	40.3	42.1	42.1	42.1	42.1	42.1	42.1	42.1
	Exceedance Level	-	-	-15.0	-10.0	-5.9	-5.3	-6.9	-9.1	-11.6	-14.6	-17.9	-21.6
NAL4 – Maidencots Cottage	Site Specific Noise Limit L_{A90}	51.7	51.9	52.1	52.3	52.6	52.9	53.3	53.8	54.4	55.2	56.2	57.4
	Predictions L_{A90}	-	-	21.8	27.0	31.8	33.6	33.6	33.6	33.6	33.6	33.6	33.6
	Exceedance Level	-	-	-30.3	-25.3	-20.8	-19.3	-19.7	-20.2	-20.8	-21.6	-22.6	-23.8

Table 10.14: Site Specific Noise Limits – Daytime

NAL		Wind speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL5 – Duneaton Bridge House	Site Specific Noise Limit L_{A90}	37.7	38.2	39.0	40.0	41.3	42.7	44.4	46.2	48.2	50.3	52.6	55.0
	Predictions L_{A90}	-	-	22.2	27.4	32.2	34.0	34.0	34.0	34.0	34.0	34.0	34.0
	Exceedance Level	-	-	-16.8	-12.6	-9.1	-8.7	-10.4	-12.2	-14.2	-16.3	-18.6	-21.0
NAL6 – Crawfordjohn Mill Farm	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.5	36.6	38.0	39.7	41.4	43.1	44.7	46.0	47.0
	Predictions L_{A90}	-	-	24.1	29.3	34.0	35.9	35.9	35.9	35.9	35.9	35.9	35.9
	Exceedance Level	-	-	-10.9	-6.2	-2.6	-2.1	-3.8	-5.5	-7.2	-8.8	-10.1	-11.1
NAL7 - Redshaw	Site Specific Noise Limit L_{A90}	43.1	43.1	43.1	43.1	41.7	33.2	33.5	41.2	42.6	44.1	45.9	47.7
	Predictions L_{A90}	-	-	18.0	23.2	27.9	29.8	29.8	29.8	29.8	29.8	29.8	29.8
	Exceedance Level	-	-	-25.1	-19.9	-13.8	-3.4	-3.7	-11.4	-12.8	-14.3	-16.1	-17.9
NAL8 – Over Balgray	Site Specific Noise Limit L_{A90}	35.0	35.0	35.0	35.0	36.0	36.9	39.3	44.1	48.8	53.6	58.9	64.6
	Predictions L_{A90}	-	-	22.9	28.1	32.9	34.7	34.7	34.7	34.7	34.7	34.7	34.7
	Exceedance Level	-	-	-12.1	-6.9	-3.1	-2.2	-4.6	-9.4	-14.1	-18.9	-24.2	-29.9
NAL9 – Red Moss Hotel	Site Specific Noise Limit L_{A90}	43.1	43.1	43.1	43.1	41.9	40.6	40.9	41.8	43.0	44.5	46.1	48.6
	Predictions L_{A90}	-	-	33.5	38.7	41.9 *	40.6 *	40.9 *	41.8 *	43.0 *	44.5 *	45.3	45.3
	Exceedance Level	-	-	-9.6	-4.4	0.0	0.0	0.0	0.0	0.0	0.0	-0.8	-3.3

**Mitigation applied*

Table 10.15: Site Specific Noise Limits – Night-time

NAL		Wind speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 - Greenfield	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	42.4	41.8	41.7	41.7	46.5	51.2	56.2	61.6
	Predictions L_{A90}	-	-	24.8	30.0	34.7	36.6	36.6	36.6	36.6	36.6	36.6	36.6
	Exceedance Level	-	-	-18.2	-13.0	-7.7	-5.2	-5.1	-5.1	-9.9	-14.6	-19.6	-25.0
NAL2 - Blackburn	Site Specific Noise Limit L_{A90}	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.0	51.4	56.3	61.6
	Predictions L_{A90}	-	-	30.7	35.9	40.7	42.5	42.5	42.5	42.5	42.5	42.5	42.5
	Exceedance Level	-	-	-14.3	-9.1	-4.3	-2.5	-2.5	-2.5	-4.5	-8.9	-13.8	-19.1
NAL3 – Netherton Farm	Site Specific Noise Limit L_{A90}	45.0	45.0	45.0	45.0	45.0	45.3	47.3	49.6	52.3	55.3	58.8	62.5
	Predictions L_{A90}	-	-	30.3	35.5	40.3	42.1	42.1	42.1	42.1	42.1	42.1	42.1

Table 10.15: Site Specific Noise Limits – Night-time

NAL		Wind speed (ms^{-1}) as standardised to 10m height											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Exceedance Level	-	-	-14.7	-9.5	-4.7	-3.2	-5.2	-7.5	-10.2	-13.2	-16.7	-20.4
NAL4 – Maidencots Cottage	Site Specific Noise Limit L_{A90}	48.1	48.1	48.1	48.2	48.4	48.9	49.6	50.7	52.2	54.1	56.5	59.4
	Predictions L_{A90}	-	-	21.8	27.0	31.8	33.6	33.6	33.6	33.6	33.6	33.6	33.6
	Exceedance Level	-	-	-26.3	-21.2	-16.6	-15.3	-16.0	-17.1	-18.6	-20.5	-22.9	-25.8
NAL5 – Duneaton Bridge House	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0	47.4	49.9	52.4	54.9
	Predictions L_{A90}	-	-	22.2	27.4	32.2	34.0	34.0	34.0	34.0	34.0	34.0	34.0
	Exceedance Level	-	-	-20.8	-15.6	-10.8	-9.0	-9.0	-11.0	-13.4	-15.9	-18.4	-20.9
NAL6 – Crawfordjohn Mill Farm	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.4	44.7	45.5
	Predictions L_{A90}	-	-	24.1	29.3	34.0	35.9	35.9	35.9	35.9	35.9	35.9	35.9
	Exceedance Level	-	-	-18.9	-13.7	-9.0	-7.1	-7.1	-7.1	-7.1	-7.5	-8.8	-9.6
NAL7 - Redshaw	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	41.6	33.0	33.0	33.0	33.0	33.0	33.0	33.0
	Predictions L_{A90}	-	-	18.0	23.2	27.9	29.8	29.8	29.8	29.8	29.8	29.8	29.8
	Exceedance Level	-	-	-25.0	-19.8	-13.7	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2
NAL8 – Over Balgray	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	42.4	41.7	41.6	41.6	46.5	51.2	56.2	61.6
	Predictions L_{A90}	-	-	22.9	28.1	32.9	34.7	34.7	34.7	34.7	34.7	34.7	34.7
	Exceedance Level	-	-	-20.1	-14.9	-9.5	-7.0	-6.9	-6.9	-11.8	-16.5	-21.5	-26.9
NAL9 – Red Moss Hotel	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	41.8	40.3	40.0	40.0	40.0	40.0	40.0	40.0
	Predictions L_{A90}	-	-	33.5	38.7	41.8 *	40.3 *	40.0 *	40.0 *	40.0 *	40.0 *	40.0 *	40.0 *
	Exceedance Level	-	-	-9.5	-4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Mitigation applied

Potential BESS, Substation and Solar Array Effects

10.5.11 The operational BESS, Substation and Solar Array noise impact results summarised in Table 10.16 below show that the predicted operational noise levels are below the representative Background Sound Levels at all BNALs for day and night-time periods and therefore there would be **no significant effects**. Full details of the modelling and assessment can be found in **Technical Appendix 10.3: Battery Energy Storage System, Substation and Solar Array Operational Noise Report (EIAR Volume 4)**.

Table 10.16: Predicted BESS, Substation and Solar Array Noise Immission Levels						
Noise Assessment Location	**Daytime**			**Night-time**		
BNAL ID	**Rating Level, dBA**	**Representative Background Sound Level, dBA**	**Margin, dB**	**Rating Level, dBA**	**Representative Background Sound Level, dBA**	**Margin, dB**
BNAL01	26	33	-7	26	27	-1
BNAL02a	18	43	-25	18	38	-20
BNAL02b	14	43	-29	14	38	-24
BNAL03	15	31	-16	15	30	-15
BNAL04	13	35	-23	13	30	-18
BNAL05a	22	35	-13	22	30	-8
BNAL05b	19	35	-16	19	30	-11
BNAL06	26	50	-24	26	45	-19
BNAL07	17	50	-33	17	45	-28
BNAL08	18	50	-32	18	45	-27
BNAL09	18	50	-33	18	45	-28

Potential Cumulative Construction Effects

10.5.12 The predicted construction noise levels at all NSRs are significantly below the daytime threshold levels (by at least 10 dB) such that any contribution from the Proposed Development would not increase the received noise levels attributable to nearby construction activities above the threshold levels at any NSR. Accordingly, there would be **no significant cumulative construction noise effects**.

Potential Cumulative Operational Effects

10.5.13 The result of the likely cumulative operational wind farm noise assessment show that the Proposed Development can operate concurrently with the operational, consented or proposed wind farms near to the NALs, whilst still meeting the Total ETSU-R-97 Noise limits established in accordance with ETSU-R-97 at all NALs. There would be **no significant cumulative operational noise effects**.

10.5.14 At the time of writing, no BESS or other developments assessed in accordance with BS 4142 are proposed (in planning), consented or operational nearby to the Proposed Development. A substation at Redshaw located north west of the Proposed Development has been screened, however, due to being in such early stages and insufficient information being available, cumulative noise from the Redshaw Substation has not been assessed. As such, there would be **no significant cumulative operational noise effects.**

10.6 Mitigation

Mitigation by Design

10.6.1 As part of the iterative design process for the Proposed Development, noise constraints identified through noise prediction modelling were considered to ensure that the ETSU-R-97 noise limits were met at all residential receptors and significant effects were avoided (see Chapter 3: Design Evolution (EIAR Volume 4)). This involved:

- The removal of turbine 23 which was identified as causing exceedances of the ETSU-R-97 noise limits at the property Blackburn (and to a lesser extent at Greenfield, Over Balgray and Crawfordjohn Mill Farm).

Mitigation during Construction

10.6.2 No significant effects resulting from construction noise are predicted. Nevertheless, a range of good practice measures detailed in the Outline Construction Environmental Management Plan (OCEMP) would be employed to minimise noise impacts.

10.6.3 Good site practices would be implemented to minimise the likely effects. Section 8 of BS 5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that would be employed onsite:

- Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- Ensure that any extraordinary site work continuing throughout 24 hours of a day (for example, crane operations lifting components onto the tower) would be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid significant traffic flows;
- Ensure all vehicles and mechanical plant would be fitted with effective exhaust silencers and be subject to programmed maintenance;
- Select inherently quiet plant where appropriate - all major compressors would be ‘sound reduced’ models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use;
- Ensure all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Instruct that machines would be shut down between work periods or throttled down to a minimum;
- Regularly maintain all equipment used on site, including maintenance related to noise emissions;
- Vehicles would be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and
- Ensure all ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided.

Mitigation during Operation

10.6.4 The exact model of wind turbine to be used for the Proposed Development would be the result of a future tendering process. Achievement of the noise limits determined by this assessment would be a key determining factor in the final choice of wind turbines for the site. For this assessment, predictions of wind turbine noise have been based upon sound power level data for the Siemens Gamesa SG 6.6-155 with serrated blades, and a noise prediction model procedure that can be considered to provide a realistic impact assessment. The assessment shows an exceedance of the derived noise limits for a limited range of wind speeds and wind directions at NAL9 during the daytime and night period and as a result, the assessment presented here assumes the targeted use of mode management[16] or turbine shut down for a limited range of wind speeds and directions in order to demonstrate that the noise limits can be adhered to. Depending on the final turbine selected for the Site, blade type and confirmation of final warranted levels from the chosen manufacturer, mode management may or may not be required. In addition, as detailed above NAL9 has been uninhabited for a period of time and may be taken out of use as part of a proposed development on land in which it is located. It is anticipated that appropriate noise limits would be secured by an appropriately worded planning condition an example condition is included in Annex 9 Technical Appendix 10.2 (EIAR Volume 4).

10.6.5 No specific mitigation measures are proposed for the BESS, substation or Solar array.

10.7 Assessment of Residual Effects

Residual Construction Effects

10.7.1 Predicted wind farm, BESS, substation and solar array construction noise levels are below the assessment criteria at all receptors, for all phases of construction. Elements of construction noise may be audible at the closest residential receptor for certain periods during the construction phases. However, with or without the good practice construction mitigation measures outlined above there would be **no significant residual effects**.

Residual Operational Effects

10.7.2 For the purpose of demonstrating the effectiveness of a potential noise mitigation measure for the candidate wind turbine considered here, the predicted noise levels at NAL9 have been reduced to ensure that the limits are met, this would be achieved by the adoption of low noise modes or turbine shut down, but this would only be required for a limited range of wind speeds and directions.

10.7.3 The results of the noise assessment show that, subject to the adoption of mitigation measures (at NAL9) when required for the candidate wind turbine, the predicted wind turbine noise levels would meet the Site Specific Noise Limits under all conditions and at all locations for both daytime and night time periods and there would be **no significant residual effects** from operational noise. There are a number of wind turbine makes and models that would be suitable for the Proposed Development and that may not require the use of low noise modes.

10.7.4 At some locations, under some wind conditions and for a certain proportion of the time operational wind farm noise would be audible; however, it would be at an acceptable level in relation to the ETSU-R-97 guidelines and there would be **no significant residual effects.**

10.7.5 No mitigation was identified to be required for operational noise regarding the proposed BESS, substation and Solar array, so there would be **no significant residual effects**.

[16] This involves operating turbines in low noise mode. This usually involves restricting the rotor speed with a corresponding reduction in noise emissions and electrical power generation.

Residual Cumulative Construction Effects

10.7.6 The predicted construction noise levels at all NSRs are significantly below the daytime threshold levels (by at least 10 dB) such that any contribution from the Proposed Development would not increase the received noise levels attributable to other nearby construction activities above the threshold levels at any NSR. While predicted noise is less than 10 dB below the evening/weekend and night-time threshold values, construction work is not planned during these periods and in the unlikely event that it is necessary it’s unlikely that other construction activities will be occurring at the same time close to the CNALs identified in this assessment. Accordingly, there would be **no significant residual construction noise effects**.

Residual Cumulative Operational Effects

10.7.7 Predicted cumulative wind farm operational noise levels at all the NALs lie below the Total ETSU-R-97 daytime and night-time Noise Limits. There would be **no significant residual cumulative operational effects**.

10.8 Monitoring

Construction Phase Monitoring

10.8.1 As no significant effects are anticipated, monitoring is not required.

Operation Phase Monitoring

10.8.2 No routine monitoring would be required during the operational phase although good practice (as set out in the IOA GPG) does provide an example condition which would require compliance monitoring in the event of a complaint. Suggested noise related planning conditions are included within Annex 8 of Technical Appendix 10.2 (EIAR Volume 4) and contain a mechanism for the Planning Authority to request compliance monitoring in the event of a complaint.

10.9 Summary

10.9.1 Predicted construction noise levels compared with the Category A criteria outlined in Section E.3 of BS 5228: Part 1 2009+A1:2014 indicate that construction noise levels are below the guidelines considered acceptable at all receptors for all construction phases and therefore **no significant effects** are anticipated.

10.9.2 The predicted construction noise levels, even without any mitigation measures, are predicted to be more than 10 dB below the threshold levels. As such, construction noise attributable to the Proposed Development would not increase the received noise levels attributable to other nearby construction activities above the threshold levels at any NSR. There would be **no significant residual effects**.

10.9.3 The guidance contained within ETSU-R-97 was used to assess the likely operational noise impact of the Proposed Development. Predicted levels and measured background noise levels indicate that for dwellings neighbouring the site, wind turbine noise would meet the noise criteria established in accordance with ETSU-R-97 at all NALs.

10.9.4 There are a range of wind turbine models that could be appropriate for the Proposed Development. If the proposal receives consent, further data would be obtained from the supplier for the final choice of wind turbine model to demonstrate compliance with the operational noise limits derived in this report.

10.9.5 Predicted cumulative wind farm operational noise levels at all the NALs lie below the Total ETSU-R-97 daytime and night-time Noise Limits. There would be **no significant residual effects**.

10.9.6 Predicted noise levels from the BESS, substation and Solar array indicate there would be **no significant effects** at all BNALs.

Table 10.17: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/Residual Effect
Construction			
Potential construction noise effects on noise sensitive receptors	No specific measures required other than standard good site practices.	These would be included in the detailed CEMP and delivered as a condition of consent.	Not Significant
Operation			
Potential operational noise effects on noise sensitive receptors.	Mode management/ turbine shutdown for certain wind speeds and wind directions.	Turbine control system (subject to selection of final turbine). Noise limits would be set as a condition of consent.	Not Significant
Decommissioning			
Potential decommissioning noise effects on noise sensitive receptors	No specific measures required other than standard good site practices which would be applicable at the time.	N/A	Not Significant
Cumulative Construction			
Potential cumulative construction noise effects on noise sensitive receptors.	No specific measures required.	N/A	Not Significant
Cumulative Operation			
Potential cumulative operational noise effects on noise sensitive receptors.	Mode management/ turbine shutdown for certain wind speeds and wind directions.	Turbine control system (subject to selection of final turbine). Noise limits would be set as a condition of consent.	Not Significant

10.10 Glossary and Abbreviations

Abbreviation	Expanded Term
NAL	Noise Assessment Location
BNAL	Battery/ Solar array Noise Assessment Location
CNAL	Construction Noise Assessment Location
NML	Noise Monitoring Location

IOA	Institute of Acoustics
GPG	Good Practice Guide
dB	Decibels
SLC	South Lanarkshire Council
EHO	Environmental Health Officer
ECU	Energy Consents Unit
BESS	Battery Energy Storage System
BS	British Standard
FML	Fixed Minimum Limit
WHO	Word Health Organisation
NSR	Noise Sensitive Receptor

11 Aviation

11.1 Executive Summary

11.1.1 This chapter has assessed the potential effects of the Proposed Development on the air traffic control primary surveillance radars (PSRs) at Lowther Hill and Cumbernauld; the air traffic control secondary surveillance radar (SSR) at Lowther Hill; the Green Lowther distance measuring equipment (DME) aeronautical radio navigation aid; Glasgow Airport instrument flight procedures (IFPs); and hang gliding/paragliding activity on Tinto Hill.

11.1.2 The assessment found that:

- Effects on the NATS En Route Lowther Hill and Cumbernauld PSRs would be **Negligible** in the construction and decommissioning phases and **Moderate** in the operational phase;
- Effects on the Lowther Hill SSR would be **Negligible** in the construction and decommissioning phases and **Minor** in the operational phase;
- Effects on the Green Lowther DME would be **Negligible** in the construction, operational and decommissioning phases;
- Effects on the Glasgow Airport IFPs would be **None** in the construction, operational and decommissioning phases;
- Effects on hang gliding/paragliding activity from Tinto Hill would be **Negligible** in the construction and decommissioning phases and **Minor** in the operational phase.

11.1.3 Mitigation measures would not be required for the effects on the Lowther Hill SSR, Green Lowther DME, Glasgow Airport IFPs or Tinto Hill hang gliding/paragliding.

11.1.4 Mitigation measures for the effects on the Lowther Hill and Cumbernauld would consist of technical measures secured via a commercial agreement with NATS and a suitably-worded planning condition.

11.1.5 The residual effects on the Lowther Hill and Cumbernauld PSRs, following implementation of mitigation, would be **Minor** and therefore not significant.

11.2 Introduction

11.2.1 This chapter considers the likely significant effects on aviation receptors associated with the construction, operation and decommissioning of the Proposed Development. The specific objectives of the chapter are to:

- describe the aviation and telecommunications baseline;
- describe the assessment methodology and significance criteria used in completing the
- impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

11.2.2 The assessment has been carried out by Malcolm Spaven, Director of Aviatica, a specialist consultancy with 28 years' experience of providing aviation advice to the wind energy industry.

11.3 Assessment Methodology

Scope of Assessment

11.3.1 This chapter considers effects on:

- primary surveillance radars (PSRs) used for air traffic control, air defence and weather forecasting;
- secondary surveillance radars (SSRs);
- aeronautical radio navigation aids; and
- obstacle hazards to civil and military aircraft flying at low level.

11.3.2 The chapter assesses cumulative effects as arising from the addition of the Proposed Development to other cumulative developments, which for this assessment are defined as those that are the subject of a valid planning application. Operational, under construction and consented developments are considered as part of the baseline. Developments close to the end of their operational life will be included as part of the baseline to present a 'reasonable worst case scenario'.

11.3.3 The assessment is based on the Proposed Development as described in Chapter 2: Development Description (EIAR Volume 2).

11.3.4 The scope of the assessment has been informed by consultation responses detailed in Technical **Appendix 1.1: Consultation Register (EIAR Volume 4)** and the following guidelines/policies:

- Civil Aviation Authority (CAA), Safety Regulation Group, CAP 764: CAA Policy and Guidelines on Wind Turbines, Sixth Edition, 2016 and Draft Seventh Edition, 2024;
- CAA, Safety Regulation Group, CAP 670: Air Traffic Services Safety Requirements, Third Issue, Amendment 1/2019, 1 June 2019, Part B, Section 4;
- Scottish Government, Planning Circular 2/2003: Safeguarding of Aerodromes, Technical Sites and Military Explosive Storage Areas: The Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosive Storage Areas) (Scotland) Direction 2003 (revised edition March 2016);
- CAA, Safety & Airspace Regulation Group, Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 m above ground level (agl), 1 June 2017.

Potential Effects Scoped Out

11.3.5 There are no Meteorological Office or air defence PSRs; licensed, certificated or Government aerodromes within the Study Area. Consequently, all of those aviation facilities have been scoped out of further assessment.

Method of Baseline Characterisation

Extent of the Study Area

11.3.6 The study areas for the aviation assessment were selected using the recommended distances set out in CAA guidance (CAP 764), modified to ensure that all radars with the range to detect wind turbines are included. The distances used are radii from the centre of the Site, as follows:.

- 120 km for air traffic control and air defence PSRs;
- 30 km for SSRs and Meteorological Office rainfall radars;

- 12 km for aeronautical radio navigation aids and air-to-ground radio communications sites;
- 30 km for licensed, certificated and Government aerodromes;
- 60 km for IFPs;
- 10 km for unlicensed aerodromes, airstrips, recreational aviation launching sites and specialist military low flying areas.

11.3.7 The determination of the aviation baseline has also been informed by consultation responses from aviation stakeholders.

Desk Study

11.3.8 The aviation baseline assessment was carried out by consulting the UK Aeronautical Information Publication, the UK Military Aeronautical Information Publication, civil and military aeronautical charts and Aviatica in-house databases of aviation infrastructure and assets.

Method of Assessment

11.3.9 Significance criteria for assessment of impacts on aviation, unlike those for environmental effects, are not based on the sensitivity of the receptor. Further, while magnitude of change can be determined in some circumstances, it typically does not provide a standardised metric on which to measure the significance of any effects. In this context, the significance of effects on aviation has been determined in this chapter by application of professional judgement, underpinned by consideration of the magnitude of change (where measurable), the regulations and procedures in place for ensuring that aviation infrastructure meets required performance standards, the safeguarding policies and practices in use by specific aviation stakeholders, and the consultation responses from those stakeholders.

11.3.10 Residual adverse effects of the Proposed Development on aviation are described as either none, negligible, minor, moderate or major. None, negligible or minor effects are categorised as not significant. Moderate or major effects are categorised as significant. The criteria applied to define each of the significance categories in this chapter are set out in Table 11.1.

Table 11.1: Significance Criteria

Significance of Effect	Description
Major	Regular, frequent or permanent effects which require changes to existing operational and/ or technical practice in order to mitigate adequately, or which are not capable of being mitigated adequately.
Moderate	Periodic effects experienced which may require alterations to existing operational practice.
Minor	Occasional effects experienced which do not require any alteration of existing operational and technical practice.
Negligible	Normally no measurable change from baseline conditions; occasional, fleeting or very short term effects experienced which do not require any alteration of existing operational and technical practice.
None	No measurable change from baseline conditions.

Limitations and Assumptions

11.3.11 The aviation baseline described in this chapter is extant as at June 2024. The assessment assumes that there will be no significant changes to this baseline over the lifetime of the Proposed Development. This is a standard assumption for such assessments and is not considered to undermine its validity.

11.4 Baseline Conditions

Current Baseline

11.4.1 The airspace above the site is uncontrolled (Class G) from ground level up to 5,500 feet above sea level (asl). Above that level is the Class D controlled airspace of the Scottish Terminal Control Area (TMA), under the control of the NATS En Route Prestwick Centre ('Scottish Control'). The Scottish TMA airspace is a Transponder Mandatory Zone (TMZ) above 6,000ft asl.

11.4.2 The uncontrolled airspace up to 5,500 feet asl is used by civil and military aircraft, mostly operating under the Visual Flight Rules (VFR). The airspace within the Scottish TMA over the Site is used by aircraft inbound to Glasgow Airport from the south and, at higher levels, en route traffic including transatlantic flights between Europe and North America.

11.4.3 There are air traffic control PSRs within the Study Area at Edinburgh Airport, Leuchars Station, RAF Spadeadam Deadwater Fell, RAF Spadeadam Berry Hill, NATS En Route Lowther Hill, QinetiQ West Freugh, Prestwick Airport, Glasgow Airport, Cumbernauld and Kincardine.

11.4.4 The NATS En Route Lowther Hill SSR is 15 km south of the Site.

11.4.5 There are no Meteorological Office radars within the Study Area.

11.4.6 The NATS En Route Green Lowther Distance Measuring Equipment (DME) facility is 13 km south of the Site.

11.4.7 There are no aeronautical radio transmitter/receiver sites within the Study Area.

11.4.8 There are no licensed, certificated or Government aerodromes within the Study Area.

11.4.9 The Site is within the IFP assessment areas for Edinburgh and Glasgow Airports.

11.4.10 An unlicensed airstrip is located at Stonehill, 6.5 km south west of the Site. The Site is also within 10 km of paragliding sites on Tinto Hill.

11.4.11 The Site is located within a specialist military low flying area known as Low Flying Area 20(T), which may be activated for daytime Operational Low Flying down to heights of 100 feet above ground level (agl). For military low flying at night the Site is within Allocated Region 2B which covers the western parts of central and southern Scotland.

Future Baseline

11.4.12 Some changes are expected in the structure of controlled airspace and the pattern of IFPs over the Site as a result of the CAA Airspace Modernisation Strategy and Airspace Change Proposals (ACPs) currently under way. These are not expected to generate any significant changes in the effects of the Proposed Development on aviation.

Summary of Sensitive Receptors

Scoped Out Receptors

11.4.13 The air traffic control PSRs at Edinburgh, Prestwick and Glasgow Airports; Leuchars Station, RAF Spadeadam Deadwater Fell, RAF Spadeadam Berry Hill and QinetiQ West Freugh have been scoped out of assessment since consultation responses from the operators of those radars have indicated that they will not be affected.

11.4.14 The NATS En Route Kincardine radar has been scoped out of assessment since it has been determined that its line of sight to the Proposed Development is blocked by intervening terrain.

11.4.15 Meteorological Office radars, aeronautical radio transmitter/receiver sites and licensed, certificated or Government aerodromes have been scoped out of assessment since there are no such facilities within the Study Area.

11.4.16 IFPs for Edinburgh Airport have been scoped out of assessment since Edinburgh Airport has confirmed that the Proposed Development will have no impact on its IFPs.

11.4.17 The Stonehill airstrip has been scoped out of assessment since it is located beyond the CAA recommended consultation distance for airstrips of this size (3 km).

11.4.18 Military low flying has been scoped out of assessment since the Ministry of Defence has advised that any effects on low flying can be addressed by provision of lighting and pre-construction notification of the details of the Proposed **Development (Technical Appendix 1.1: Consultation Register (EIAR Volume 4))**.

Scoped In Receptors

11.4.19 The aviation receptors scoped into the assessment are:

- NATS En Route Lowther Hill and Cumbernauld PSRs, which will have line of sight to the Proposed Development;
- NATS En Route Lowther Hill SSR, since the Site is within the statutory consultation zone for the facility and it will have line of sight to the Proposed Development;
- NATS En Route Green Lowther DME, since the Site is within the statutory consultation zone for the facility and it will have line of sight to the Proposed Development;
- Glasgow Airport IFPs, since the Site is within the airport’s IFP assessment area and Glasgow Airport has advised that an assessment will be required; and
- Effects on hang gliders and paragliders using launching sites on Tinto Hill since the Site is within 10 km of Tinto Hill.

11.5 Assessment of Likely Effects

11.5.1 This section describes the potential significant effects on aviation which might occur as a result of the Proposed Development.

Potential Construction Effects

Radars

11.5.2 PSRs and SSRs used for air traffic control purposes are designed to process out stationary objects such as terrain and buildings. Since the turbine rotors would not be rotating during the construction phase, the effect of the Proposed Development on the Lowther Hill and Cumbernauld radars would be **Negligible** and therefore not significant.

Green Lowther DME

11.5.3 DME facilities may be affected by multipath effects caused by structures within their coverage. This occurs when, in addition to the direct signal between the DME and an aircraft, the signal may also travel via a reflection from the structure. This can lead to incorrect distances being displayed by the equipment.

11.5.4 NATS En Route safeguards its DME facilities against wind turbine developments by means of a statutory safeguarding zone of 20 km radius. The Green Lowther DME is 13 km from the nearest turbine in the Proposed Development.

11.5.5 International Civil Aviation Organisation (ICAO) European guidance material on safeguarding aeronautical radio navigation aids recommends that structures should not infringe a surface extending from ground level at the base of a DME antenna, at an elevation angle of 1° above the horizontal, to a maximum radius of 3,000 metres from the facility.[1] The Proposed Development lies well beyond the lateral boundary of this area. Additionally, the highest point of all turbines in the Proposed Development will be at negative elevation angles from the Green Lowther DME, ranging from -0.66° to -1.10° (without taking account of earth curvature).

11.5.6 UK guidance on the safeguarding of aeronautical radio navigation aids is set out in CAP 670: *Air Traffic Services Safety Requirements*. In relation to DME, CAP 670 advises that structures should not be built which would infringe a 2% (1:50) slope surface originating at ground level extending 300 m radially.[2] The Proposed Development would be well outside those zones.

11.5.7 It is concluded that the potential effect of the Proposed Development on the Green Lowther DME would be **Negligible** and therefore not significant.

Glasgow Airport IFPs

11.5.8 Effects on IFPs are dependent on the maximum height above sea level of any structure in the Proposed Development. This will be the blade tips of Turbine 4, at approximately 1,815 feet asl. Assessments of the effects of tall structures on IFPs are required to be carried out by a CAA-Approved Procedure Design Organisation (APDO). APDOs may employ a filtering tool which identifies obstacles which are located inside IFP protection areas but do not penetrate the IFP surfaces and therefore do not need to be separately assessed by an APDO. Pending any filtering and/or assessment exercise by an APDO, this section of this chapter considers the potential effects of the Proposed Development on Glasgow Airport's IFPs.

11.5.9 The Proposed Development will be located in a sector of the Glasgow Airport Air Traffic Control Surveillance Minimum Altitude Chart (ATCSMAC) where the minimum altitude to be assigned by controllers is 4,000 ft asl. In addition, the Site is within the 5 nm buffer zone of a sector of the ATCSMAC where the minimum altitude to be assigned by controllers is 3,000 ft asl. These levels are designed to provide a minimum of 1,000 ft vertical clearance over all terrain and obstacles within 5 nm of the aircraft.

11.5.10 The Proposed Development would only require alteration of the Glasgow Airport ATCSMAC if its highest structure exceeded 2,000 ft asl. Since this will not be the case, the effect of the Proposed Development on the Glasgow Airport ATCSMAC would be **None** and therefore not significant.

11.5.11 All Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs) from/to Glasgow Airport that pass within 10 nm of the Proposed Development have minimum levels of at least 6,000 ft asl. These would be unaffected by the Proposed Development.

11.5.12 The Minimum Sector Altitude (MSA) in the sector containing the Proposed Development for all instrument approach procedures to Glasgow Airport is 3,000 ft asl. This would be unaffected by the Proposed Development.

11.5.13 The Proposed Development has higher terrain or obstacles to the north west (Galawhistle Wind Farm, 1,882 ft asl) and north east (Tinto Hill, 2,334 ft asl) which indicate that the

[1] ICAO, *European Guidance Material on Managing Building Restricted* Areas, ICAO EUR DOC 015, 3rd Edition, 2015, Appendix 1, Table 1.

[2] CAA, *Air Traffic Services Safety* Requirements, CAP 670, Third Issue, Amendment 1/2019, 1 June 2019, GEN02.19.

Proposed Development will not require any changes to procedure altitudes/levels in the Glasgow Airport IFPs.

11.5.14 It is concluded that the Proposed Development would have no impact on Glasgow Airport's IFPs. This may require confirmation from a filtering exercise and/or full assessment by an APDO.

Paragliders

11.5.15 The Proposed Development is located between seven and 10 km south of the 'Tinto South' hang glider/paraglider launching area, operated by the Lanarkshire & Lothians Soaring Club (LLSC).[3] The closest turbine in the Proposed Development would be 6 km from the normal landing fields used by hang gliders/paragliders operating from the Tinto South site.

11.5.16 Since the Proposed Development is located several kilometres away from the launching and normal landing sites for hang gliders and paragliders operating from 'Tinto South', it is considered that it will have no significant effects on the availability of landing sites or the risk of collision for these aircraft. This would be a **Negligible** effect and therefore not significant.

Potential Operational Effects

Radars

11.5.17 The rotating blades of wind turbines can generate false plots on PSR which, depending on the type of radar service being provided by controllers using these radar data, may require to be regarded as being real aircraft. Wind turbines may also reduce the ability of the radar to detect real aircraft above the wind farm and also behind the wind farm at low altitudes. False wind turbine plots may also introduce errors in the way the radar display shows the tracks of aircraft crossing the Site.

11.5.18 NATS En Route operates a Multi Radar Tracker (MRT) system at its Scottish Area Control Centre, combining the radar data from multiple radar heads and using the most accurate and reliable data to form the displayed radar picture in each part of the airspace. The effects on the Lowther Hill and Cumbernauld radars are assessed as being **Moderate** and therefore significant.

11.5.19 As regards the effects of the Proposed Development on the Lowther Hill SSR, CAP 764 notes that "wind turbine effects on SSR are traditionally less than those on PSRs but can be caused due to the physical blanking and diffracting effects of the turbine towers, depending on the size of the turbines and the wind farm. These effects are typically only a consideration when the turbines are located very close to the SSR i.e. less than 10 km."[4] The closest turbine in the Proposed Development will be more than 14 km from the Lowther Hill SSR. In addition, all of the proposed turbines will be at negative elevation angles from the SSR antenna, ranging from -0.64° to -1.04° to the blade tips (excluding the effects of earth curvature). It is concluded that the effects on the Lowther Hill SSR would be **Minor** and therefore not significant.

Green Lowther DME

11.5.20 Effects on the Green Lowther DME during the operational phase of the Proposed Development would be the same as those during the construction phase.

[3] https://www.llsclub.co.uk/index.php/tinto-south, accessed 10 June 2024.

[4] CAA, *CAA Policy and Guidelines on Wind Turbines*, CAP 764, 6th Edition, 2016, paragraph 2.10.

Glasgow Airport IFPs

11.5.21 Effects on Glasgow Airport IFPs during the operational phase of the Proposed Development would be the same as those during the construction phase.

Paragliders

11.5.22 In addition to potential collision hazard, wind turbines may pose a risk to hang gliders/paragliders due to turbulence generated downwind of the turbines. CAA guidance CAP 764 advises that "*whilst being a consideration for all aircraft (particularly in* critical *stages of flight), turbulence is of particular concern to those involved in very light sport aviation such as gliding, parachuting, hang-gliding, paragliding or microlight operations as in certain circumstances turbulence could potentially cause loss of control that is impossible to recover from*."[5]

11.5.23 CAP 764 notes that "published research suggests a distance of 8-12 rotor diameters downstream of the wind turbine is a distance at which the turbulence effects are not expected to affect conventional aircraft flying". If the greater vulnerability to turbulence of hang gliders and paragliders is assumed to warrant an avoidance zone up to 20 rotor diameters downwind, this would create an avoidance zone up to 3,100 metres to the north of the Proposed Development (the Tinto South site is only used in southerly winds). Since the turbines at the Proposed Development would all be sited at distances greater than the avoidance zone of 3,100 m away from the normal launching and landing sites at Tinto South it is concluded that the Proposed Development would have a **Minor**, and therefore not significant, impact on the activities of the LLSC at Tinto South.

Potential Decommissioning Effects

11.5.24 The potential effects of the Proposed Development on aviation receptors during the decommissioning phase would be the same as during the construction phase.

Potential Cumulative Construction Effects

Radars

11.5.25 PSRs and SSRs used for air traffic control purposes are designed to process out stationary objects such as terrain and buildings. Since the turbine rotors would not be rotating during the construction phase, the cumulative effect of the Proposed Development with other wind energy developments on the Lowther Hill and Cumbernauld radars would be **Negligible** and therefore not significant.

Green Lowther DME

11.5.26 NATS En Route safeguards its DME facilities against wind turbine developments by means of a statutory safeguarding zone of 20 km radius. The Green Lowther DME is 13 km from the nearest turbine in the Proposed Development. There are no other operational, consented or in-planning developments closer to the Green Lowther DME. The West Andershaw development, in scoping at the time of writing, is a similar distance from the DME. Its highest turbines would, like the Proposed Development, be at negative elevation angles from the DME. It is therefore considered that the cumulative effects of the Proposed Development, with other developments, on the Green Lowther DME would be **Negligible** and therefore not significant.

[5] CAA, *CAA Policy and Guidelines on Wind Turbines*, CAP 764, Draft 7th Edition, 2024, paragraph 2.60.

Glasgow Airport IFPs

11.5.27 Numerous other developments within 15km of the Proposed Development and closer to Glasgow Airport have higher blade tip heights than the Proposed Development, including Galawhistle, West Andershaw, Bodinglee and Little Gala. The cumulative effect of the Proposed Development on Glasgow Airport IFPs will be **None** since any alteration in those IFPs is driven entirely by the development with the highest structures above sea level.

Paragliders

11.5.28 Three other developments – the in-planning Grayside, Bodinglee and Little Gala wind farms - are located closer to the 'Tinto South' hang glider/paraglider launching and landing areas than the Proposed Development.

11.5.29 The Grayside EIAR concludes that due to its distance from the Tinto Hill launching/landing site the Development would not have any significant effect on the operations of LLSC.

11.5.30 The Bodinglee EIAR makes no mention of potential effects on hang gliding/paragliding. However LLSC has lodged an objection to that development on grounds of turbulence and collision hazard.

11.5.31 The Little Gala Supplementary Information acknowledges potential effects on hang gliding/paragliding from Tinto Hill. A specialist consultancy report commissioned by the Little Gala Applicant concludes that use of the Tinto Hill landing site should be prohibited in south west winds to limit effects of turbulence but that the Development would have no other effects on flying activities.

11.5.32 The Proposed Development is sufficiently far away from the launching and normal landing sites for hang gliders and paragliders operating from 'Tinto South' to have no significant stand-alone effects on these activities. In the event that the Little Gala and/or Bodinglee developments were built and constraints placed on the use of the landing sites in specified wind directions, there would be no need for any additional constraints in order to mitigate effects generated by the Proposed Development. It is therefore considered that the cumulative effects of the Proposed Development on hang gliding/paragliding activity from Tinto South are no greater than the stand-alone effects and are therefore **Minor** and not significant.

Potential Cumulative Operational Effects

11.5.33 The potential for cumulative operational effects on NATS En Route PSRs is considered by NATS En Route in their consultation responses and in considering the feasibility of mitigation measures. The NATS Lowther Hill and Cumbernauld radars both have line of sight to numerous other developments in the area surrounding the Proposed Development. However there is no indication that there are impending limits on the capacity of the NATS radar system and the mitigation measures typically used to address wind farm effects on PSR over southern Scotland. It is therefore concluded that the cumulative effects of the Proposed Development, with other developments, on NATS En Route PSRs would be **Moderate**.

11.5.34 In view of the distance between the Lowther Hill SSR and other cumulative wind farm developments, it is concluded that the cumulative effects on this facility would be **Minor**.

11.5.35 Cumulative effects on the Green Lowther DME, Glasgow Airport IFPs and paragliding would be the same as in the construction phase.

11.6 Mitigation

Mitigation during Construction

11.6.1 While there are not predicted to be any significant adverse effects of the Proposed Development on civil or military aircraft flying at low altitude, the turbines in the Proposed Development have tip heights of 150m or more agl and are therefore subject to the mandatory lighting requirements of Article 222 of the ANO. Articles 222(6) and 222(7) of that order give the CAA the authority to approve lighting schemes which differ from the normal provisions of Article 222. In order to mitigate the night time visual impact of the Proposed Development on non-aviation receptors a reduced lighting scheme has been designed and will be submitted to the CAA for approval. It proposes 2000 candela steady red lights on eight of the 22 turbines but no mid-tower lighting.

11.6.2 No other mitigation is required as no significant effects of the Proposed Development on aviation during the construction phase are predicted.

Mitigation during Operation

11.6.3 While the NATS En Route Lowther Hill and Cumbernauld PSRs would be adversely affected by the Proposed Development, the Glasgow Airport PSR, whose data is also used by the MRT, would not since it would not have line of sight to any of the turbines. The Glasgow PSR data may then be used by the MRT to maintain the accuracy and integrity of the radar picture in the airspace overhead the Proposed Development.

11.6.4 Additionally, the Lowther Hill PSR is an Indra 3D radar which has the capability to determine the location of targets in elevation as well as azimuth by means of multiple electronically-steered elevation beams. This can allow wind turbines that are within line of sight of the radar, but located in elevation beams at negative elevation angles from the radar, to be mitigated by blanking those elevation beams in the vicinity of the wind turbines. This eliminates the false targets from the wind turbines but retains real aircraft targets because they are in higher elevation beams that are unaffected.

11.6.5 Mitigation of the effects of the Proposed Development on NATS En Route PSRs in the operational phase would be secured by a commercial agreement between the Applicant and NATS En Route, underpinned by a planning condition using standard agreed wording for such arrangements.

Mitigation during Decommissioning

11.6.6 No mitigation is required as no significant effects of the Proposed Development on aviation during the decommissioning phase are predicted.

11.7 Assessment of Residual Effects

Residual Construction Effects

11.7.1 No residual effects on aviation during construction of the Proposed Development are predicted.

Residual Operational Effects

11.7.2 Residual effects on NATS En Route PSRs during the operation of the Proposed Development would be **Minor** and therefore not significant.

Residual Decommissioning Effects

11.7.3 No residual effects on aviation during decommissioning of the Proposed Development are predicted.

Residual Cumulative Construction Effects

11.7.4 No residual cumulative effects on aviation during construction of the Proposed Development are predicted.

Residual Cumulative Operational Effects

11.7.5 Residual cumulative effects on NATS En Route PSRs during the operation of the Proposed Development would be **Minor** and therefore not significant.

11.8 Summary

11.8.1 This chapter has assessed the potential effects of the Proposed Development on the air traffic control PSRs at Lowther Hill and Cumbernauld; the air traffic control SSR at Lowther Hill; the Green Lowther DME aeronautical radio navigation aid; Glasgow Airport IFPs; and hang gliding/paragliding activity on Tinto Hill.

11.8.2 The assessment found that:

- Effects on the NATS En Route Lowther Hill and Cumbernauld PSRs would be **Negligible** in the construction and decommissioning phases and **Moderate** in the operational phase;
- Effects on the Lowther Hill SSR would be **Negligible** in the construction and decommissioning phases and **Minor** in the operational phase;
- Effects on the Green Lowther DME would be **Negligible** in the construction, operational and decommissioning phases;
- Effects on the Glasgow Airport IFPs will be **None** in the construction, operational and decommissioning phases;
- Effects on hang gliding/paragliding activity from Tinto Hill would be **Negligible** in the construction and decommissioning phases and **Minor** in the operational phase.

11.8.3 Mitigation measures would not be required for the effects on the Lowther Hill SSR, Green Lowther DME, Glasgow Airport IFPs or Tinto Hill hang gliding/paragliding. Mitigation measures for the effects on the Lowther Hill and Cumbernauld would consist of technical measures secured via a commercial agreement with NATS and a suitably-worded planning condition.

11.8.4 The residual effects on the Lowther Hill and Cumbernauld PSRs, following implementation of mitigation, would be **Minor** and therefore not significant.

Table 11.2: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/ Residual Effect
Operation			
False plots/reduced sensitivity of NATS En Route Lowther Hill and Cumbernauld PSRs	In-fill from Glasgow PSR/use of inherent data processing capacity of Lowther Hill Indra 3D radar	Commercial agreement with NATS and suitably-worded planning condition	Not significant

12 Shadow Flicker

12.1 Executive Summary

12.1.1 This chapter provides an assessment of the potential impacts on residential amenity resulting from shadow flicker from the Proposed Development. The shadow flicker assessment has been undertaken to consider the maximum tip height of 200 m and a representative rotor diameter of 155 m for the Proposed Development. A study area of 10 rotor diameters (1.55 km) around each turbine was considered and 16 receptors potentially susceptible to shadow flicker were identified within the study area.

12.1.2 There are no published guidelines in Scotland that define acceptable levels of shadow flicker. In the absence of specific guidelines, the assessment has considered the Parsons Brinckerhoff (2011)[1] paper which considers guidelines from different countries relating to Shadow Flicker. This assessment has used the following criteria that are based on Northern Irish and German guidance as listed in the above paper: shadow flicker should not be allowed to exceed 30 hours per year or 30 minutes per day. As such, properties where shadow flicker would potentially exceed these thresholds would be subject to significant effects, in the absence of mitigation.

12.1.3 The assessment indicates that the potential number of shadow flicker hours experienced exceeds 30 hours per year or 30 minutes per day at five of the properties identified within the study area. In the absence of mitigation, shadow flicker effects are potentially significant for these receptors.

12.1.4 This analysis provides an extremely conservative estimate of the extent that the properties would be affected by shadow flicker. Due to frequent cloud cover, low irradiance intensity, turbines not turning at all times, the presence of intervening vegetation and turbine rotors not being aligned with the sun in a way to cast maximum shadow onto the proposed properties all of the time, the number of hours when shadow flicker would affect the aforementioned properties is anticipated to be far fewer.

12.1.5 Mitigation in the form a wind farm shadow flicker protocol has been proposed by the Applicant to avoid significant shadow flicker effects. With appropriate mitigation measures in place the impact from shadow flicker is predicted to be non-significant for the Proposed Development.

12.2 Introduction

12.2.1 This chapter considers the likely significant effects on shadow flicker associated with the construction, operation and decommissioning of the Proposed Development.

'The term "shadow flicker" refers to the flickering effect caused when rotating wind turbine blades periodically cast shadows over neighbouring properties as they turn, through constrained openings such as windows. The magnitude of the shadow flicker varies both spatially and temporally and depends on a number of environmental conditions coinciding at any particular point in time, including, the position and height of the sun, wind speed, direction, cloudiness, and position of the turbine to a sensitive receptor'[2].

[1] Parsons Brinckerhoff. (2011). Update of UK Shadow Flicker Evidence Base. Report prepared for Department of Energy and Climate Change.. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf [Accessed 15/05/2024].
[2] Ibid.

12.2.2 The specific objectives of the chapter are to:

- describe the shadow flicker baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

12.2.3 The assessment has been carried out by Ramboll UK Limited (Ramboll). Lead author is Peter Bruce MSc BSc (Hons), Director - Impact Assessment. Mr Bruce has over sixteen years of experience in environmental consultancy, specialising in Impact Assessment for renewable energy developments (refer to Technical Appendix 1.2 for further details).

12.2.4 This chapter is supported by the following figures and technical appendices:

- Volume 3a: Figures
  - Figure 12.1: Shadow Flicker Study Area and Receptors
- Volume 4: Technical Appendices
  - Technical Appendix 12.1: Shadow Flicker Modelling Output

12.2.5 The Figure and technical appendix are referenced in the text where relevant.

12.3 Assessment Methodology and Significance Criteria

Scope of Assessment

12.3.1 This chapter considers potential shadow flicker effects on properties within 10 rotor diameters (RD) of the proposed turbine locations. The Scottish Government web-based renewable advice for onshore wind turbines recommends that a separation between turbines and dwellings beyond 10 RD should avoid nuisance issues and annoyance to nearby residents[3]. The advice quotes:

"*In most cases however, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 RD), 'shadow flicker' should not be a problem*."

12.3.2 The assessment is based on the Proposed Development as described in Chapter 2: Development Description (EIAR Volume 2).

12.3.3 The scope of the assessment has been informed by consultation responses detailed in **Technical Appendix 1.1: Consultation Register (EIAR Volume 4)**, although no consultation responses were received during this period on the scope and assessment of shadow flicker.

12.3.4 Using proprietary specialist modelling software 'Windfarm' (RESoft Windfarm V5.0.2.2), an annual analysis of shadow flicker for the Proposed Development was carried out, taking into account the behaviour of the sun, the local topography and the turbine layout and dimensions.

12.3.5 It should be noted that the modelling analysis was performed using the following standard assumptions:

- the sun will always be visible during daylight hours (conservative assumption);
- the turbine blades are always turning at these times (conservative assumption);

[3] Scottish Government, Onshore Wind Turbines: Planning Advice, (2014). Available online from: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/. [accessed 12/05/2024]

- the alignment of the turbine rotor blades with respect to the sun's position will always produce maximum shadow casting (conservative assumption; it is unlikely that the wind, and therefore the rotor blades, will track the sun in practice);
- the analysis looks at shadow casting over the building from all directions rather than over vertical orientated windows only (conservative assumption);
- the intensity of the sun will be insufficient to cast strong shadows at elevations less than 2.0˚;
- shielding due to features such as trees or other obstacles has not been taken into account; and
- terrain shielding, however, is modelled.

12.3.6 The significance of the shadow flicker effect to the surrounding properties has been informed by the Parsons Brinckerhoff (2011)[4] paper. Having considered this paper, it is recommended that shadow flicker at neighbouring offices and dwellings within 500 m should not exceed 30 hours per year or 30 minutes per day.

Potential Effects Scoped Out

12.3.7 As shadow flicker is a phenomenon caused by the moving shadow of the turbine rotor being cast over a narrow opening, such as a window or open door, no shadow flicker effects from the construction or decommissioning of the Proposed Development are possible. Assessments of potential shadow flicker effects resulting from the construction and decommissioning of the Proposed Development has therefore been scoped out of the shadow flicker assessment.

12.3.8 Based upon a review of cumulative schemes, no properties identified as sensitive to shadow flicker from the Proposed Development are located within 10 RDs of any cumulative schemes. Therefore, no cumulative assessment was deemed necessary for the shadow flicker assessment.

12.3.9 A related visual effect to shadow flicker is that of reflected sunlight. Theoretically, should the light be reflected off a rotating turbine blade onto an observer then a stroboscopic effect could be experienced. In practice, a number of factors limit the severity of the phenomenon. Firstly, wind turbines have a semi-matt surface finish which means that they do not reflect light as strongly as materials such as glass or polished vehicle bodies. Secondly, due to the convex surfaces found on a turbine, the light would generally be reflected in a divergent manner. Thirdly, the variability in flow within a wind farm results in slightly differing orientation of rotor directions. Therefore, it is unlikely that an observer would experience simultaneous reflections from a number of turbines. Fourthly, as with shadow flicker, certain weather conditions and solar positions are required before an observer would experience the phenomenon. Therefore, it is concluded that the Proposed Development would not cause a material reduction to amenity owing to the reflected light, therefore the reflected light is scoped out and has not been considered in the assessment.

12.3.10 People with photosensitive epilepsy are usually sensitive to flickering light that is between 3 to 60 Herts (Hz); according to the Parsons Brinckerhoff (2011) paper[5] 'the maximum frequency of the shadowing effect arising from commercial-scale wind turbines is less than 1 Hz'. Therefore, any potential shadow flicker effects arising from the Proposed Development

[4] Parsons Brinckerhoff. (2011). Update of UK Shadow Flicker Evidence Base. Report prepared for Department of Energy and Climate Change.. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf [Last Accessed 15/05/2024].

[5] ibid.

are purely an effect on amenity, rather than having the potential to affect the health or wellbeing of occupants.

Method of Baseline Characterisation

Extent of the Study Area

12.3.11 The Shadow Flicker study area is comprised of a 10 RD (1,550 m) assessment area surrounding each proposed turbine, in accordance with the Scottish Government advice. The Parsons Brinckerhoff (2011) paper[6] states that at UK latitudes only properties within 130 degrees either side of north of turbines can be affected by shadow flicker. To undertake the shadow flicker assessment specialist modelling software 'Windfarm' has been used which accounts for the sun angle and movement. The study area is shown in Figure 12.1: Shadow Flicker Study Area and Receptors.

Desk Study

12.3.12 A desktop assessment was undertaken in May 2024 using Royal Mail address data and publicly available aerial and satellite images, in order to identify all residential properties located within the study area. Computer modelling was used to present the extent of shadow flicker to those properties for the Proposed Development, assuming a worst-case scenario and providing a very conservative (i.e. high) estimate.

Modelling Methodology

12.3.13 A modelling exercise was carried out for the Proposed Development using a 155 m RD[7]. The computer software 'WindFarm' was used to identify potential areas susceptible to shadow flicker, and the extent of shadow flicker impact caused. This software identified the study area for the assessment based on candidate turbine dimensions and orientations, as well as model periods of predicted shadow flicker. The following model parameters were used:

- a candidate wind turbine with hub height of 122.5 m, a rotor diameter of 155 m and a tip height of 200 m[8];
- the maximum distance of shadow flicker influence considered is 10 times the RD (155 m x 10 = 1,550 m);
- the centre of the window (viewing height) is 2 m above ground level;
- each property has 2 windows facing the Proposed Development ;
- Each window is 1 m by 1 m;
- the calculation year is 2022;
- the maximum sun height is 2° above the horizon; and
- topography has been considered using 20 m grid spaced digital terrain model (DTM) data and the Earth's curvature has been accounted for.

Model Output

12.3.14 For each property within the study area, the model predicted the number of days per year, maximum hours per day, mean hours per day and total hours per year that the property would experience shadow flicker. The model output is presented in Table 12.1: Summary of Model Output.

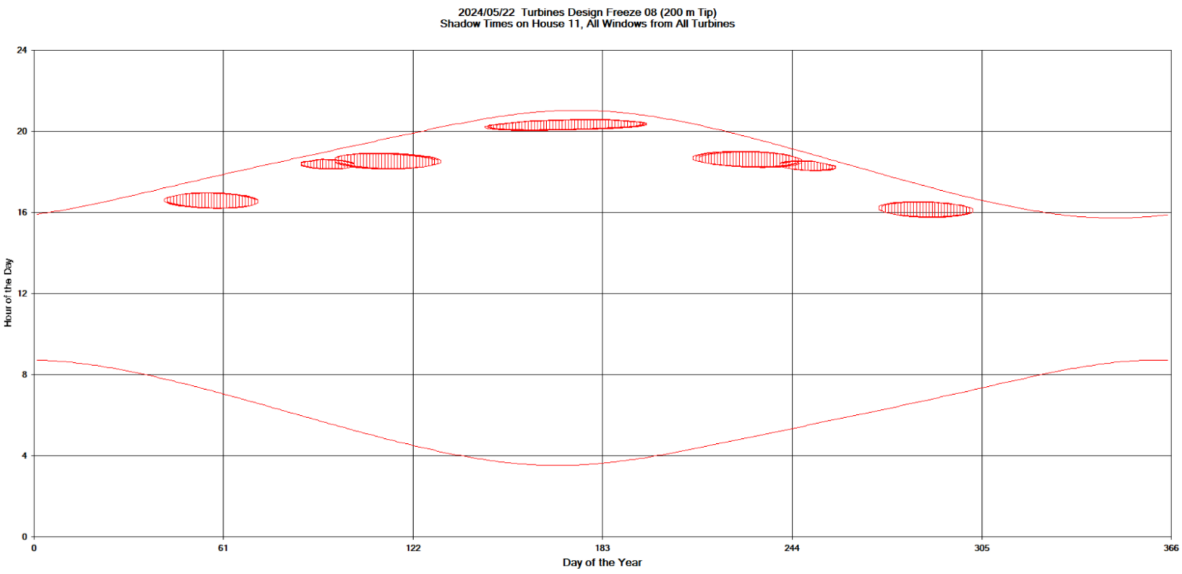
6 ibid.

7 155 m rotor diameter was used for EIAR purposes only.

8 Parameters specified for the purposs of modelling potential shadow flicker only.

12.3.15 In addition, the model has produced a graph illustrating the time of day and time of year shadow flicker effects could potentially arise for each property within the shadow flicker study area. An example graph for House 11 (H11) is illustrated below in Graph 12.1: Potential Shadow Flicker Effects at House 11.

GRAPH 12.1: POTENTIAL SHADOW FLICKER EFFECTS AT HOUSE 11



12.3.16 The area between the two red lines represents daylight hours over the course of a calendar year (calculation year 2024). The red circular areas represent times when the shadow flicker effects from the Proposed Development could potentially occur at this property. A similar graph for each receptor that is predicted to experience shadow flicker effects is provided in **Technical Appendix 12.1: Shadow Flicker Modelling Output (EIAR Volume 4)**.

CRITERIA FOR THE ASSESSMENT OF EFFECTS

12.3.17 No formal guidance is available regarding what levels of shadow flicker may be considered acceptable in Scotland. In the absence of this, the significance of the shadow flicker effect to the surrounding properties has been assessed according to the thresholds detailed in the Parsons Brinckerhoff (2011) paper, which recommends that shadow flicker at neighbouring offices and dwellings should not exceed 30 hours per year or 30 minutes per day.

12.3.18 For the purposes of this chapter, values greater than 30 hours per year or 30 minutes per day are considered significant.

Limitations and Assumptions

12.3.19 A number of worst-case assumptions were made to generate the modelling output for the assessment. It should also be noted that even if shadow flicker impact does occur at a specific location, this does not imply that it would be witnessed. Potential receptors may be occupying a room on the other side of the house, which is not impacted, or indeed absent from the location altogether (e.g. at work, on holiday) during the times of the shadow flicker events.

12.3.20 The use of these assumptions is considered to provide a precautionary basis for the purpose of this assessment.

12.3.21 The instances of shadow flicker would always be less than that predicted by the model. The occurrence of shadow flicker is only possible during the operation of the wind turbine (i.e., when the rotor blades are turning) and when the sky is clear enough for the sun to cast strong shadows. It is important to consider the following facts when making an assessment:

- Climatic conditions dictate that the sun is not always shining. Met Office data gives average annual sunshine hours for the west of Scotland to be 29% of total daylight hours[9], based on climate data from 1981-2010. Cloud cover during other times may obscure the sun and prevent shadow flicker occurrence. While some shadow may still be cast under slightly overcast conditions, no shadow at all would be cast when heavy cloud cover prevails.
- Objects such as trees or walls may surround windows and obscure the view of the turbine and hence prevent or limit shadow flicker.
- During operation, the turbine rotors would automatically orientate themselves to face the prevailing wind direction. This means the turbine rotors would not always be facing the affected window and in fact would sometimes be 'side-on' to the window. Very little of the blade movement would be visible during such occurrences and therefore the potential for shadow flicker is reduced.

12.4 Baseline Conditions

Current Baseline

12.4.1 The desk study identified 16 properties within the shadow flicker study area from the Royal Mail address data. The properties included in the assessment are shown in **Figure 12.1: Shadow Flicker Study Area and Receptors (EIAR Volume 3b)**.

12.4.2 The sixteen properties within the shadow flicker study area are as follows:

- H1 - Maidencoatts Farmhouse located approximately 1.2 km east of Turbine 16;
- H2 – Over Balgray located approximately 1.6 km south of Turbine 19;
- H3 – The Strand located approximately 200 m south of Turbine 21;
- H4 - Maidencotts located approximately 1.2 km east of Turbine 16;
- H5 – Manse Road No.305 located approximately 1.1 km south of Turbine 22;
- H6 – Thirstone Cottage located approximately 280 m south of Turbine 12;
- H7 – Manse Road No.311 located approximately 1.1 km south of Turbine 22;
- H8 – Blackburn Farm Bungalow located approximately 500 m southwest of Turbine 20;
- H9 – Manse Road No.309 located approximately 1.1 km south of Turbine 22;
- H10 – Gilkerscleugh Mains Farm located approximately 1.5 km south of Turbine 22;
- H11 – Netherton Farm Cottage (no.1) located approximately 800 m south of Turbine 16;
- H12 – Netherton Farm Cottage (no.2) located approximately 800 m south of Turbine 16;
- H13 – Manse Road No.307 located approximately 1.1 km south of Turbine 22;
- H14 - Netherton Farm located approximately 800 m from Turbine 16;
- H15 Crawfordjohn Mill Farm located approximately 1 km south of Turbine 20, and
- H16 Blackburn Farm located approximately 500 m southwest of Turbine 22.

12.4.3 It should be noted that H3 (The Strand) and H6 (Thirstone Cottage) will not be in use as residential properties during the operation of the Proposed Development and as such have been discounted from futher consideration. Further detail on receptors H3 and H6 and their status are described in **Chapter 2: Development Description (EIAR Volume 2)**.

[9] Calculated based on figures available at https://www.metoffice.gov.uk/public/weather/climate/ [accessed 15/05/2024]

Future Baseline

12.4.4 If a new property were to be constructed within the shadow flicker study area during the operational phase of the Proposed Development, this would create a potential new shadow flicker receptor. No consented or proposed residential developments have been identified within the shadow flicker study area on the South Lanrkshire Planning Portal at present.

12.4.5 In addition, if any of the existing properties within the study area were modified, for example, a new window or door was installed, or the property is extended, this could alter the individual property's sensitivity to shadow flicker. Again, no consented or proposed planning applications to modify existing properties within the shadow flicker study area have been identified on the SLC Planning Portal.

12.4.6 No further changes to the shadow flicker baseline in the absence of the Proposed Development are anticipated.

12.5 Assessment of Likely Effects

12.5.1 The results of the shadow flicker model for the Proposed Development are detailed in Table 12.1.

Table 12.1: Summary of Model Output

House	Easting	Northing	Days per Year	Max Hours per Day	Mean Hours per Day	Total Hours per Year	Total Hours per Year (incl. adjustment for sulight)*
H1	292703	626350	35	0.45	0.35	12.22	3.54
H2	288033	624664	0	0	0	0	0
H4	292638	626355	36	0.47	0.37	13.24	3.84
H5	289615	624061	0	0	0	0	0
H7	289637	624056	0	0	0	0	0
H8	289012	625335	156	**0.65**	0.42	**65.71**	19.06
H9	289607	624063	0	0	0	0	0
H10	289747	623688	0	0	0	0	0
H11	290833	625512	208	**0.79**	**0.54**	**111.81**	**32.42**
H12	290901	625446	202	**0.74**	**0.51**	**102.42**	29.70
H13	289629	624058	0	0	0	0	0
H14	290832	625501	208	**0.79**	**0.54**	**112.13**	**32.52**
H15	288964	625283	158	**0.64**	0.42	**66.55**	19.30
H16	289663	624148	0	0	0	0	0

*The Met Office data shows that the west of Scotland receives an average of 29% sunshine of the total daylight hours annually. This percentage is applied to total annual hours column to estimate the expected total sunshine hours for the year.

Bolded text represent where the assessment indicates that the potential number of shadow flicker hours experienced at the receptor exceeds 30 hours per year and/ or 30 minutes per day (0.5 hours per day).

12.5.2 The assessment indicates that seven properties could be subject to shadow flicker from the proposed turbines. Table 12.1 provides a summary of the results and Figure 12.1: Shadow Flicker Study Area and Receptors, details the house locations relative to the Proposed Development.

12.5.3 H11 would experience 32.42 hours of shadow flicker per year and up to 47 minues of shadow flicker per day. H14 would experience 32.52 hours of shadow flicker per year and up to 47 minutes per day. As such the impact of shadow flicker on H11 and H14 is greater than 30 hours per year and 30 minutes per day and deemed **significant adverse** in both instances.

12.5.4 H12 would experience 29.70 hours of shadow flicker per year and up to 44 minues of shadow flicker per day. The impact of shadow flicker on H12 is greater than 30 minutes per day but less than 30 hours per year. As such the impact of shadow flicker on H12 is deemed **significant adverse** in terms of daily exposure and **non-significant adverse** in terms of yearly total.

12.5.5 H8 and H15 would experience 19.06 and 19.30 hours of shadow flicker per year and up to 39 minues of shadow flicker per day. The impact of shadow flicker on H8 and H15 is greater than 30 minutes per day but less than 30 hours per year. As such the impact of shadow flicker on H8 and H15 is deemed **significant adverse** in terms of daily exposure and **non-significant adverse** in terms of yearly total.

12.5.6 H1 and H4, both at Maidencotts, would experience acceptable levels of shadow flicker in accordance with assessment criteria. The shadow flicker levels at H1 and H4 would be less than 30 minutes per day and 30 hours per year and as such **non-significant adverse**.

12.5.7 The results of the shadow flicker modelling conclude that H2, H5, H7, H9, H10 and H13 would not experience any shadow flicker from the Proposed Development and therefore **no effects** are anticipated at these receptors.

12.5.8 It should be emphasised that this analysis provides an extremely conservative estimate of the extent that the properties would be affected by shadow flicker. In addition to the frequent cloud cover which is factored in to Table 12.1, low irradiance intensity, turbines not turning at all times and turbine rotors not being aligned with the sun in a way to cast maximum shadow onto the proposed property, would further reduce the actual amount of shadow flicker affecting the aforementioned properties.

12.6 Mitigation

12.6.1 The Applicant proposes that prior to the erection of the first turbine, a Wind Farm Shadow Flicker Protocol would be submitted to and approved in writing by the Local Planning Authority. This would set out the protocol to be followed should a shadow flicker complaint be received from a receptor within the study area and potential mitigation measures. These mitigation measures may include the provision of internal or external screening at the property of the complainant, or programming of the turbines to minimise impacts. Operation of the Proposed Development would be undertaken in accordance with the Wind Farm Shadow Flicker Protocol. It is proposed that this is secured through an appropriate condition attached to the consent.

12.6.2 The Applicant anticipates that this mitigation would be secured by appropriately worded condition.

12.7 Assessment of Residual Effects

12.7.1 With appropriate mitigation measures in place the residual effects during operation of the Proposed Development would be **no effect** on all receptors.

12.8 Monitoring

12.8.1 No monitoring is required as there are no significant residual effects as a result of the operation of the Proposed Development.

12.9 Summary

12.9.1 This chapter provides an assessment of the potential impacts on residential amenity resulting from shadow flicker from the Proposed Development. The shadow flicker assessment has been undertaken based on the maximum tip height of 200 m and a rotor diameter of 155 m for the Proposed Development. A study area of 10 rotor diameters (1.55 km) around each turbine was considered and four receptors were found to be potentially susceptible to shadow flicker within the study area.

12.9.2 There are no published guidelines in Scotland that define acceptable levels of shadow flicker. In the absence of specific guidelines, the assessment has considered the Parsons Brinckerhoff (2011) paper paper which considers shadow flicker guidance from a number of countries. Best Practice suggests shadow flicker should not be allowed to exceed 30 hours per year or 30 minutes per day. As such, properties where shadow flicker would potentially exceed these thresholds would be subject to significant effects, in the absence of mitigation.

12.9.3 The assessment indicates that the potential number of shadow flicker hours experienced exceeds 30 hours per year or 30 minutes per day at four of the properties identified within the study area. In the absence of mitigation, shadow flicker effects are potentially significant for these receptors.

12.9.4 This analysis provides an extremely conservative estimate of the extent that the properties would be affected by shadow flicker. Due to frequent cloud cover, low irradiance intensity, turbines not turning at all times, the presence of intervening vegetation and turbine rotors not being aligned with the sun in a way to cast maximum shadow onto the proposed properties all of the time, the number of hours when shadow flicker would affect the aforementioned properties is anticipated to be far fewer.

12.9.5 Mitigation has been proposed by the Applicant to avoid significant shadow flicker effects. Table 12.2: Summary of Potential Significant Effects of the Proposed Development provides a summary of the effects. With appropriate mitigation measures in place the impact from shadow flicker is predicted to be non-significant for the Proposed Development.

Table 12. 2: Summary of Potential Significant Effects of the Proposed Development

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/ Residual Effect
Disturbance to properties within the shadow flicker study area.	A shadow flicker protocol.	Prior to the erection of the first turbine a Wind Farm Shadow Flicker Protocol would be submitted to and approved in writing by the Local Planning Authority. This would set out the protocol to be followed should a shadow flicker complaint be received from a receptor within the study area and potential mitigation measures. These mitigation measures may include the provision of internal or external screening at the property of the complainant, or programming of the turbines to minimise impacts.	No effect

13 Schedule of Environmental Mitigation

13.1 Introduction

13.1.1 The purpose of this chapter is to summarise the mitigation measures proposed in each of the technical chapters to avoid, reduce or offset impacts which could otherwise give rise to significant residual environmental effects. In addition, some good practice environmental management measures and commitments have been proposed to further reduce environmental effects which are not considered to give rise to likely significant effects with or without mitigation.

13.1.2 The main aim of the design process was to 'design out' the potential for significant environmental effects as far as possible. Embedded mitigation in the form of design solutions is presented in **Chapter 3: Design Evolution and Alternatives (EIAR Volume 2)**, in particular in Table 3.1 which provides a detailed review of mitigation achieved through design. As such, these measures have not been replicated here.

13.1.3 Most of the pre-construction and construction phase mitigation would be delivered through a Construction Environmental Management Plan (CEMP). The outline content of the proposed CEMP is provided in **Technical Appendix 2.1: Outline CEMP (EIAR Volume 4)**. Further details on specific measures to be included in the final CEMP are contained in each of the technical chapters of the Environmental Impact Assessment Report (EIAR), where relevant.

13.1.4 Throughout the EIAR, technical disciplines have considered the likely significant effects of the Proposed Development with consideration of embedded mitigation and commitments. Where significant effects have been identified, additional mitigation is proposed to minimise these effects where possible. A summary of these measures are provided in Table 13.1 below. It is anticipated that the mitigation measures outlined in this table would be secured through appropriately worded conditions of consent.

Table 13.1: Schedule of Mitigation and Environmental Management Measures				
Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
General Mitigation	Pre-Construction Construction	An Outline Construction Environmental Management Plan (OCEMP) has been prepared as part of the Environmental Impact Assessment (EIA) process for the Proposed Development. The Principal Contractor to construct the Proposed Development will prepare detailed method statements which will be incorporated into the final Construction Environmental Management Plan (CEMP). The CEMP will provide: ▪ a schedule of all construction stage mitigation measures required to address likely significant effects identified in the EIAR; ▪ a schedule of all additional construction and decommissioning stage good practice management measures included as part of the proposed construction work, in line with industry good practice guidance; ▪ a schedule of roles and responsibilities for delivering the requirements of the CEMP, including a statement of responsibility to 'stop the job/ activity' if in potential breach of a mitigation or legislation occurs; ▪ a method statement for monitoring, auditing, and templates for reporting and communication of environmental management performance on-site and with the Applicant, planning authority and other relevant parties; and ▪ construction stage environmental management measures, based on both compliance with relevant regulations and relevant good practice. An appropriately qualified Environmental Clerk of Works (EnvCoW) will be appointed to monitor the implementation of the CEMP.	The CEMP will describe the environmental management and construction methods to be employed during the construction of the Proposed Development, in accordance with the environmental mitigation measures identified in the EIAR.	Submitted to South Lanarkshire Council (SLC) for approval, in consultation with relevant statutory bodies and regulatory authorities.
General Mitigation	Construction	The locations of the proposed turbines, other infrastructure and borrow pits would be subject to micro-siting. It is anticipated that a micro-siting distance of 100 m would form a condition of consent. Any repositioning would not encroach into environmentally constrained areas and would be carried out under the supervision of an Environmental Clerk of Works (EnvCoW) and an appropriately experienced engineer.	To ensure environmental constraints are considered if micro-siting is required.	An updated site plan must be submitted to SLC showing the final position of all wind turbines and other infrastructure forming part of the Proposed Development.

Table 13.1: Schedule of Mitigation and Environmental Management Measures				
Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
Landscape and Visual	Construction Decommissioning	Effective management of the construction project using experienced Contractors and measures set out in the OCEMP.	To mitigate direct effects within the Site as a result of ground disturbance and construction activity.	Submitted to South Lanarkshire Council (SLC) for approval, in consultation with relevant statutory bodies and regulatory authorities.
Cultural Heritage	Pre-Construction Construction Decommissioning	A professionally qualified Archaeological Contractor would be appointed to act as an Archaeological Clerk of Works (ACoW). The ACoW would provide advice to the appointed construction Contractor(s) regarding the micro-siting of development components, where there is a possibility of intersecting with identified heritage assets, and to undertake archaeological monitoring of topsoil stripping operations in areas designated and approved by the Council's Archaeological Advisors (West of Scotland Archaeology Service (WoSAS)).	To ensure the appropriate implementation of cultural heritage mitigation measures.	The activities of the ACoW would be approved by WoSAS in advance of development works commencing and would be set out in the Written Scheme of Investigation (WSI).
Cultural Heritage	Pre-Construction Construction Decommissioning	Thirstone Stone Circle to be marked out for avoidance during the construction phase. A buffer of 50 m around the scheduled area would be fenced off and the fence would be left in place for the duration of the construction phase and removed on completion of the Proposed Development.	To mitigate potential direct construction impact on Thirstone Stone Circle from construction traffic traversing the site.	To be approved by WoSAS in advance of development works commencing and would be set out in the WSI.
Cultural Heritage	Pre-Construction Construction	Archaeological Watching brief(s) would be carried out at the locations of Asset (40) and Asset (41).	To record the character of any field banks crossed and identify any evidence of historic cultivation (rig and furrow) that may remain as buried features and recover any artefactual evidence that may be present or any underlying archaeological features of earlier date.	To be approved by WoSAS in advance of development works commencing and would be set out in the WSI. Due to the moderate potential for hitherto undiscovered archaeological remains to be present within the site, if required under the terms of a condition of consent, the scope of any other required archaeological watching brief(s) would be approved by WoSAS in advance of development works commencing and would be set out in the WSI.

Table 13.1: Schedule of Mitigation and Environmental Management Measures				
Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
Cultural Heritage	Pre-Construction Construction Decommissioning	Three heritage assets (30, 31 and 33) would be marked out for avoidance during the construction phase. The features would be identified by placing high visibility markers 5 m from the outer limit of the visible remains, facing the working area. Any required micro-siting of the solar panels would be managed to avoid the visible remains and the demarcated areas. The markers would be left in place for the duration of the construction phase and removed on completion of the Proposed Development.	To mitigate potential direct construction impacts on heritage assets 30, 31 and 33 within the solar array from construction traffic traversing the site.	To be approved by WoSAS in advance of development works commencing and would be set out in the WSI.
Cultural Heritage	Construction	If new archaeologically significant discoveries are made during archaeological monitoring, and it is not possible to preserve the discovered remains in situ, provision would be made for the excavation, where necessary, of any archaeological deposits encountered. The provision would include the consequent production of written reports on the findings, with post-excavation analysis and publication of the results of the works, where appropriate.	To record any affected archaeological remains.	To be approved by WoSAS.
Cultural Heritage	Pre-Construction Construction Decommissioning	Written guidelines would be issued for use by all construction Contractor(s), outlining the need to avoid causing unnecessary damage to known heritage assets. The guidelines would set out arrangements for calling upon retained professional support if buried archaeological remains of potential archaeological interest (such as building remains, human remains, artefacts, etc.) should be discovered during any construction activities. The guidelines would make clear the legal responsibilities placed upon those who disturb artefacts or human remains.	To ensure appropriate procedures are followed in regards to heritage assets and archaeological remains.	To be approved by WoSAS.
Ecology/Ornithology	Pre-Construction Construction Decommissioning	A suitability experienced Ecological Clerk of Works (ECoW) will be appointed prior to the commencement of construction to advise the Applicant and the Contractor on all ecological (and ornithological) matters (with the assistance of a suitably qualified /licenced ornithologist if required). The ECoW will be required to be present on-Site during the construction phase and will carry out monitoring of works and beifings with regards to any ecological sensitivities on the Site to the relevant staff of the Contractor(s).	To ensure the appropriate implementation of ecological mitigation measures.	None required.
Ecology	Construction Decommissioning	A Species Protection Plan (SPP) will be implemented during the construction (and decommissioning) phase. The SPP will include pre-construction surveys and good practice measures during construction. re-construction surveys will be undertaken to check for any new protected species or features in the vicinity of the construction works. The results of the pre-construction surveys will be used to update the outline SPP ahead of construction	To ensure the safeguarding of protected species known or likely to be in the area.	Submitted to SLC for approval.

Table 13.1: Schedule of Mitigation and Environmental Management Measures				
Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
		starting. The SPP will remain a live document to be updated as required and in agreement with the ECoW where changes to the distribution and status of protected species and features are recorded.		
Ecology	Pre-Construction Construction	Implementation of a Biodiversity Enhancement Management Plan (BEMP). The BEMP would aim to achieve significant biodiversity enhancement at the Proposed Development and would include provisions for the protection, maintenance, restoration and/or enhancement of bog habitats locally. An Outline BEMP (OBEMP) has been prepared as part of the EIAR (see **Technical Appendix 6.6 (EIAR Volume 4)**). The OBEMP is based on a number of identified habitat management areas for each respective habitat management and biodiversity enhancement proposal. These habitat management areas will likely be refined following further specialist surveys and feedback from relevant consultees, and all search areas may not be taken forward for the final BEMP, and other search areas and/or proposals may also be considered; however, the Applicant remains committed to delivering significant biodiversity enhancement at the Proposed Development.	To mitigate potential indirect effects on Red Moss Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) and potential direct and indirect effects on Blanket Bog and Wet Modified Bog. In addition, the BEMP will be implemented to ensure the Proposed Development secures significant biodiversity enhancements through restoring degraded habitats and strengthening nature networks.	The aims, objectives and prescriptions of management measures outlined in the BEMP will be agreed and finalised with South Lanarkshire Council (SLC), in consultation with NatureScot, relevant landowners and the advisory of an appointed Biodiversity Advisory Committee (BAC).
Ecology	Pre-Construction Construction Operation	A wildlife-friendly lighting scheme will be designed for infrastructure lighting.	To minimise the impacts of such infrastructure lighting on crepuscular species such as bats, otter and badger, and their navigation corridors.	Designed in consultation with NatureScot and submitted to SLC for approval.
Ecology	Operation	The Proposed Development will utilise the method of reduced rotation speed whilst idling by feathering, at all wind turbines, to reduce collision risks to bats during the bat active period (April to October). This measure will be put in place from the start of the operational period of the Proposed Development.	To mitigate potential collision risks to bats during the bat active period.	None required.
Ecology	Operation	Operational phase environmental management plans following relevant best practice and guidance will be in place during operation of the Proposed	To ensure operational activities are carried out in a such a manner to reduce	None required.

Table 13.1: Schedule of Mitigation and Environmental Management Measures

Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
		Development, these will for example include provisions for, but not limited to, ongoing pollution prevention control measures.	impacts on the environment.	
Ornithology	Pre-Construction Construction Operation Decommissioning	A Bird Disturbance Management Plan (BDMP) will be prepared and implemented for the Proposed Development which details good practice and species-specific measures to be implemented during construction, decommissioning and where relevant during operational maintenance activities. The following additional species-specific measures are outlined for inclusion within the BDMP to be informed by pre-commencement surveys and which will avoid or further minimise the potential for disturbance to sensitive breeding birds during the construction phase: ▪ Black grouse: no construction and/or operational maintenance works will be undertaken within 750 m of any identified black grouse lek sites before 9am in April and May; ▪ Short-eared owl: no construction works and/or operational maintenance works will be undertaken within 30 m of any active short-eared owl nest.	To enable legislative compliance and safeguard sensitive bird species including those listed on Schedule A1, 1 and 1A of the Wildlife and Countryside Act 1981 (as amended).	Prepared in consultation with NatureScot and submitted to SLC for approval.
Ornithology	Operation	Species-specific habitat management measures would be undertaken within the Site and included within the finalised BEMP. Measures would include the identification of marsh/marshy grassland, wet modified bog, wet dwarf shrub heath and aced grassland areas, away from operational infrastructure, to be managed over the operational lifetime of the Proposed Development to provide suitable opportunities for roosting and nesting hen harrier and short-eared owl. Management is proposed to be undertaken through changes in livestock grazing (or undertaking mechanical cutting if necessary) and predator controls (as required and subject to trials as necessary).	To minimise potential operational displacement impacts upon breeding short-eared owl and roosting hen harrier.	Additional measures to be outlined in the BEMP will be agreed and finalised in consultation with NatureScot,an appointed Biodiversity Advisory Committee (BAC) and submitted to SLC for approval.
Ornithology	Operation	An operational carcass recovery protocol would be prescribed and implemented for the Proposed Development. This would include for regular searching of the turbine array area (and additional areas within the Site) for fallen livestock and removal to an agreed disposal site.	To minimise the magnitude of potential operational collision mortality risks to red kite.	The protocol, including frequency of searches, monitoring and review period would be preparedin consultation with NatureScot and other relevant stakeholders and submitted to SLC for approval.

Table 13.1: Schedule of Mitigation and Environmental Management Measures				
Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
Hydrology, Hydrogeology and Geology	Pre-Construction Construction	The appointed Principal Contractor would compile a Pollution Prevention Plan (PPP) which would include details of construction phase SuDS, construction Site plans and proposed drainage management measures.	To ensure that pre-development runoff rates are maintained and that rates of runoff to watercourses are not increased.	To be submitted to SLC for approval in consultation with SEPA.
Hydrology, Hydrogeology and Geology	Pre-Construction Construction	The installation of SuDS measures would be supervised by the Environmental Clerk of Works (EnvCoW) during the construction phase of works. Any requirement for monitoring of water quality within watercourses downstream of the Proposed Development would be agreed with SEPA and procedures for this would be detailed in the CEMP.	To ensure water quality is maintained and to mitigate potential sedimentation and erosion effects.	To be submitted to SLC for approval in consultation with SEPA.
Hydrology, Hydrogeology and Geology	Pre-Construction Construction	Sediment capture methods to be implemented at the Site would be detailed in a Drainage Impact Assessment which would be prepared by the Principal Contractor.	To ensure water quality is maintained and to mitigate potential sedimentation and erosion effects.	To be submitted to SLC for approval.
Hydrology, Hydrogeology and Geology	Pre-Construction Construction	Detailed proposals for the management of surface water runoff at the Site would be agreed with SEPA by the Principal Contractor under a Construction Runoff Licence.	To ensure water quality is maintained and to mitigate potential sedimentation and erosion effects.	To be submitted to SLC for approval in consultation with SEPA.
Hydrology, Hydrogeology and Geology	Pre-Construction Construction	At two locations mitigation through drainage design would ensure that water supply is maintained to downslope habitats. Measures would include: ▪ installation of upslope cut off drains to collect surface water runoff from upslope locations and distribute runoff to downslope areas; ▪ installation of cross drains below tracks at regular intervals to ensure the distributed conveyance of runoff across linear features (i.e. the collection and downslope release of runoff should not create new preferential surface water flow paths); ▪ consideration to be given to the installation of floating track and granular, permeable sub-base materials on track at these locations to maintain flows of soil water; and ▪ installation of SuDS measures to ensure the settlement of sediments, prior to distributed release over downslope vegetated areas.	To ensure groundwater flow, hydraulic continuity and water quality is maintained to mitigate potential effects on groundwater dependant terrestrial ecosystems.	To be submitted to SLC for approval in consultation with SEPA.

Table 13.1: Schedule of Mitigation and Environmental Management Measures				
Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
Hydrology, Hydrogeology and Geology	Pre-construction Construction Operation	An Outline Peat Management Plan (OPMP) (**Technical Appendix 8.2, EIAR Volume 4)**) has been prepared as part of the EIA process for the Proposed Development. The Principal Contractor will prepare a detailed Peat Management Plan (PMP) prior to the commencement of construction. The PMP would include operational mitigation measures as appropriate.	To mitigate potential effects on soils and peat.	To be submitted to SLC for approval in consultation with SEPA.
Hydrology, Hydrogeology and Geology	Operation	A site maintenance programme with regard to site plant and infrastructure would be implemented by the Principal Contractor. A maintenance schedule would be developed for all SuDS and drainage assets installed at the construction stage to ensure that the function and benefit provided by the assets remains for the lifetime of the Proposed Development.	To mitigate potential effects on water quality during operation.	To be submitted to SLC for approval.
Hydrology, Hydrogeology and Geology	Decommissioning	At the time of decommissioning, a Decommissioning Environmental Management Plan (DEMP) would be prepared and implemented by an appointed Contractor to the extent that the infrastructure is fully or partially decommissioned. Should full decommissioning of the Site be carried out following the lifespan of the Proposed Development, the Site would be returned to 'the same' or 'a better' condition such that natural drainage conditions would be replicated, as far as practicably possible based on the intended land use.	To mitigate the effects of decommissioning activities.	To be submitted to SLC for approval in consultation with SEPA.
Traffic and Transport	Construction	A project website, blog or web-based communication tools which may include social media, will be regularly updated to provide the latest information relating to traffic movements associated with vehicles accessing the site.	To reduce potential disruption to road users.	To be agreed with SLC and Transport Scotland (TS).
Traffic and Transport	Pre-construction Construction	A Construction Traffic Management Plan (CTMP) would be prepared and implemented. The CTMP will include, but is not limited to, the following measures: ▪ Agreement on Abnormal Indivisible Loads (AIL) route modification and improvements with SLC, TS and other relevant stakeholders; ▪ A Site worker transport and travel arrangement plan, including transport modes to and from the worksite (including pick up and drop off times). ▪ An AIL Transport Management Plan;	To reduce potential effects on road users.	To be agreed with SLC and Transport Scotland (TS).

Table 13.1: Schedule of Mitigation and Environmental Management Measures				
Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
		▪ Specific training and disciplinary measures to ensure the highest standards are maintained to prevent construction vehicles from carrying mud and debris onto the carriageway. ▪ Establishment of wheel cleaning facilities at the Site entrance. ▪ Normal Site working hours. ▪ Appropriate traffic management measures along the Site access roads to avoid conflict with general traffic, subject to the agreement of the roads authority. Typical measures will include HGV turning and crossing signs and banksman where necessary. ▪ Adoption of a voluntary speed limit of 15 miles per hour (mph) for all construction vehicles along the B7078. ▪ Induction and tool box talk safety briefing.		
Traffic and Transport	Pre-construction Construction	Before AILs traverse the route, the following tasks will be undertaken: ▪ Ensure any vegetation which may foul the loads is trimmed back to allow passage; ▪ Confirm there are no roadworks or closures that could affect the passage of the loads; ▪ Check no new or diverted underground services on the proposed route are at risk from the abnormal loads; and ▪ Confirm the police are satisfied with the proposed movement strategy.	To reduce potential effects on road users.	Consultation with SLC, TS and Police Scotland.
Traffic and Transport	Construction	Any damage to road infrastructure caused directly by construction traffic will be made good, and street furniture that is removed on a temporary basis will be fully reinstated. Any damage caused by traffic associated with the Proposed Development, during the construction period that would be hazardous to public traffic, will be repaired immediately.	To mitigate any damage caused by traffic associated with the Proposed Development.	Consultation with SLC and TS.
Traffic and Transport	Construction	There will be a regular road edge review and any debris and mud will be removed from the public carriageway to keep the road clean and safe during the initial months of construction activity, until the construction junction and immediate access track works are complete.	To reduce potential effects on road users.	To be agreed with SLC.

Table 13.1: Schedule of Mitigation and Environmental Management Measures

Topic	Timing of Mitigation Measure	Description	Purpose of Mitigation Measure	Consultation or Approval Required
Traffic and Transport	Construction	An AIL Transport Management Plan will be prepared to cater for all movements to and from the Proposed Development. This will include: ▪ Procedures for liaising with the emergency services to ensure that police, fire, and ambulance vehicles are not impeded by the loads. This is normally undertaken by informing the emergency services of delivery times and dates and agreeing communication protocols and lay over areas to allow overtaking. ▪ A diary of proposed delivery movements to liaise with local communities to avoid key dates such as popular local events etc. ▪ A protocol for working with local businesses to ensure the construction traffic does not interfere with deliveries or normal business traffic. ▪ Proposals to establish a construction liaison committee to ensure the smooth management of the Proposed Development / public interface with the Applicant, the Contractor, the local community, and if appropriate, the police forming the committee. This committee will form a means of communicating and updating on forthcoming activities and dealing with any potential issues arising.	To reduce potential effects on road users.	Consultation with SLC, TS, emergency services and relevant stakeholders.
Traffic and Transport	Construction	An Access Management Plan would be prepared which would include, but is not limited to, such measures as: ▪ Where feasible, users of Core Paths and the Wider Network paths will be separated from construction traffic through the use of barriers; ▪ Crossing points will be provided where required, with path users having right of way; ▪ Appropriate Traffic Signs Manual compliant temporary road signage will be provided to assist at crossing points; and, ▪ Advisory speed limit signed will be installed on approaches to areas where path users may interact with construction traffic.	To reduce potential effects on pedestrians and cyclists.	Consultation with SLC And TS.
Traffic and Transport	Operation	The Site entrances will be well maintained and monitored during the operational life of the Proposed Development. Regular maintenance will be undertaken to keep the Site access track drainage systems fully operational and the road surface in good condition.	To ensure no adverse issues affecting the public road network.	Consultation with SLC.
Traffic and Transport	Decommissioning	A decommissioning phase Traffic Management Plan would be prepared prior to decommissioning.	To reduce potential effects on road users.	To be agreed with SLC and TS.

Table 13.1: Schedule of Mitigation and Environmental Management Measures				
Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
Noise	Construction	Good site practices would be implemented through the CEMP. Section 8 of BS5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that would be employed onsite: ▪ Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern; ▪ Ensure that any extraordinary site work continuing throughout 24 hours of a day (for example, crane operations lifting components onto the tower) would be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid significant traffic flows; ▪ Ensure all vehicles and mechanical plant would be fitted with effective exhaust silencers and be subject to programmed maintenance; ▪ Select inherently quiet plant where appropriate - all major compressors would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use; ▪ Ensure all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers; ▪ Instruct that machines would be shut down between work periods or throttled down to a minimum; ▪ Regularly maintain all equipment used on site, including maintenance related to noise emissions; ▪ Vehicles would be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and ▪ Ensure all ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures should be provided.	To minimise construction noise effects on noise sensitive receptors.	None required.
Noise	Operation	Further data would be obtained from the suppliers of the final choice of wind turbine model, BESS, substation and Solar Array components to demonstrate compliance with the operational noise limits derived in the EIAR.	To minimise operational noise effects on noise sensitive receptors.	None required.

Table 13.1: Schedule of Mitigation and Environmental Management Measures				
Topic	**Timing of Mitigation Measure**	**Description**	**Purpose of Mitigation Measure**	**Consultation or Approval Required**
Aviation	Construction Operation	A reduced lighting scheme has been designed and will be submitted to the Civil Aviation Authority for approval. It proposes 2000 candela steady red lights on eight of the 22 turbines but no mid-tower lighting.	To mitigate the night time visual impact of the Proposed Development on non-aviation receptors.	Approval from the CAA and SLC.
Aviation	Operation	In-fill from Glasgow Primary Surveillance Radar (PSR) / use of inherent data processing capacity of Lowther Hill Indra 3D radar to mitigate false plots/reduced sensitivity of NATS En Route Lowther Hill and Cumbernauld PSRs.	To maintain the accuracy and integrity of the radar picture in the airspace overhead of the Proposed Development.	Commercial agreement with NATS.
Shadow Flicker	Construction Operation	Prior to the erection of the first turbine, a Wind Farm Shadow Flicker Protocol would be submitted to and approved by the Local Planning Authority. The protocol would set out the steps to be followed should a shadow flicker complaint be received from a receptor within the study area and potential mitigation measures.	To mitigation potential disturbance to properties within the shadow flicker study area.	To be submitted to SLC for approval and thereafter implemented.
Telecommunications	Pre-Construction Construction	Prior to the erection of the first turbine, a technical mitigation solution will be agreed with Vodafone in regards to the exclusion zone infringement of turbines 5 and 14.	To mitigate potential impact of the Proposed Development on wireless microwave point to point links, operated by Vodafone.	Technical mitigation solution to be agreed with Vodafone.